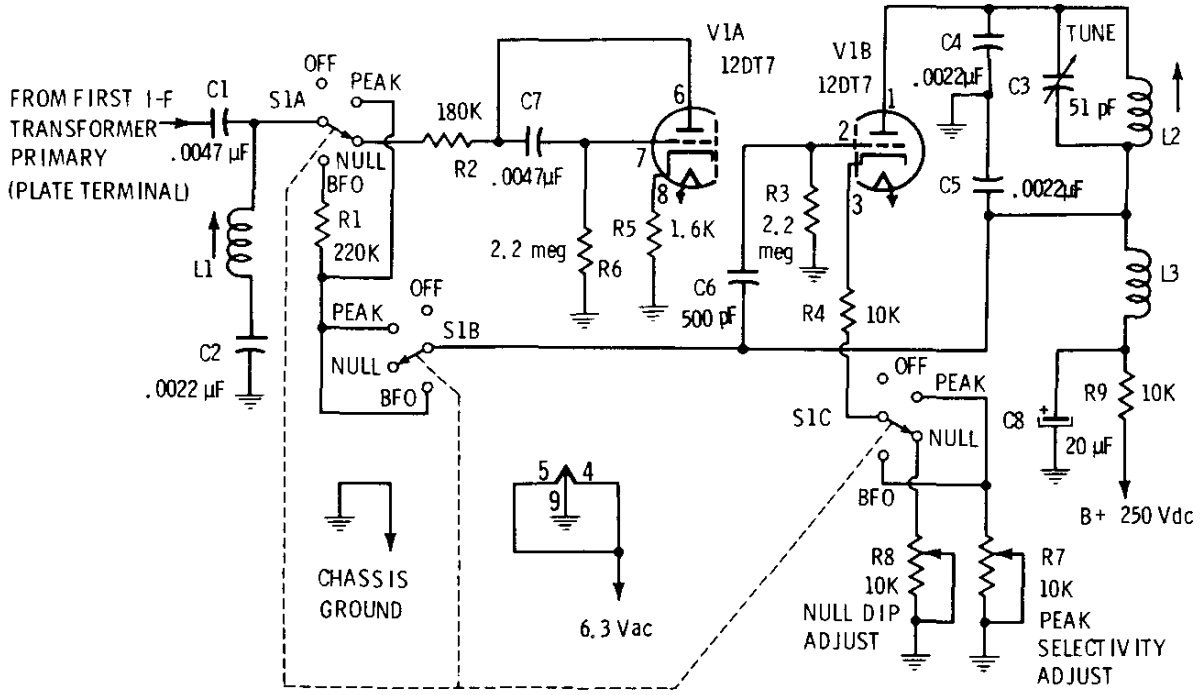
HOMEBREW Q-MULTIPLIER

This circuit can boost the signal strength in your receiver by 1 or 2 S-units, giving approximately 10 dB gain.

A Q-multiplier amplifies the Q of the first IF transformer so that a sharper peak or notch in the bandwidth of the transformer is formed. Peaking and notching of the signal is performed by adjustment of the regeneration control (***R_7*** and ***R_8***).

Separate regeneration controls are used in this circuit primarily for purposes of convenience. A BFO is also built into the circuit making it readily useful to short-wave receivers that lack the ability to receive CW signa1s.



Q-multiplier schematic.

The compactness of the unit is attributed to the 12DT7 tube, serving the function of two tubes. ***L_1*** and ***L_2*** should be mounted on opposite ends of the metal box and at right angles to each other. Lead lengths are not very critical so the circuit design may vary from breadboard to compact. ***S_1*** is a 3P4T-stacked switch used as a mode selector.

The circuit is designed for use with a 455 kHz IF transformer, but may be altered for use on the other frequencies. If the

frequency is higher than 800 kHz, change C_2 to 0.001 mF. If it is lower, change it to 0.0025 mF.

- Connect capacitor C_1 to the plate terminal on the primary winding of the first IF transformer.
- Turn the receiver and the Q-multiplier on and set the receiver frequency to 3 MHz.
- Turn R_7 about half way and C_3 to maximum capacitance. Adjust L_1 while S_1 is in the "off" position.
- Listen for slight drop in the audio output of the receiver; when it is heard, stop turning L_1.
- Now, turn S_1 to "peak" and adjust R_7 to just below the squeal level.
- Turn L_2 until a louder output is noticed.
- The multiplier is now completely tuned, except for R_7 and R_8, which should be adjusted for maximum selectivity and sensitivity.

When changing receiver frequency, C_3 will have to be readjusted; C_3 can be calibrated if desired. R_7 and R_8 will also have to be readjusted slightly.

Parts List for Homebrew Q-Multiplier

Item No.	Description
C1, C7	.0047 μF capacitors.
C2, C4, C5	.0022 μF capacitors.
C3	51 pF variable capacitor.
C6	500 pF capacitor.
C8	20 μF capacitor.
L1	1000-2000 μH slug-tuned coil (North Hills 120-K, or equiv.).
L2	500-1000 μH slug-tuned coil (North Hills 120-J, or equiv.).
L3	Rf choke (J. W. Miller 4555 or equiv.).
R1	220K resistor.
R2	180K resistor.
R3, R6	2.2 meg resistors.
R4, R9	10K resistors.
R5	1.6K resistor.
R7, R8	10K potentiometers.
S1A, S1B, S1C	4-position, triple-pole rotary switch.
V1	12DT7 tube.

A 12AX7 is a satisfactory substitute to the 12DT7.
TV Horizontal peaking coils may substitute for L_1 and L_2.

The Q-Multiplier

Extracted from *The Radio Handbook 17th Edition*, by William Orr

The selectivity of a receiver may be increased by raising the Q of the tuned circuits of the IF strip. A simple way to accomplish this is to add a controlled amount of positive feedback to a tuned circuit, thus increasing its Q. This is done in the *Q-mu1tip1ier,* whose basic circuit is shown in figure 39.

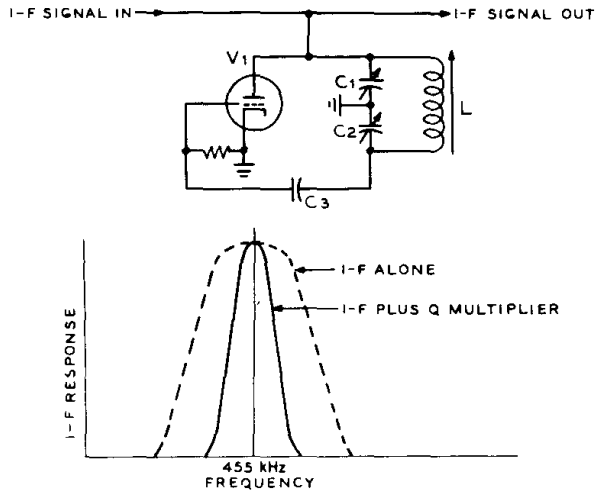


Figure 39

The Q-MULTIPLIER

The loss resistance of a high-Q circuit is neutralized by regeneration in a simple feedback amplifier. A highly selective passband is produced which is coupled to the i-f circuit of the receiver.

The circuit ***L-C1-C2*** is tuned to the intermediate frequency, and the loss resistance of the circuit is neutralized by the positive-feedback circuit composed of ***C3*** and the vacuum tube. Too great a degree of positive feedback will cause the circuit to break into oscillation.

At the resonant frequency, the impedance of the tuned circuit is very high, and when shunted across an IF stage will have little effect upon the signal. At frequencies removed from resonance, the impedance of the circuit is low, resulting in high attenuation of the IF signal. The resonant frequency of the Q-multiplier may be varied by changing the value of one of the components in the tuned circuit.

The Q-multiplier may also be used to "null" a signal by employing negative feedback to control the plate resistance of an auxiliary amplifier stage as shown in figure 40.

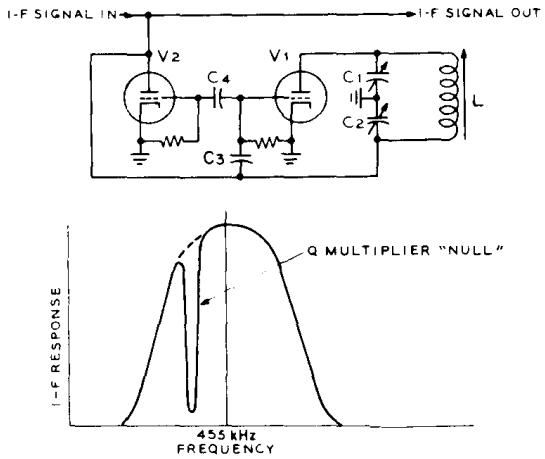
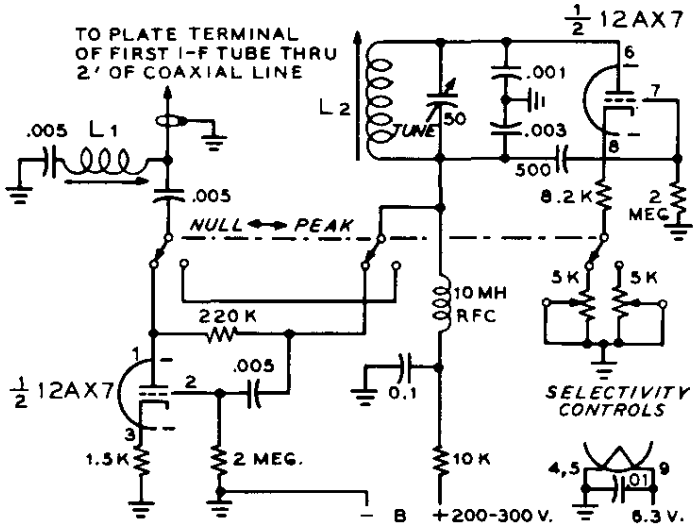


Figure 40

Q-MULTIPLIER NULL CIRCUIT

The addition of a second triode permits the Q-Multiplier to be used for nulling out an unwanted heterodyne.

Since the grid-cathode phase shift through the Q-multiplier is zero, the plate resistance of a second tube may be readily controlled by placing it across the Q-multiplier. At resonance, the high negative feedback drops the plate resistance of V_2, shunting the IF circuit. Off resonance, the feedback is reduced and the plate resistance of V_2 rises, reducing the amount of signal attenuation in the IF strip. A circuit combining both the "peak" and "null" features is shown in figure 41.



L1 = *GRAYBURNE* V6 CHOKE (*0.6 – 6.0 MH*)
L2 = *GRAYBURNE* "LOOPSTICK" COIL

Figure 41

SCHEMATIC OF A 455-kHz Q-MULTIPLIER

Coil L_1 is required to tune out the reactance of the coaxial line. It is adjusted for maximum signal response. L_1 may be omitted if the Q-multiplier is connected to the receiver with a short length of wire, and the i-f transformer within the receiver is retuned.

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