



Ham Tips

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RCA TUBE DEPARTMENT, HARRISON, N. J.

JAN. MARCH, 1950

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HAM DISPLAY GREETS RCA VISITORS



The many visitors to the RCA Home Office during January were greeted by this display. Set up, ready for operation, it gave hundreds of people their first glimpse of a complete amateur radio system. QSL cards displayed were those of some of the many RCA Tube Department employees who are active ham operators. (I have to see the red entrance now—the receptionist still has a sore jaw from answering questions—Ed.)

ELECTRONIC KEYING SYSTEMS

By MACK SEYDOLD, W2RY1

RCA Tube Department, Harrison, N. J.

Amateurs have been using electron tubes in keying circuits for the past twenty years. As a matter of fact, it was almost that far back when I operated cw on 80-meters with a pair of 6X245's in parallel, to key the cathode circuit of an old 210. My recollection of that rig, even though it was a key-note head-board dust-catcher, is very pleasant, and I never did get any key-click complaints from the nearby broadcast listeners or local hams.

Just to get an idea of where that keying circuit had come from, I recently thumbed back through the years of radio journals in my shack. To my amazement, I found dozens of keying circuits for the betterment of Ham's estate.

Keying Filters

Among the more complete articles on the subject, there was one by the late Ross Hull. This carefully prepared resume in February, 1929, QST, covered all of the major systems in use up to that time. Even today, I'll bet that more than half of the boys on the air are

using keying systems that were designed in Hull's article. The main components used are chokes and capacitors. In addition to eliminating the sparks at the key contacts, proper utilization of the components in the keyed stage or in the feed lines to that stage minimizes the production of transients in the radiated signal when the key contacts make and break. A typical filter for cathode keying is shown in Fig. 1.

Sometimes the old choke and capacitor methods really do accomplish the desired results. But the
Continued on Page 2, Column 1

A SIMPLE CODE- PRACTICE UNIT FOR THE NOVICE

By KEN BUCKLIN, W2CDP
RCA Tube Department

Practice with a soldering iron is as important to the newcomer entering amateur radio as learning the code. The code practice oscillator described helps to accomplish both purposes. It is essential to prepare for the inevitable code test and to develop a good set; it serves as a practical experiment for the novice and after the new call letters have been issued, the parts can be put to other useful purposes.
Continued on Page 2, Column 2

"MEET THE GANG"

(First in a series of month-end articles introducing RCA Tube Department employees who contribute to Ham Tips. We hope you enjoy "Meeting The Gang".)



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ex-W6GGN, W3CQX

Age—35
Employed in—Chemical & Physical Lab, RCA Tube Department, Harrison, N. J.

Home QTH—44 Gerdes Avenue, West Orange, N. J.
Graduate of—Lehigh University
Active on—2, 10, 20, and 35-meter

Phone and cw.
Sig.—500 Watts to RCA 813

YL—Lolo
Harmonic—Susy, Age 4½

Articles—Plate Traps—Low-Pass Filters (QST)

TVI Shielding—TVI-Proof Rig (CQ)

Class-B 801 Modulator and many others (Ham Tips)
Other Hobbies—Photography, Fishing, Boats

WHAT'S NEW IN TUBES?

Type	Service	Cost
5Y3	Monotone high-impedance rectifier primarily for TV receiver	1.20
5X2	Monotone high-impedance rectifier primarily for TV receiver	2.05
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6BQ6CT	Beam power amplifier for TV horizontal deflection	3.20
6CB6	Monotone high-impedance pentode amplifier for TV	2.00
6CD6	Beam power amplifier for TV horizontal deflection	4.40
6E4	Monotone medium-impedance amplifier for TV receiver	2.45
6HCP4	Short lead vacuum tube	49.00

KEYING SYSTEMS

Continued from Page 1
tinkering required to clean up a thump or click condition with those systems, and their unreliability under varying conditions, are probably the fundamental causes for all of the additional work that has been done on keying circuits in subsequent years.

Early Electronic Methods

The first complete references that I could find in which vacuum tubes were used to make and break the circuit in the cathode lead of an

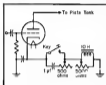


Figure 1

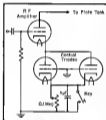


Figure 2A

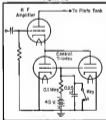


Figure 2B

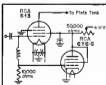


Figure 3

amplifier were in QST for August, 1951. These references were, evidently, the source information for my earliest venture into electronic key-click control. One circuit is shown in Fig. 2A, and the QST article attributes the original idea to F. B. Kennell of RCA Communications. The immediate proponent of the system, W. H. Hamish, W4US, had remarkable access with the device in his amateur rig.

The same issue showed the circuit (Fig. 2B) of C. W. Carter, W1AGT, for another electronic key-click control which was the basis for many series-controlled systems which were to follow.

Screen-Grid Transmitting Tubes

During the first few years after power pentodes and tetrodes became available for amateur use, the same general methods that previously had been used for keying triodes were employed. Some of the boys did utilize the screen grid as a keying control element by putting a key or a relay in series with the screen lead, but this method still required the use of key-click filters.

The beginnings of vacuum-tube control of pentode-screen keying seem to have occurred in 1941. In the December Radio for that year, W. W. Smith, W6BCX, described "A Substitute for Safety Bias" which utilized a triode shunting the screen of an output tube. Later, F. T. Smith, W1FTX, built a transmitter (Feb. 1947 QST) in which a 6Y6-G triode connected, controlled the screen of an 813. In these screen-shunting systems, an earlier stage is keyed, and the bias developed across the gridlead of the final amplifier is the voltage which triggers the control tube. A diagram of the W1FTX final is shown in Fig. 3.

VR-Tube Keying

My solution to the problem of key-click control has been arrived at from a somewhat different ap-

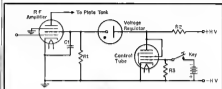


Figure 4

proach, in that voltage-regulator tubes are used. The characteristics of the VR tubes are suited remarkably well for this application and the maximum ratings established for them are not exceeded in this new circuit.

The gaseous atmosphere within a VR tube limits the tube to two major operating states—conducting, and non-conducting. In the conducting state, the current-carrying medium is ionized gas, and the voltage drop between anode and cathode is constant throughout a range of current flow from 5 to 40 milliamperes. In the non-conducting state, when the voltage applied between the anode and cathode falls below the ionizing potential of the gas, the tube virtually is an open circuit. For the 9A2, the voltage required for tube operation is 75 volts. For the 9C3 and the 6D3 it is approximately 105 and 150 volts, respectively. For the miniature types 9A2 and 6D3 it is approximately 150 and 105 volts, respectively.

When one of these tubes, say the 9C3, is placed in the screen supply lead of the rf amplifier and permits normal key-down operation. When the key is up, the bias on the control tube drops to zero, making it conduct and, as a result, the voltage drop across it becomes lower than the required ionizing potential for the VR tube. The VR tube, therefore, stops conducting, the supply voltage is con-

stant, and the VR tube causes an infinitesimal time delay which smooths the leading and lagging edges of a keyed character.

Operation

The VR tube in a keying circuit is an effective non-mechanical keying gap. Since the tube needs no filament supply, it can be placed at any convenient point in the screen supply line. The VR tube is controlled by an auxiliary vacuum tube which determines the "on" or "off" conditions. This control tube is activated by applying the correct potential to its grid No. 1 and, since the grid No. 1 is operated at a negative potential, very little current flows in the actual key circuit. Figure 4 shows the basic components of the system.

When the key is down, the bias voltage applied to the control tube prevents it from conducting and the VR tube and the rf amplifier conduct current through R₁. The supply voltage, minus the drops across R₁ and the VR tube, is the effective screen-grid potential applied to the rf amplifier and permits normal key-down operation. When the key is up, the bias on the control tube drops to zero, making it conduct and, as a result, the voltage drop across it becomes lower than the required ionizing potential for the VR tube. The VR tube, therefore, stops conducting, the supply voltage is con-

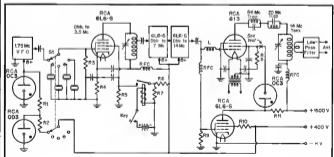


Figure 5

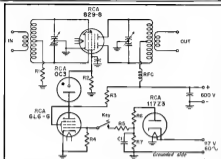


Figure 3

pletely removed from the screen grid of the *af* amplifier, and the transmitter goes off the air.

This procedure can be repeated as often as desired, as in *ew* work; the rapidity of keying is limited only by the ionizing and de-ionizing characteristics of the VR tube. In the circuit of Fig. 4, the resistors R₁ and R₂ are high in value, and are present merely to maintain each grid at a potential near zero when keying potentials are removed. C₁ is a conventional bypass capacitor.

Transmitter Circuits

A practical application of the system is shown in Fig. 5. Here an 829-B final is keyed with an OC3 controlled by a 6L6-G. Cathod bias for the 6L6-G is obtained from a 117Z3 as shown, or it can be taken from any type of supply capable of furnishing 125 volts of bias.

Another application of the VR tube keying circuit is shown in Fig. 6. This arrangement makes it possible to key a buffer stage or the oscillator so that break-in keying may be utilized. Bias for the control tube is obtained automatically at the correct time from the grid resistor of the final amplifier. The protection the control tube gives to the final amplifier, if exci-

tion fails or when doubler and buffer stages are being adjusted, makes this keying system a valuable adjunct to a beam power or pentode final. (On higher-powered finals, a hukker beam power tube must be used as a control tube.)

One additional component has been added to the circuit by Bill Scherer, W2AKF. This addition is a 5-henry choke placed in series with the screen lead at the point marked "X". The choke was added to give a more rounded leading edge to the keyed character. Further details on this addition may be found in Scherer's article, "The Gold-Plated Special," in *CQ*, October, 1948.

For those who wish to design an amplifier operating under conditions other than those shown here, a detailed description of the system is given in "VR Tube Keying Circuits," which appeared in the May, 1948 issue of *CQ*. Another version of the system is described in "A TVI-Free Transmitter for 10 Meters" which was published in *CQ* for October and November, 1949.

If clickless keying is desired, the VR tube keying system is a straightforward answer to a problem that has been confronting hams since the days of the spark transmitter.

PARTS LIST

Fig. 1

- R₁ = 5.0 ohm, 1/2 watt
- R₂ = 100 ohms, 1 watt
- R₃ = 0.5 megohm, 0.5 watt
- R₄ = 20,000 ohms, 20 watts
- R₅ = 10,000 ohms, 0.5 watt
- R₆ = 100 ohms, 0.5 watt
- R₇ = 0.1 megohm, 0.5 watt

Fig. 2

- L = 6.2 henry, grid choke
- R₁ = 120 ohms, 1 watt
- R₂ = 400 ohms, 20 watts
- R₃ = 2.1 megohm, 0.5 watt
- R₄ = 100 ohms, 10 watts
- R₅ = 0.22 megohm, 0.5 watt
- R₆ = 35,000 ohms, 5 watts
- R₇ = 700 ohms, 1 watt
- R₈ = 0.1 megohm, 1 watt
- R₉ = 31,000 ohms, 100 watts
- R₁₀ = 20,000 ohms, 3 watts
- RF component and bypass capacitors are conventional.

TYPE DESIGNATIONS

The following dual type designations are being dropped in favor of single identification. As stocks of double-branded tubes are exhausted, single branded tubes will take their place. There is no change in tube characteristics or quality.

Old Brand	New Brand
1B3GT/3016	1B3GT
6AB7/3553	6AC7
6AC7/3552	6AB7

CODE-PRACTICE OSC

Continued from Page 1

The code oscillator is mounted on a wood board and is complete except for headphones. A 1½-volt radio "A" cell (RCA-V5036) serves to heat the 50 milliamperer filament of the 1A5-GT, and a very small 45-volt "B" battery (RCA-V5655) is adequate to supply power to the plate of the tube, which draws only ½ milliamperer. The transformer and circuit were chosen to provide good volume for the phones at low battery drain.

The 1A5-GT is a pentode, connected as a triode (with screen tied to plate) in a Hartley-type oscillator circuit. When the transformer is mounted, washers or some other type spacers should be used to provide clearance between the base of the transformer and the chassis for the transformer leads. The batteries are held with wires fastened to the chassis by means of soldering lugs and wood screws. The connections to the 1½-volt V5036 are soldered. A standard snap-type battery plug is used for the 45-volt V5655.

Pitch Control

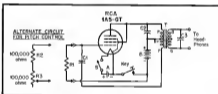
No provision was made in this

model for changing the tone of the oscillator, but a pitch or frequency control can be added if desired. This control is a 100,000-ohm potentiometer (such as an ordinary volume control) which, in series with a 100,000-ohm fixed resistor, replaces the 100,000-ohm resistor. An on-off switch on the pitch control may replace the knife switch (S).

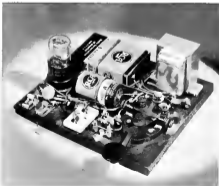
With this code practice oscillator, several headphones may be used in series, or an amplifier may be connected in place of the phones. The tone is very good, and is much more pleasing and realistic than that obtained with a buzzer.

PARTS LIST

- R₁ = 100,000 ohms, 0.5 watt
- R₂ = 100,000 ohms, 0.5 watt
- R₃ = 100,000 ohms, 0.5 watt
- C₁, C₂ = 0.001 of Sprague film ceramic
- C₃ = 0.001 of Sprague film ceramic
- S = SPST knife switch
- T = Audio volume potentiometer, push-pull plate to push-pull grid, Theravox TR43A or equivalent
- A = "A" battery, 1½ volts, RCA-V5036
- B = "B" battery, 45 volts, RCA-V5655
- Socket = Push-in mounting type Eky 124 (optional)



Wiring diagram of the code-practice oscillator.



Completed code-practice oscillator is simple and compact. (These RCA Batteries Not Shown)

SIMPLE OVER-MODULATION INDICATOR

By GEORGE HANSHLEY, W2YM
RCA Tube Dept., Harrison, N. J.

This simple and inexpensive over-modulation indicator is a useful piece of equipment which enables the amateur to comply with the FCC requirements for amplitude-modulated transmitters. It consists essentially of a high-voltage rectifier, type 1B3-GT, a 50-ohm potentiometer R, and a small neon glow lamp (NE45). A diagram of this indicator connected into a typical class C modulator stage is given in Fig. 1. Filament voltage for the 1B3-GT is obtained from the drop across the potentiometer R. This potentiometer is calibrated, as described below, in milliamperes of plate current so that when once the final has been adjusted, the proper filament voltage can be applied to the 1B3-GT. The 1B3-GT can be used with any transmitter in which

the final plate current exceeds 225 milliamperes. Transmitters having a final plate current of less than 225 milliamperes may use a tube such as the 2N4 diode-connected (grid No. 1 tied to filament and tap; grid No. 2 tied to plate) provided the plate supply voltage does not exceed 600 volts.

When the amplitude of the modulation voltage drives the instantaneous plate voltage of the modulated amplifier to a value negative with respect to B— the rectifier conducts allowing the neon lamp to glow and, thus, to indicate over modulation.

Adjustment and Use

When the transmitter is being adjusted, potentiometer R should always be set so that there is no



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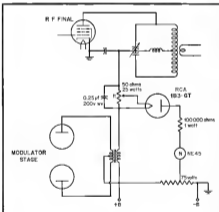


Figure 1

HAM TIPS is published by the RCA Tube Department, Harrison, N. J., and is made available to Amateur and Radio Experimenters through RCA tube and parts distributors.
T. A. "PAT" PATTERSON, W2VBL — Editor

UP TO 3000 MC!

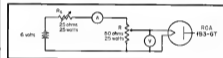


Figure 2

$$\% \text{ modulation} = \frac{\text{Total bleeder voltage} - \text{tap voltage} + \text{glow lamp voltage}}{\text{total bleeder voltage}} \times 100$$

Figure 3

voltage on the filament of the 1B3-GT. This precaution is necessary to prevent damaging the tube. After the transmitter adjustments are completed, the plate current of the modulator stage is measured and the potentiometer R set accordingly. In the circuit shown in Fig. 1, the neon lamp will glow when the rectified voltage is approximately 75 volts. If indication of 100-per-cent modulation is desired, the bleeder tap should be set at 75 volts. If it is desired that modulation percentages of less than 100 per cent be indicated, the following equation should be used for calculating the position of the voltage tap on the bleeder. (See Figure 3)

Calibrating Potentiometer R

Potentiometer R may be calibrated, as shown in Fig. 2, by means of a 6-volt battery, a 25-ohm (25-watt) variable resistor R₀, and a meter. Adjust the variable resistor R₀ to provide a definite value of current, say 300 milliamperes on meter A, and then adjust potentiometer R so that the voltage applied to the filament of the 1B3-GT is 1.25 volts. Because there is slight

interaction resulting from the position of the variable arm of R, a few further adjustments of R₀ and R may be necessary to obtain correct voltage and current readings. R₀ is then set for different values of current and R is again adjusted to obtain the proper filament voltage. After sufficient readings are taken, a curve of final plate current versus dial reading for correct filament voltage may be plotted for future reference.



Getting One OK!