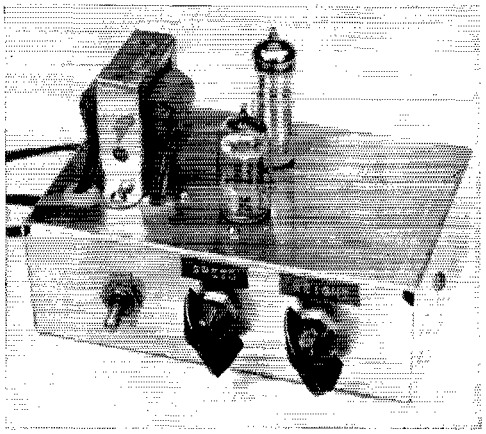
Simple Self-Completing Circuit



The W9HFM keyer is housed in a 4 × 6 × 2-inch aluminum chassis. Power switch, speed and weight controls are mounted along the front apron. On top are the power transformer, the 12AU7 and 0B2 regulator.

A Single-Tube Electronic Keyer

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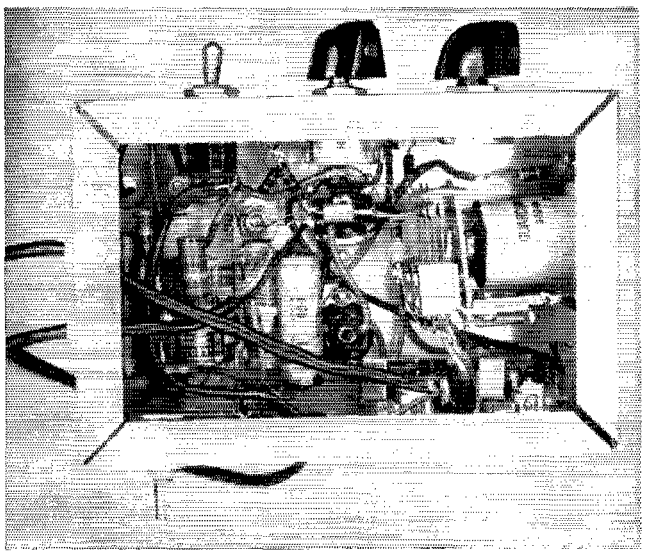
An electronic keyer is a device that generates dots or dashes. To produce good code, a keyer must be self-completing and make the correct space between dots and dashes. A slow letter "N" is a good illustration. The operator hits the dash side of the lever and immediately moves it over to the dot side and holds. The keyer makes a complete dash, a correct space, and then one or more dots, depending on how long the lever is held in the dot position. Many different circuits have been made to do this.

With some of the simpler circuits there have been problems of interaction between three controls — weight, speed, and dot-dash ratio. The dot-dash ratio control can be eliminated and a near-perfect ratio can be produced by using a divider, such as a bistable or synchronized oscillator. The circuit shown in Fig. 1 uses the latter.

Circuit Operation

In theory, a perfect dash can be formed by filling the space between two dots. That is what happens when the output of the dot generator is combined with that of the synchronized oscillator. Speed adjustment is accomplished by varying the frequency of both oscillators simultaneously by means of R_4. Referring to Fig. 2, it is seen that there is a large margin for error in tracking, if the weight adjustment is normal, because of the overlapping of the outputs from relays K_2 and K_3. The margin is equal to the width of a dot, and normally has a time one third that of a dash.

When the lever is pushed to the dot side, C_1 is charged to approximately +140 volts through the current-limiting resistor, R_1, biasing V_{1A} into heavy conduction. This causes K_1 and K_2 to operate, removing the charging voltage and closing the keyed circuit. C_1 discharges rapidly through V_{1A} until the grid of V_{1A} becomes negative in respect to the cathode. C_1 then continues to discharge at a slower rate, determined by the capacitance, the resistance of R_2, and the voltage setting of R_3. As conduction in V_{1A} falls off, K_2 opens and, at about twice the time interval, K_1 recloses. If the key is held closed, C_1 is recharged, and the cycle is repeated. It should be noticed



Bottom view of the simple keyer. K_3 is mounted against the right-hand wall of the chassis, K_1 and K_2 against the rear wall. The relay mounting screws pass through rubber-grommet-lined holes to minimize relay noise. The control in the lower left-hand corner is R_3, the divider-adjustment control. The placement of other components is not critical, as is apparent in this experimental layout.

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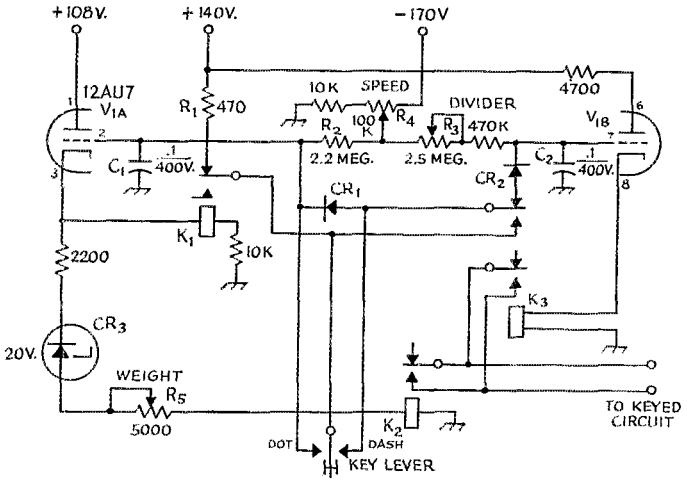

Fig. 1—Circuit of the W9HFM keyer. Capacitances are in microfarads; resistances are in ohms (K = 1000). Capacitors are paper; fixed resistors are ½-watt. Diodes are 400-p.i.v. silicon, 50-ma. or more. Key-lever leads should be shielded, with shield grounded to chassis. R.f. filtering of key leads is recommended.

CR_3—20-volt 1-watt Zener diode (G.E. Z4XL20, or similar).
K_1, K_2—S.p.d.t. relay, 2300-ohm coil (Sigma 11F-2300-G/SIL).
K_3—D.p.d.t. relay, 5000-ohm coil (Guardian IR-625-5).
R_3, R_4, R_5—Linear-taper control.
Other component labels are for text-reference purposes.

that, with the lever on the dot side, CR_1 is reverse-biased and does not conduct.

With the lever on the dash side, CR_1 and CR_2 conduct, and the charging voltage is applied to both C_1 and C_2. This causes all relays to function. K_3 is synchronized by K_1 because C_2 can receive a pulse only through the contacts of K_1. The contacts on K_3 serve two purposes. One is to prevent C_2 from receiving a pulse while K_3 is closed, and the other is to make the dash self-completing by insuring that two dots are produced while a dash is being formed.

CR_3 was found to be necessary to stabilize the weight adjustment.

Power Supply

The diagram of the built-in power supply is shown in Fig. 3. It consists primarily of positive and negative rectifiers operating from the same transformer secondary. The 0B2 provides a regulated 108-volt tap on the positive supply.

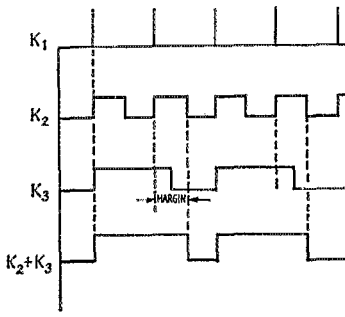

Fig. 2—Diagrams showing contact-closed time for the three relays. Notice that the contacts of K_1 are open (coil energized) for most of the dot cycle. Contacts close (coil deenergized) only momentarily to charge capacitors. Bottom line shows resultant of overlap of K_2 and K_3 when the key lever is in the dash position. K_3 may open at any time within the margin limits indicated without affecting the length of the dash.

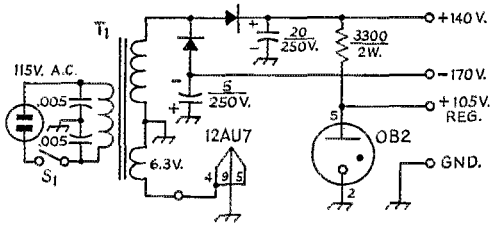

Fig. 3—Circuit of the power supply used with the keyer. Capacitances are in microfarads; resistance is in ohms. Capacitors are electrolytic. Diodes are 400-p.i.v. silicon, 50-ma. or more.
S_1—S.p.s.t. toggle switch.
T_1—Power transformer: 125 volts, 15 ma.; 6.3 volts, 0.6 amp.

Adjustment

The only special adjustment required is that of R_3. It should be set so that K_3 divides by 2, and yet does not lengthen the dash. When listening to K_2 alone, it should sound exactly the same, whether the lever is pushed to the dot side or the dash side. Then, when listening to K_3 alone, it should have a weight midway between a dot and a dash. When these requirements are met, the keyer should work properly. Fig. 2 indicates the permissible margin of adjustment for K_3. K_3 may open at any time within the limits indicated without changing the length of the dash transmitted.

I have compared this keyer carefully with a W9TO keyer that I have, and I have been unable to detect any difference in operation. QST