PACKAGED SELECTIVITY

455-KC MECHANICAL FILTER RECEIVER ADAPTER

Enjoy 1957-style selectivity and performance from your present receiver by plugging in this simple mechanical filter adapter that replaces the first IF amplifier tube.

—Lighthouse Larry

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The mechanical filter has none of the characteristics of "ringing" sound that sometimes results when a crystal filter is adjusted to produce an extremely sharp selectivity. Curve D, Fig. 2 illustrates the selectivity of the 3.1-kilo-
cycle mechanical filter bandwidth suitable for AM and SSB reception. Compare this curve with "A," which is drawn to the same scale!

A mechanical filter is, as the name implies, a series of vibrating, mechanically resonant, disks tied together with small slots that transmit the vibrations from disk to disk. Small indentations coupled to the disks at both ends convert the electrical energy passing through them into mechanical vibrations at the input end and back into electrical energy at the output end. Each disk has a "Q" 20 times as high as an ordinary tuned circuit, so that several disks of slightly different resonant frequencies must be coupled together to achieve a nearly rectangular bandwidth response curve.

Since the filter characteristic determines the over-all intermediate frequency bandwidth, any other tuned circuits in the intermediate-frequency amplifier may utilize a low-cost, readily available coil, such as the varituner, instead of more expensive IF coupling transformers.

The adapter model pictured on the cover was assembled from parts that cost about five dollars (plus $45.00 for the Collins F-453J.31 filter). 2W2FZ, designer of the adapter, was so pleased with hot station receiver's new-found selectivity (formerly about 30 kilocycles broad at the -60 db-point) after testing the adapter that he promptly added "AIV" to the receiver's model number.

The adapters with an intermediate-frequency amplifier on 665 kilocycles (formerly found in pre-World War II receivers) to be added to the receiver's first IF tube socket. The tuning frequency of the mechanical filter, otherwise very little signal will be heard when the adapter is added. This change in the intermediate frequency will render the crystal filter practically inoperative unless a 665-kilocycle filter crystal is substituted for the original.

**ELECTRICAL DETAILS**

The adapter picks up the signal from the control grid of the receiver's first IF tube socket through coupling capacitor C1, then feeds it into the input end of a parallel tube, C2, as shown in the schematic diagram, Fig. 3. The plate circuit of V1, the capacity-coupled to the input terminals to the mechanical filter to keep plate current from flowing through the coil. A much wider signal voltage range can be handled by the filter without distortion when no current flows through the coil. Both filter coils are tuned to resonance at the operating frequency by fixed capacitors C1 and C2.


The filter output terminals are connected directly to the control grid of V3 and the chassis, since no-grid current will flow in this stage. The output signal from V1 is again capacity coupled back into the plate terminal of the receiver's IF tube socket. The tuned circuits connected to the plates of both V2 and V4 are composed of varituner coils, L1 and L0, shunted by fixed capacitors C1 and C2.

The input and output coaxial cables are 16-inches in length of RG-58/U. This cable forms the 40-mm ground leg of a capacitance voltage divider, C1 being the other leg, that reduces the signal voltage applied to V1, to about 1/16 of the voltage across the secondary of the receiver's first IF transformer.

The over-all signal amplification of the adapter has been held down to a few decibels more than the 10-db loss through the filter through use of small input and output coupling capacitors and fairly large cathode bias resistors in both amplifier stages. This is suitable for receivers having two or more intermediate frequency coupling amplifier stages, but additional gain from the adapter may be obtained by reducing the value of one or both cathode resistors to 370 ohms. This may be desirable when the adapter is operated with a receiver having only one intermediate frequency amplifier stage. The capacity ratio in the input voltage divider may be reduced by shortening the input coil, or increasing C1, to 25 mmf, for a plug-in base (Collins 425A-5). The first IF transformer in the receiver may then have to be retuned to achieve maximum signal gain.

Each cathode resistor may be reduced through a male octal chassis plug, but a three- or four-wire cable may be substituted. The plug connections are shown as to how this adapter could be plugged directly into the "HIFM" adapter socket on certain National receiver models. Most communications receivers have an accessory power socket on the rear of the chassis from which power may be obtained. If 6DJ8 tubes are used for V1 and V2, the power required (6.5 volts at 0.3 amperes, and 105 to 250 volts at 10 ma) may be

**PARTS LIST**

C1 - 600-mm ceramic (270- and 330-mm may be paralleled.
C2 - 120-mm ceramic.
C3 - 10-mm tubular ceramic (Aerotron Type G-1 or Wire Type 331).
FL - 455-kilocycle mechanical filter with 3-1/2 kilocycle bandwidth and 6-pin miniatures plug-in base (Collins 425A-5).
L1 - 200-uh iron slug-tuned coil (Greyhounds or Supreme Vari-tuner Model VI, or Miller No. 6300).
P - male octal plug with retaining ring (Johnspax 86-PW).
V1 - 6BQ5 or 6BQ6.
V2 - 6BA6 or 6BQ5.
V3 - 6L6 or 6BQ6.
V4 - 6L6 or 6BQ6.
little more than was drawn by the IF tube replaced by the adapter. A single plate and screen voltage lead will suffice when the supply voltage is 130 or less. A single 250-ohm D.C. source will require that an 18,000-ohm, 12-watt screen voltage dropping resistor be connected between pins 4 and 8 on the power plug.

An alternate output coupling circuit, and a method of applying 8V voltage from the receiver to the second amplifier stage in the adapter are shown in Fig. 4. This circuit is mainly useful when the adapter is con- nected to a receiver that has few AVC-controlled stages. The AVC voltage is taken from the control grid connection on the IF tube socket and is applied to the grid of $V_4$, through the output coupling coil or the mechanical filter. The lead from the plate of $V_4$ to the IF tube socket should be the shortest possible length of RG-59/U coaxial cable. The primary of the receiver's second IF transformer should be returned after plugging in this cable.

**MECHANICAL DETAILS**

This adapter unit was constructed in a 2½" x 2½" x 4-inch Minibox (Rad CU-3003), a good compromise that is compact, yet not too small for easy wiring. A larger box may be required if a "B" or "C"-type rectangular mechanical case filter designed for horizontal mounting is used instead of the "J" model. A somewhat smaller Minibox will suffice if the circuit in Fig. 4, eliminating $L_0$, is used.

For maximum isolation between input and output circuits, a parts layout similar to that shown in the drilling diagram, Fig. 5, should be followed. After drilling and punching all holes, the tube and me- chanical filter sockets, power plug and rubber grom- mets may be assembled. Solder lugs were plated on all socket screws for ground connections. Then, a 3 x 3-inch piece of perforated sheet aluminum is formed into the shield shown in the bottom and oblique views.

**Fig. 5.** Suggested parts layout for the adapter.

For maximum isolation between pins 3 and 4 and 8 and 9, then is mounted to a soldering lug that has been soldered to pin 2 on the socket. The upper flange on the shield also is bolted to the box directly above $L_0$, and two self-tapping screws are driven into the shield's side flanges when the outer end of the box is assembled.

Assembling the two IF tube socket probes takes little more time than is required to explain it. First, cut two lengths of RG-59/U coaxial cable 17 inches long and remove ⅛ inches of the vinyl core on one end of each piece. Slide the braided shield back over the outer core, then trim the center conductor and insulation so that ⅛ inch protrudes beyond the shield. Next, the shield is to expose ⅛ inch of the center conductor, trim one end of the 10-mmd capacitor, $C_0$, and solder it to the center conductor with a ⅛ of an inch overlap. Cut narrow strips of plastic insulating tape and wrap them around this joint to the body diameter of the capacitor as shown in Fig. 6. Slide the braided shield over the capacitor, pull it to explain...

**Fig. 6.** Bottom view of the adapter showing locations of major parts.

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**DRILLING LEGEND**

"A"—No.-32-drill for socket and shield

"B"—⅛-inch-diameter drill

"C"—⅛-inch-diameter socket punch

"D"—⅛-inch-diameter socket punch
Fig. 7. Oblique view of the adapter.

Fig. 8. Cross-section assembly view of signal cables.

carrier strength on the meter. On a receiver that has no "S" meter, Lc and L2 are best adjusted by turning the RF gain down, the audio gain up, and tuning both coils for maximum audio output from a modulated sig.

A somewhat different technique should be used for tuning a signal generator. Simply add one additional step to the tuning installation of "PACKAGED SELECTIVITY." If any of your receivers have a receiver with built-in me-


capacitors (V) serve as the heart of the circuit and the center conductors are soldered to the correct pin on the receiver, the radio, one edge of the filter section, or to the IF amplifier, short lengths of No. 18 tinned wire may be used for the plug-in pins on the cables, or the capacitors and ground lead may be soldered to a special 1-pin miniature male adapter plug (Vector No. 71)

For easy parts assembly, the shield may be tem-
porarily removed, and replaced when wiring is com-
pleted. Heater, screen and plate power wires are next installed, keeping all such leads close to the box when-
ner possible to minimize stray signal pickup. Small parts, resistors and capacitors, are now soldered in place, after which the coaxial cable input and output leads are connected. About 1/4" of an inch of the outer vinyl jacket is stripped from these cables and the shield braid is twisted into a single conductor. These cable ends are then brought into the box through rubber grommeted holes. The cable shield is soldered to the closest ground bus lead and the center conductors are soldered to the correct tube socket pins. Finally, the varicap coil and capacitors C1 and C2 are assembled and wired.

The adapter is connected to a communications re-
ciever as previously described, following a wiring and power check to insure that the correct voltages are applied to the various tube elements. The receiver should then be tuned to the center of a strong, steady local amateur or broadcast station signal. If the re-
ciever has no "S" meter, the AVC may be left "ON" while tuning the slug in coil La for maximum gain and then the AVC set to "OFF." Note the degree of tuning that is required to bring up the audio level to a desired level and the degree of tuning required to "shut out" or "cut off" the carrier. The slug may then be reset for maximum gain and the degree of tuning required for the desired degree of "cut out" noted. This will give a measure of the sensitivity of the receiver to the carrier.

In addition to the 3.1-kilocycle bandwidth filter previously mentioned, 455-kilocycle plug-in filters may be obtained in the following bandwidths: 0.15, 0.3, 3.1, 5.0, and 11.0 kilocycles at the -6 db points.

The 3.1-kilocycle bandwidth model is ideal for re-
cuping SSB, and receiving any type of modulated AM signals. The 0.3-kilocycle bandwidth model pro-
vides for the maximum possible filter selectivity, which is practical for CW reception. Devoted brass pounders may prefer the 3.1-kilocycle model, requiring only a "PITCH CONTROL" (labeled "S") by its setting. This may be varied from zero to maximum audio gain and the setting may be "pushed off" the edge of the IF bandwidth.

When receiving single-sideband, suppressed carrier signals—or for single-sideband CW reception—the receiver's "beat frequency oscillator is turned on and the "PITCH CONTROL" is adjusted so that the BFO is set to carrier frequency. The proper pitch control setting may be determined by tuning the receiver across a carrier while adjusting the pitch con-
roller so that a beat note on one side of zero beat is heard. After finding or marking this setting of the pitch control, again tune it so that the test signal on only the other side of zero beat is heard. Note this setting, then try tuning in an amateur SSB signal. If intelligible speech cannot be heard, shift the BFO pitch control to the next control setting and again carefully tune the receiver across a carrier.

As with the reception of "phone" signals with carrier, some interference may be removed by shifting the SSB signal by shifting the BFO pitch control a small amount, then retuning the receiver so that the correct voice pitch is again heard.

This adapter will serve as an SSB signal sifter for SSB reception, especially if your receiver has strong BFO interference. When used, the crystal diode second detector is replaced by a product detector, which can be constructed as a plug-in adapter, and a wide range of SSB signal strengths can be handled by the receiver without continually tuning the RF gain control up and down. (See "CO" magazine, November, 1946, page 19; and the ARRL's "Single-Sideband for the Radio Amateur," page 86, for additional details on product detectors.)

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From this efficient station layout (top), Mary (Mae) Burke, W3CUL, taps out another of the more than 3000 messages per month she averages while operating about eight hours daily in six traffic networks. Her sedans handles messages on "phone—"It's so time consuming"—preferring a better than 30-word-per-minute rate on CW. Her longest stretch of operating without missing a schedule was 1825 days—five years without taking a vacation or a single day off. Mae's husband, Al, licensed as W3VR, and their 15-year-old pet, "Butch," listen admiringly to another hobby, playing her church model Hammond electric organ (lower left). A third hobby is gardening and growing violets (lower right). Al's on-the-air time is quite limited by a busy schedule as a maintenance supervisor of electric equipment on oil tankers, and keeping the almost continually running transmitters and receivers in peak operating condition. W3CUL received the Edison Award trophy and a $500 check at a presentation ceremony in Washington, D. C., on February 26, 1957.
SWEEPING THE SPECTRUM

From the Edison Radio Amateur Award committee—heartiest congratulations to the eight Special Citation winners, also the twenty-two recipients of Civil Defense Commendations chosen by the 1956 Award judges in addition to the principal winner.

The Special Citation winners include: W4ZD and W5XH, cited for outstanding technical and organizational efforts; W4FPL, W5FQ and W3ZVL, for emergency communications work; plus two individuals and a club committee who provided well-organized communications for the U.S. Navy's "OPERATION DEEPFREEZE" in the Antarctic (see story on page 8).

Many Easterners will remember newspaper accounts of W2FPL's rule in arranging and expediting shipment by air of a rare drug needed to save a two-year-old boy's life in the Belgian Congo in July, 1956. This was in addition to his usual operations, devoted mostly to handling messages and special requests.

The Civil Defense Commendation was initiated by the Award judges to honor those 1956 candidates who were nominated for outstanding organizational efforts in local or state Civil Defense amateur radio communications groups. These amateurs received unanimous high praise from Civil Defense officials in nominating letters, and the Award judges.

It's sad, but true! The supply of G-E HAM NEWS SECOND BOUND VOLUMES probably will be exhausted by the time you read this item. It was possible to assemble only a limited quantity of this book, and it thus joins the now extinct first bound volume which contained all the rare early issues.

... a student figure in my crystal ball indicates that another G-E HAM NEWS bound volume, containing all issues published from 1956 to 1960, will be available yet. In answer to many requests, the DX LOG issue is published every three years in the January-February issue, and not yearly. However, the 1956 DX LOG is still available simply by writing me for it. This year, we concentrated instead on a two-element beam for the 20-meter DX chasers.

NOW TO GET G-E HAM NEWS
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Has your club or group been thinking about the annual ARRL Field Day in June yet? If not, it's high time to get those plans rolling!

It's a real test of operators and equipment if you decide to go at all for a big score. Oh, it can be organized strictly for fun, in order to let every licensed amateur in the club, novice or expert, take his turn at the key or the mike. The latter probably is the best approach to take, unless there are enough top-notch CW operators in your club to sufficiently man several stations during the 24-hour operating period. There are plenty of technical problems to be solved, but preventing interference between closely grouped stations usually is the most difficult to overcome. It does little good to set up five stations if only one can operate at a time because of inter-station QRM!

First, each CW transmitter should be completely free of key clicks, preferably through use of a vacuum-tube key. Phone transmitters should have audio peak limiting circuits to prevent over-modulation splatter. Second, the antennas should be separated as widely as possible and fed with coaxial cable to reduce receiver overload. Also helpful are bandwidth stepladder filters for both transmitters and receivers. Full-break-in operation is essential to save precious seconds.

Third, choose transmitters that require a minimum of returning when sliding across the band. Many contacts can be lost if an operator has to touch up a half-dozen diacs each time he QSY's a few kilocycles. A well-matched antenna also helps minimize changes in final amplifier loading.

Two operating limits are worth a mention: free operators of all paper work by assigning a logging opera-
tor to each station; and, devise a logging system which provides an instant cross check of stations worked on each band. Most top-scoring stations in Field Day are using these, in addition to closely guarded secrets.

Here's another item from the Edison Radio Amateur Award committee, saying that for the 1956 Award, more candidate were nominated by amateur radio clubs than ever before. It certainly is an excellent way to honor amateur radio clubs which have been doing an outstanding public service job.

The secretary was the chairman, or a special committee, draft a nominating letter giving complete account of the candidate's public service work then signed by the club members and sent to the Award committee. At least two members were selected to individual letters giving additional details that were of great help in the Award committee.

... the committee also wants me to point out that you can nominate any person for any service club, since each nomination is judged separately. No member of the committee has been published in QST, CQ and G-E HAM NEWS. Or, I'll be glad to send a copy of the rules to you upon request.
Edison Award Special Citation winners Newt Kraus, W1BCR (shown with his Boxer, Admiral, above left), 16-year-old Julius Madey, K2KGJ (right), together with the 14 members of the Radio Amateurs of Greater Syracus "OPERATION DEEPFREEZE" committee, have faithfully maintained nightly message-handling and 'phone patch schedules with the Antarctic expedition during most of 1956. The KEC stations are on the air from about 11 p.m. to 6 a.m. (EST), meaning either lost sleep or an inverted living schedule for these public-spirited amateurs who jointly have delivered several thousand individual messages. Since an even greater number of persons will be in the Antarctic during the coming International Geophysical Year, radio clubs in all areas of the United States should consider setting up an operation similar to the RAGS committee, in which each member operates a three-hour schedule once a week. It's good public relations—talk it over at your next meeting!

OPERATION DEEPFREEZE