FM Commercial Eliminator for Fringe Areas

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Many FM stations are still simplexing background music programs with 20 k-c beep tones to kill announcements on their subscribers' leased sets. Here is a device which will work as an adjunct to any set.

MANY OF OUR FM stations broadcast a 20-kc "beep" signal along with commercials and pleas for subscriptions, so that receivers with selective relays emit only instrumental music, and are silent during chin music. As the commercials become more long-winded and offensive, their elimination becomes increasingly desirable.

Relatively simple circuits for eliminating commercials from the stations that broadcast "beep" signals have been published one by Stoner[1], being typical of the more practical. This type of circuit works very well in strong and moderate signal areas, for which it is designed, but is somewhat undependable in fringe areas, where signals tend to be weak.

Several highly sensitive selective amplifier-relay combinations are commercially available at relatively high cost, most of them using either complicated L-C filter combinations, or twin-T feedback amplifiers. Tests with several of these showed that, in addition to high cost and power consumption, they were too selective, so that they needed continual readjustment to follow the minor variations in the "beep" frequency put out by the FM station. Needed, for this application, was a selective amplifier capable of operating a relay when the input was about 50 mv at 20 kc ± 1 kc.

After some computation and experimentation, the amplifier of *Fig.* 1 was developed. This uses only two dual triodes, and develops an output of 55 volts negative with an input of only 40 mv from 19 to 21 kc. All parts are standard "over the counter" items, and construction is simple and straightforward. So that both speaker interruption, by use of a relay, and biasing off of the first a. f. tube could be used, as desired, dual outputs are provided on this chassis, which is considerably larger than is needed for either type of operation singly. Power supply used here is also much larger than is necessary.

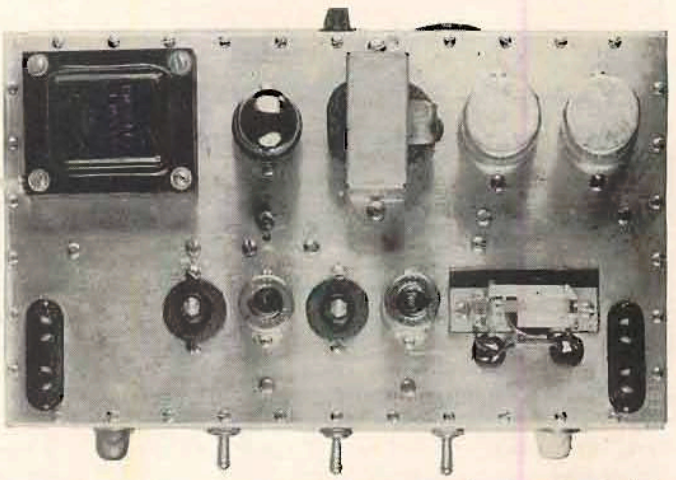

Fig. 1. Sensitive "beep" amplifier and relay, with power supply.

Circuit of this selective amplifier, with alternative output modes, and two alternative power supplies, is shown in *Fig.* 2. Several other rather obvious alternatives can be used without impairing operation of the device, which has no critical adjustments except tuning.

Operation of the selective amplifier is standard, and is much like that of an i. f. system less avc. Input, taken from the FM detector circuit ahead of the deemphasis network, is applied across the first tuned circuit, through a 220-k resistor. At the frequency to which this circuit is tuned, 20 kc, a high voltage is applied to the grid of V_{1a}. At all other frequencies, a very much lower voltage is applied to this same grid.

Amplification of the signal applied to the grid occurs in the tube, and its output is applied across another tuned circuit, where the process repeats, energizes the grid of V_{1b} greatly if the signal is at 20 kc, and negligibly at all other frequencies. A third amplification takes place in V_{2a} in the same manner, and the amplified output of this tube is full-wave rectified by the two diodes in the output circuit. This is filtered by the .02 µf capacitor and 1-meg. resistor in the output, and regulated by the NE-51 lamp, which also serves as a "beep" pilot. If only a bias output (here −55 volts) is desired, output is taken from A-A, and V_{2b} can either be omitted or used for something else. If relay operation is desired, the bias voltage developed across the output of the rectifier is applied to the grid of V_{2b}, effectively cutting it off, and opening the contacts across B-B as the relay armature is released due to no plate current in the relay coil.

In some instances, the input resistor, here evaluated at 220 k ohms, can be increased considerably, reducing the loading effect of the amplifier on the FM detector. Increasing the resistance from 220 k ohms to 1 megohm reduces the sensitivity of the amplifier from 40 millivolts for full output to 55 millivolts for full output.

Power-supply requirement is approximately 6.3 volts at 0.8 amperes for filaments and pilot and 300 volts at 20 ma for plates. This can safely be "robbed" from many receivers. Where this is not possible or desirable, a separate power supply must be provided. That shown at (A) in *Fig.* 2 works excellently, but is much larger than necessary. Alternative plate circuits shown at (B) and (C) work well, and not only use an electrically smaller transformer, but also generate much less heat. An electrolytic capacitor can be used in place of the 4 µf paper capacitor shown at (B), but a larger capacitance is usually necessary,

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1 Stoner, D. L. "How to beep out FM commercials", *Pop. Electron.* March, 1957.

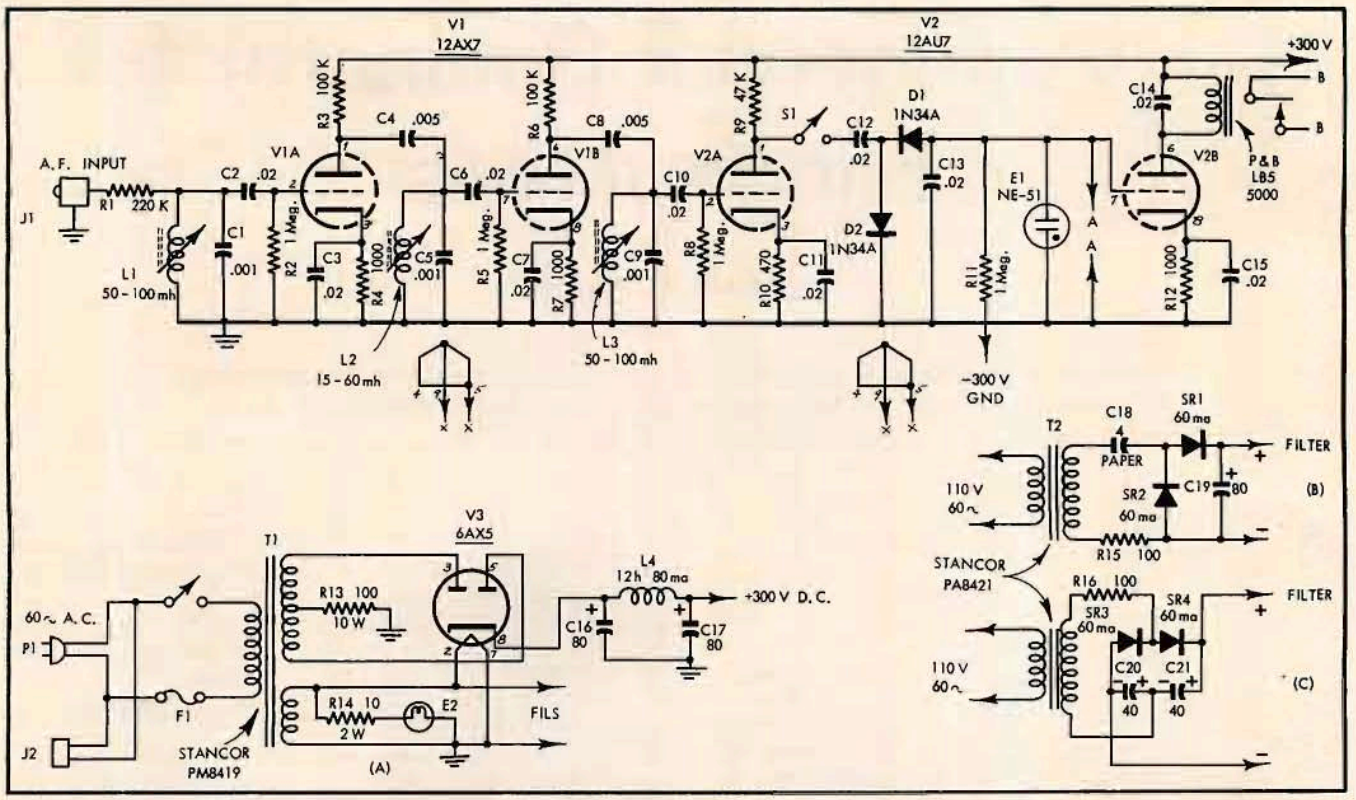

Fig 2. Circuit of sensitive 20-kc selective amplifier, with two output modes and three optional power supplies.

as electrolytic capacitors do not release their charges instantaneously. A BR-845 capacitor (8 μf. 450 volts) works well here, but a similarly rated unit of other manufacture may not work identically.

The first and third inductances here are high-grade cup-core inductances, and use of such self-shielded coils is essential here to prevent oscillation, unless rather complete shielding is installed. The second coil is unshielded, as it has nothing

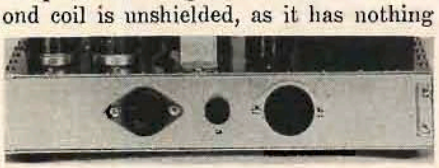

Fig. 3. A.c. connections and fuse on rear chassis apron.

to couple to, with the other coils having no external fields.

Layout and Construction

Construction is entirely straightforward, and not only requires no special techniques, but component arrangement can be modified to suit individual conditions and tastes without affecting performance. The model illustrated, which has both bias and relay outputs, and an oversize power supply, was constructed on a 7" by 12" by 2" Seezak chassis. With single output mode and either of the alternative power supplies shown in *Fig.* 2, a chassis 5" by 9" by 2" will be more than adequate.

Power supply is arranged in linear fashion along the rear of the chassis, with the choke interposed between the rectifier tube and the electrolytic capacitors to protect them from tube heat. Power input and fuse are mounted on the rear chassis apron, as in *Fig.* 3. An a.c. outlet is wired in parallel to the input plug ahead of the fuse and switch to take care of the chronic shortage of outlets in electronic installations.

Pilots and controls are mounted on the front chassis apron, as in *Fig.* 4. These can be rearranged to suit conditions and personal preferences except that the leads to the disabling switch, in the plate circuit of V_{2a} should be short and not too close to the input, or unwanted positive feedback may result.

Tuned circuits are arranged for convenience in wiring, and tuning capacitors (.001 μf tubular ceramics) are mounted directly on the inductor terminals. While power leads are cabled, signal leads are wired point to point. Output rectifier and other related components are mounted on a small terminal board, as in *Fig.* 5. As will be noted in this figure, the filter capacitors are mounted in Cinch sockets, to facilitate replacement. As with most components which are easy to change, they never seem to need it.

Adjustments

To align and adjust this amplifier, determine the "beep" frequency in use at the FM station in which you are interested. This is usually 20 kc, and can be determined by asking some stations, by use of an a. f. frequency meter, or by use of an oscilloscope. Set an audio oscillator to this same frequency to produce a steady input of the desired frequency. Set the output of the oscillator to a convenient low value, such as 100 millivolts.

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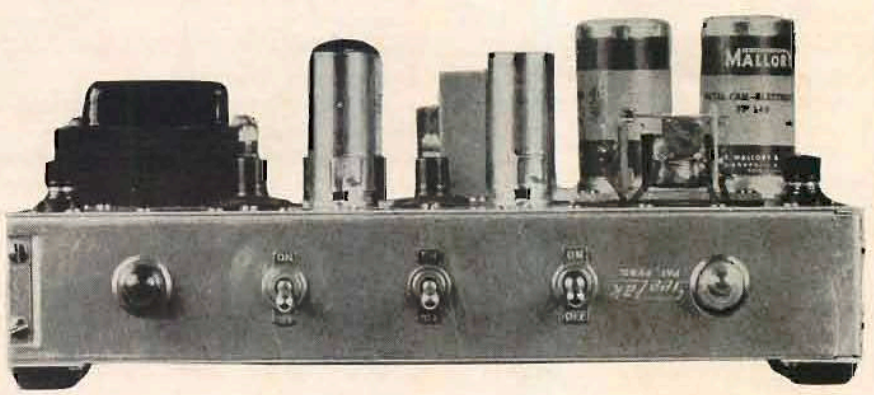

Fig. 4. Pilots and controls on front chassis apron. Components, from left to right, are: power pilot, power switch, disabling switch, mode switch, and output pilot.

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Connect this oscillator to the input of the amplifier, remove the output pilot bulb from its socket, and connect a VTVM across points A-A (*Fig.* 2). Adjust the inductance of the coils for maximum output, starting with the third coil, and proceeding down the line. When output appears maximum, run through the sequence again for resonance. When the amplifier appears aligned, replace the output pilot bulb, and note performance as the oscillator frequency is varied from somewhat below 20 kc to somewhat above it. Output should appear as in *Fig.* 6.

The input to this amplifier is normally connected to the FM detector output, ahead of the de-emphasis network. The bias output of the amplifier can be connected to the grid circuit of the first a. f. tube of the receiver as at (A) in *Fig.* 7. This connection is made by lifting the grounded end of the first a. f. grid resistor, and inserting a 470 k resistor between the free end of the grid resistor and ground. The junction of the two resistors is connected to the "hot" "A" terminal in *Fig.* 2, and ground of the receiver is connected to ground of the amplifier. The resistor is inserted here so that the receiver will work whether or not the commercial suppressor is connected.

If relay control of the speaker is desired, in place of bias control of the first a. f. stage, the ungrounded speaker line is opened, and connected to points B-B in *Fig.* 2. With this connection, the speaker functions normally as long as no "beep" tone is present, but is open-circuited whenever the 20-kc signal is received. Connections are shown at (B) in *Fig.* 7.

Alternate Connection

If, for psychiatric or other reasons, you want to listen to the commercials, but do not desire the musical programs, terminals B-B of *Fig.* 2 may be connected across the speaker, as in *Fig.* 7, C. With this connection, the speaker is shorted at all times when the 20-kc tone is absent, but operates normally when the "beep" signal is present.

Performance of this selective amplifier commercial killer is highly satisfactory, and it will function with any FM station that can produce intelligible

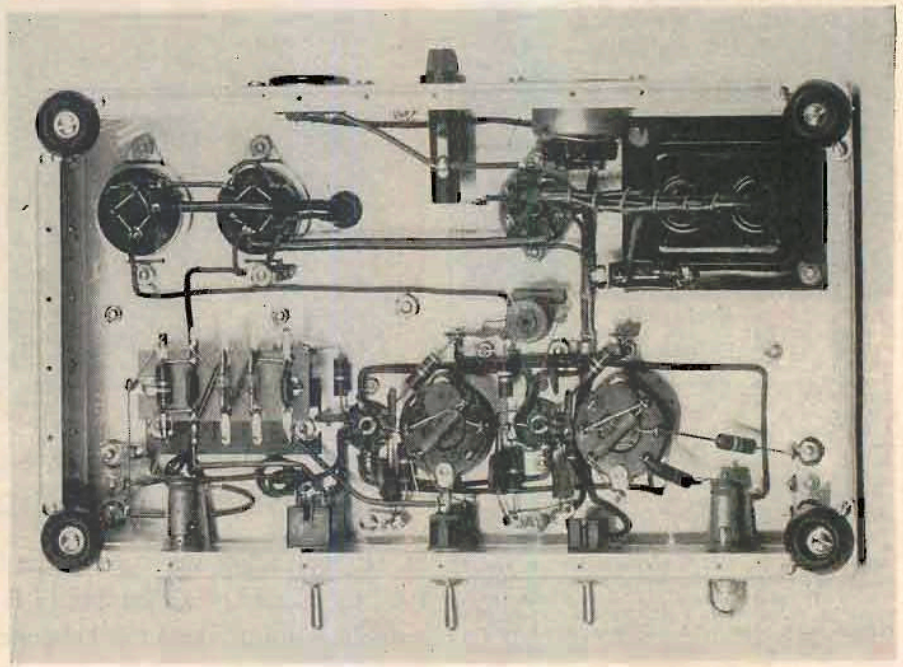

Fig. 5. Underchassis view of selective amplifier.

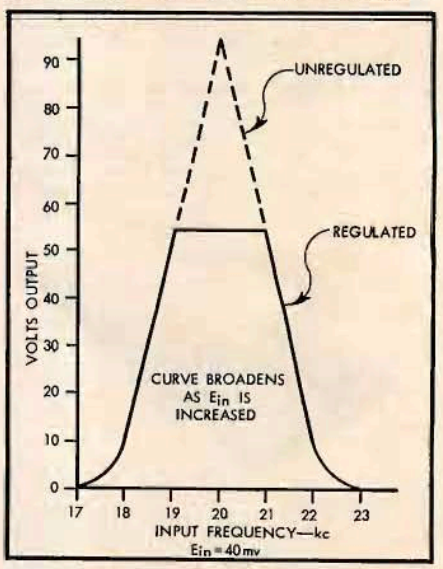

Fig. 6. Output characteristic of selective amplifier.

speech, provided it also puts out a "beep" signal (most stations do not). Tube life should exceed 5000 hours of actual use, some in similar service having lasted beyond 10,000 hours. Tuning adjustments apparently last indefinitely, if they are not tampered with. Those shown have withstood three months of use including several thousand miles of travel in a suitcase.

With this type of "beep" commercial killer, you can enjoy FM musical programs, from stations which emit a silencing signal, even in fringe areas, with periods of silence replacing the long-winded importunate tirades commanding you to "run, do not walk" to the nearest supermarket, where you *must* buy a "large economy size 55 gallon drum" of Joe Blow Yogurt ("contains *activated* Milorganite, a potent source of vitamin B-29"). This type of suppressor is also effective in squelching the hourly dissertations on the difference between background music and *functional* background music. Æ

PARTS LIST

C_1, C_3, C_9	.001 µf, tubular ceramic
C_2, C_5, C_6, C_7, C_{10}, C_{11}, C_{12}, C_{13}, C_{14}, C_{15}	.02 µf, disc ceramic
C_4, C_8	.005 µf, disc ceramic
C_{16}, C_{17}, C_{19}	80 µf, 450 volts, electrolytic
C_{18}	4 µf, 250 volts, paper
C_{20}, C_{21}	40 µf, 250 volts, electrolytic
D_1, D_2	1N34A crystal diodes
E_1	NE51 neon lamp
E_2	#44 pilot lamp
J_1	input connector, to suit personal preference
J_2	female a.c. connector, Amphenol 61-F
L_1, L_2	50–100 mH, North Hills #700F

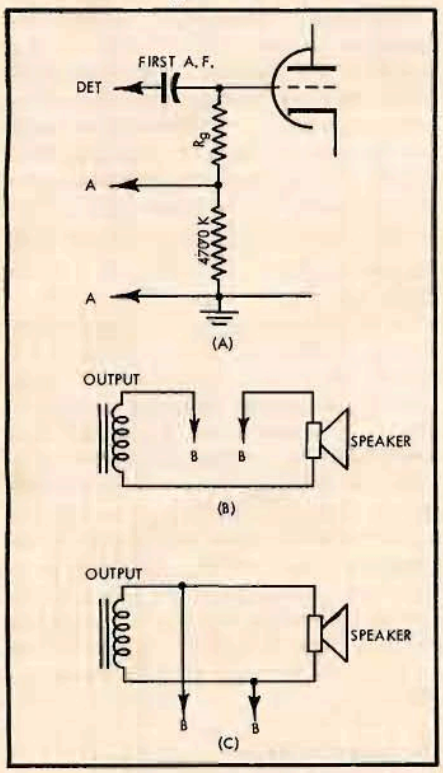

Fig. 7. Receiver connections to amplifier output.

L_2	15–60 mH, Miller #6319
L_4	filter choke, 12 H, 80 ma.
P_1	male a.c. connector, Amphenol 61M61
R_1	220 k ohms, 1 watt, (all resistors 10%)
R_2, R_5, R_8, R_{11}	1 megohm, 1 watt
R_3, R_6	100 k ohms, 1 watt
R_4, R_7, R_{12}	1000 ohms, 1 watt
R_9	47,000 ohms, 1 watt
R_{10}	470 ohms, 1 watt
R_{13}, R_{15}, R_{16}	100 ohms, 10 watts, wirewound
R_{14}	10 ohms, 2 watts
SR_1, SR_2, SR_3, SR_4	60 ma, 125-volt selenium rectifiers
T_1	power transformer, 240–0–240 v. at 10 ma; 6.3 v. at 3a. (Stancor P8419 or equivalent)
T_2, T_3	alternate power transformer, 125 volts at 50 ma, 6.3 volts at 2 a. (Stancor PA-8421 or equivalent)
V_1	12AX7 tube
V_2	12AU7 tube
V_3	6X5 or 6AX5 tube
	Chassis—Seezak 7 × 12 × 2 in. or 5 × 9 × 2 in. (See text)