input for the particular receiver mentioned. It will be noted that the plate current is recorded for various signals from approximately 10 μv. to 30,000 μv. The curve is a straight line through most of its length, when the scale of signal inputs is plotted exponentially. With antenna and ground shorted (no signal input of any kind) the plate current was approximately 10.5 ma.; with antenna connected and receiver tuned between stations, the plate current was depressed to an average value of 9.5 ma. This was due to a general noise level.

The gaseous discharge tube provided with a long cathode, a short anode and an auxiliary electrode was devised by Professor A. Senauke of New York University, to be applied to AVC receivers to serve as a visual tuning indicator. Figure 2 illustrates the essential portions of the circuit of an AVC receiver for providing visual tuning with the gaseous discharge or neon tube. The meter M, measures the current of the controlled r-f tubes. If a resistor R is inserted, as the plate current of the tubes decreases, the voltage between points A and K increases. This causes the gaseous discharge to increase in area and hence travel up the long cathode. The motion of the glowing gas discharge replaces the moving pointer of the meter. The height of the discharge is proportional to the increase in voltage between A and K above the voltage required to just start the climb. In the tubes as manufactured (under various trade names such as Tunalite, Flashograph, Tonebeam, etc.), the height of the column is also directly proportional to the current flowing between cathode and anode which is approximately two ma. at full column. The third electrode was provided to create an initial ionization which gives a much more dependable action than if but two electrodes were used. This third electrode is generally connected to a point about 40 volts more negative

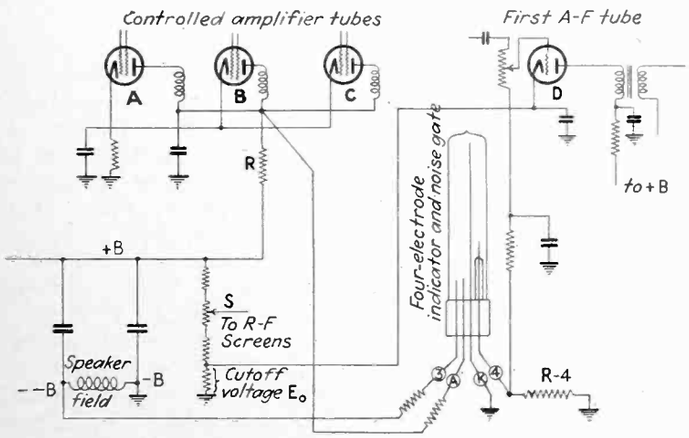


Fig. 4—Circuit of four electrode gaseous tube as tuning indicator and noise gate

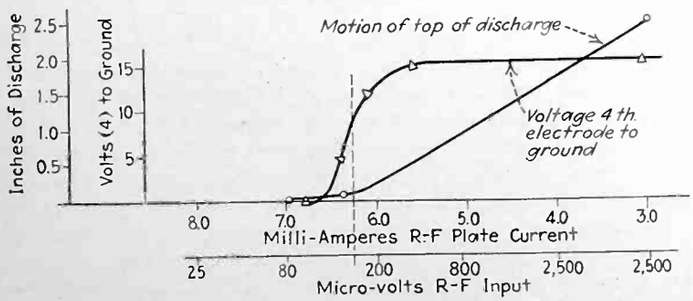


Fig. 5—Characteristics of indicator tube when adjusted to exclude signals below 200 microvolts

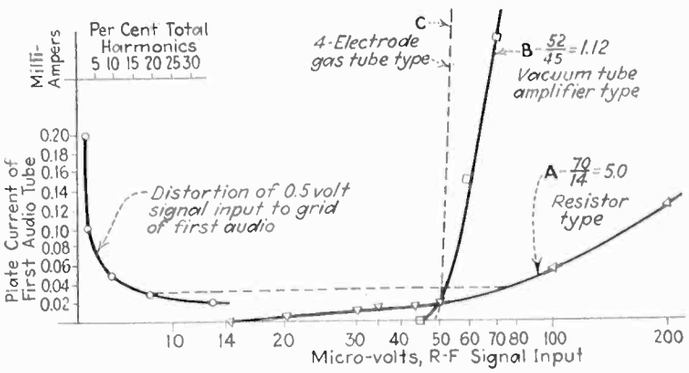


Fig. 6—Characteristics of three noise-gate systems

than K through a current limiting resistor of one-tenth to one-quarter megohm.

Figure 3 illustrates a magnified portion of the station selector dial in the vicinity of the 660 kc. signal. The curve directly above the calibrations illustrates the height of the gaseous discharge as the receiver is adjusted through the signal.

In turning the station selector from 650 kc. toward the desired signal at 660, the action is as follows: first, noise up to 654 kc. gradually increasing signal accompanied by bad hiss up to 658 kc., fair reception of signal up to 659 kc. Good reception is then enjoyed for the small space of 2 kc. and the action is then repeated in the reverse order on the other side.

Referring again to Fig. 2, adjustment of the potential of point K is desirable to take care of variations in (1) line voltage, (2) normal plate-current of r-f tubes and (3) variations in the indicator itself. The first two of these variations are present even though a conventional meter is used. The third has been greatly minimized so that the adjustment K is no longer essential.

Several prominent manufacturers have used the gaseous discharge tube as a tuning indicator for over a year and have found it satisfactory. Recently, experiments have been under way by Professor Senauke and the writer, to utilize this type of tuning indicator for a noise gate as well. The addition of a fourth electrode and certain circuit changes give promise of doing this, even better than the present methods employing vacuum tubes.

In Fig. 4, the essential elements of circuit employing the four-electrode tube are illustrated. Tubes A, B, and C are the ones controlled and the action of the electrodes (3), (A), and (K) is the same as previously described for the tuning indicator action in Fig. 2. In this illustration, the fourth electrode (4), is insulated with a glass stem to a point about one-half inch above the lower ends of the other electrodes. This electrode is connected through a resistance (one-quarter to one-half megohm) to ground. It is also connected through a low-pass filter to the grid return of the first a-f tube. The cathode of this tube is initially biased positively by a voltage (E_o) sufficient to completely cut off its current. The adjustment for both the noise gate and tuning indicator is effected by varying the maximum plate current of the controlled tubes. This is done by means of a potentiometer connection to the screens. Other methods of adjustment are feasible.

To explain the action, a characteristic of a typical four-electrode tube is submitted in Fig. 5. In this figure a curve of the voltage developed in resistor R_4 against plate current of controlled tubes is shown. It will be noted that approximately 10 volts are developed

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