



The Drake Receiver

ALTOGETHER too seldom is a new receiver introduced that is really "state-of-the-art." The Drake 2-B receiver is an improvement of the 2-A, which was a modernization of the original 1-A model. All three incorporate many very fine principles of receiver design. Physically the receiver is quite small. Its dimensions are: 12" long, 7" high and 9" deep. Weighing only 14.5 pounds this receiver only uses 40 watts from the power line. This is significant since there is much less heat dissipated in this unit than many standard types of receivers. The top cover is made of perforated steel to aid in heat dissipation.

Circuit Operation

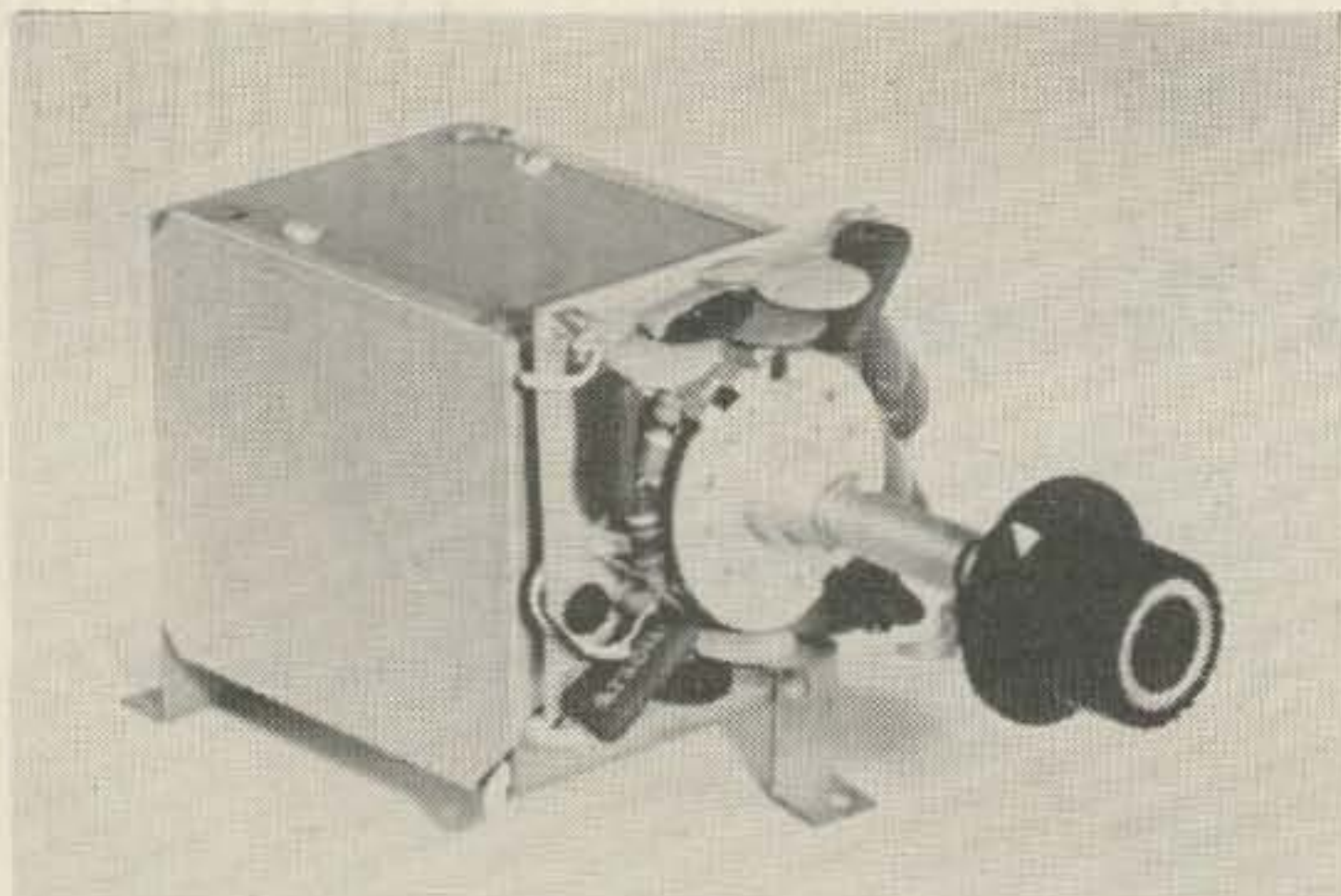
The block diagram in Fig. 1 shows the basic operation of the receiver. A 6BZ6 is used as a pentode rf amplifier. This tube exhibits semi-remote cutoff characteristics thus providing good control characteristics and low intermodulation. This stage is tuned by one dual control. As the BAND switch is positioned to the various bands additional inductances are switched across the basic tuned circuits allowing complete coverage of from 3.5 to 30 mc. Enough gain is provided by the rf amplifier to effectively mask any noise generated by the 1st mixer. The pentode section of a 6U8 is used as the 1st mixer. On all bands except 80 meters, this tube is operated as a mixer. When used for 80 meter operation, the oscillator is disabled and the pentode section of the 6U8 is used as a second rf amplifier.

A low-pass filter is used in the output section of this tube. This is used to prevent undesired mixed products being presented to the input of the if section. This filter is packaged

as T1. The choice of a pentode-6U8 as the mixer is a good one. In any receiver most of the noise generated is created in the highest frequency mixer stage. The function of an rf amplifier is two-fold in that the rf amplifier must provide enough signal so that the noise of the mixer is not objectionable and selectivity at rf is also achieved. The basis for comparing tubes in terms of noise generation is that of comparing the equivalent noise resistances of the tubes involved. For instance, a 6BE6 exhibits a conversion transconductance of 475 micromahs which results in an equivalent noise resistance. Req, of about 230,000 ohms. The noise resistance is a function of the noise generated within the tube itself and is composed mainly of shot noise and partition noise. This figure of 230,000 ohms for the 6BE6, is compared to the 6U8 which is 9120 ohms. It will be noted that there is a very great difference between the two noise resistances. This relationship indicates that the 6U8 performs very well in mixer service at HF and VHF. This prediction is borne out in practice. A number of hams have dropped by to see the "new goodie." Almost every one has mentioned how quiet the 2-B sounds.

First IF Section

A frequency from 3500 to 4100 kc is presented to the first IF section. A 6BE6 is used as a combination variable frequency oscillator (VFO) and mixer. The output of the 6BE6 is 455 kc. Since the oscillator is variable, tuning is accomplished in this section. Since only one frequency range is converted by the oscillator and this frequency range is very low, 3955 to 4555 kc, unusual stability is made possible.



Great pains have been taken to result in an oscillator design that is extremely stable. In repeated experiments it has been found that the test receiver tested achieves 90% of its frequency stability in the first 30 seconds. This is well within the specification of less than 500 cps warmup and 100 cps thereafter. In fact, it has been noted that the warmup drift in a normally heated room is inconsequential. With this receiver, no longer is it necessary to indulge in long receiver warmup periods. It is significant to note that during sideband operation no drift is noted in normal operation.

Third Converter, Filter and IF Amplifier

The output frequency from the VFO-mixer circuit is 455 kc. This frequency is converted down to 50 kc for filtering. The tube used for this purpose is another 6BE6. The oscillator section of the 6BE6 is fixed-tuned at 405 kc. The output frequency, 50 kc, is presented to a passband filter/tuner. This is the heart of the 2-B and establishes the selectivity characteristics of the receiver. A switch lever selects bandwidths of 0.5 kc, 2.1 kc or 3.6 kc and a concentric shaft moves the passband, without changing its shape, above, through and below the fixed BFO frequency. This combina-

tion works wonders on CW, SSB and AM.

On CW, with a crowded band like the Novice portion of 40 or 80, put the lever in the .5 kc position and you can select and separate any signal out of a possible 10 or 15 just by tuning around with the passband tuning knob.

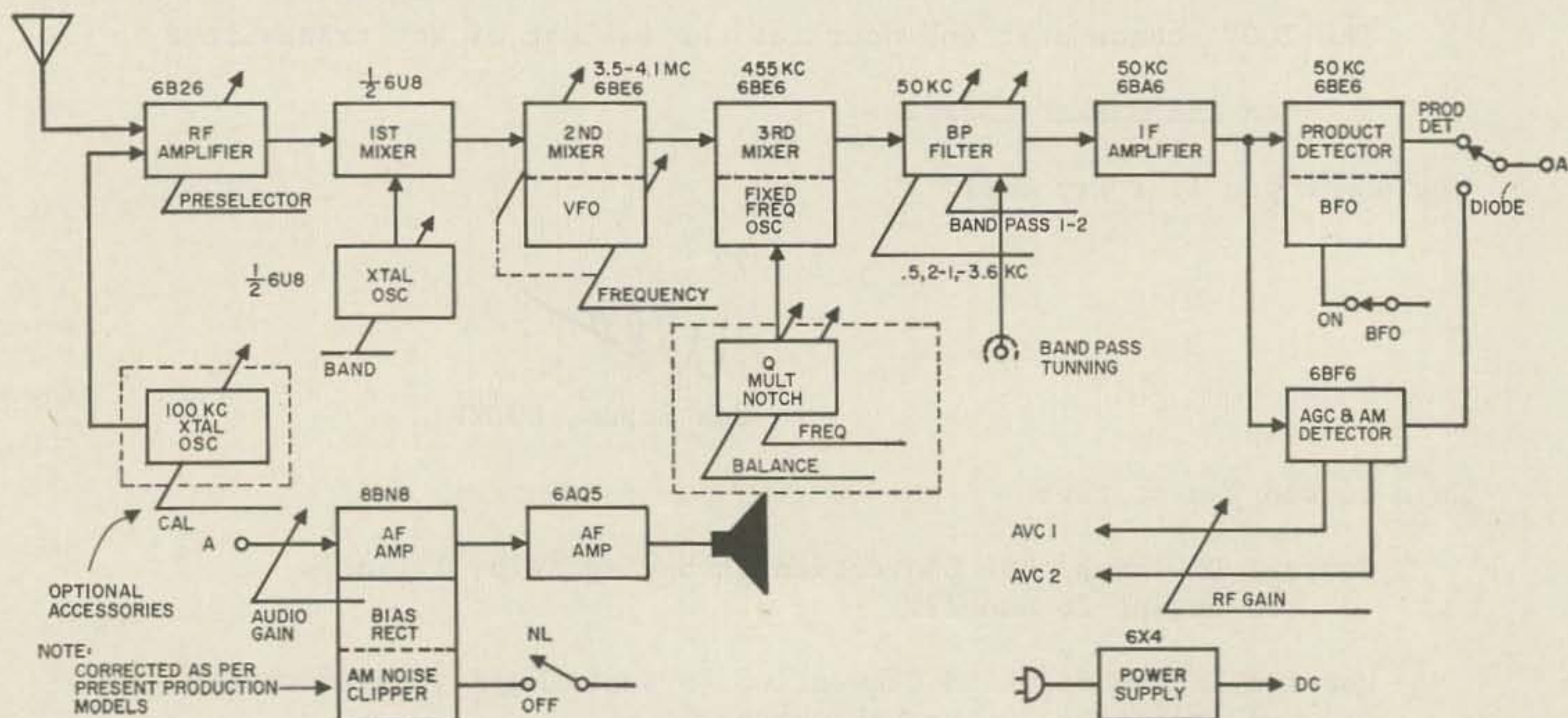
Normal SSB reception is made with the lever in the 2.1 kc position, though it can be copied in the .5 kc position when the QRM gets rough. You can get "hi-fi" SSB with the switch in the 3.6 kc position and the skirts on this new filter are steep enough for good unwanted suppression even in the wide position. At any bandwidth the passband tuning knob permits selection of upper or lower sideband and adjustment of voice quality without re-tuning the frequency.

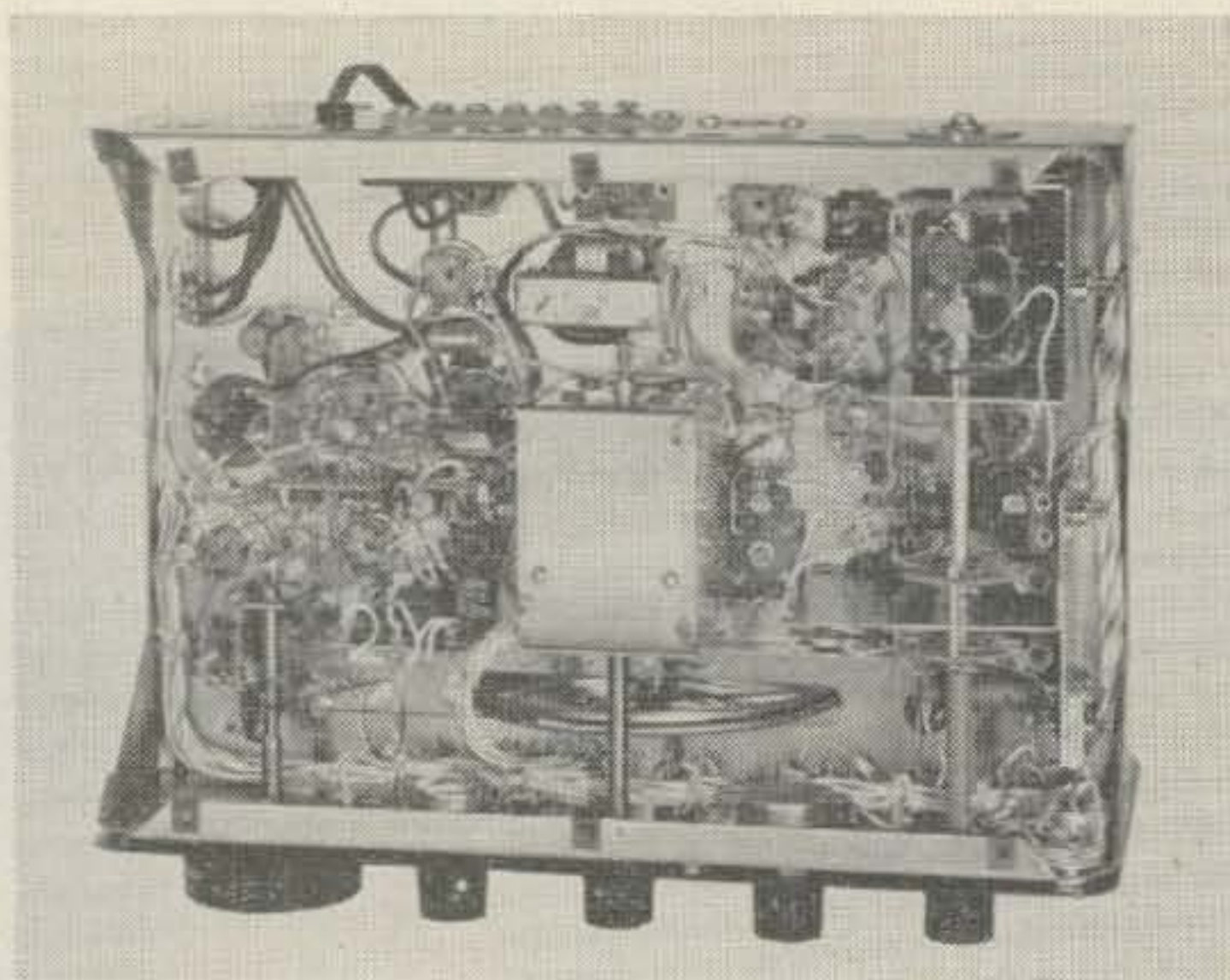
The 3.6 kc bandwidth is just right for AM. However, if receiving conditions become unbearable due to interference or selective fading, switch on the product detector and cut the bandwidth to 2.1 kc or even .5 kc!

On the remote chance that someone might want even more selectivity Drake has a combination loudspeaker and Q-multiplier available as an accessory. Adding the action of the Q-multiplier and the passband filter you get such a sharp notch that it can separate almost anything. The Q-multiplier is much more valuable when used in the notch position. Reception through almost any ham band bedlam is possible. The Q-multiplier may also be used as a notch filter for phone operation. After the *if* filter an *if* amplifier is provided to raise the level of the signal to be suitable for detection. This amplifier uses a 6BA6. The S-meter circuit is in the plates of the *if* and rf amplifiers. A bridge-type circuit is used with a 100 microfarad capacitor shunting the meter for critical damping.

Detector

One of the strongest points of this receiver is the product detector. A 6BE6 is used as a





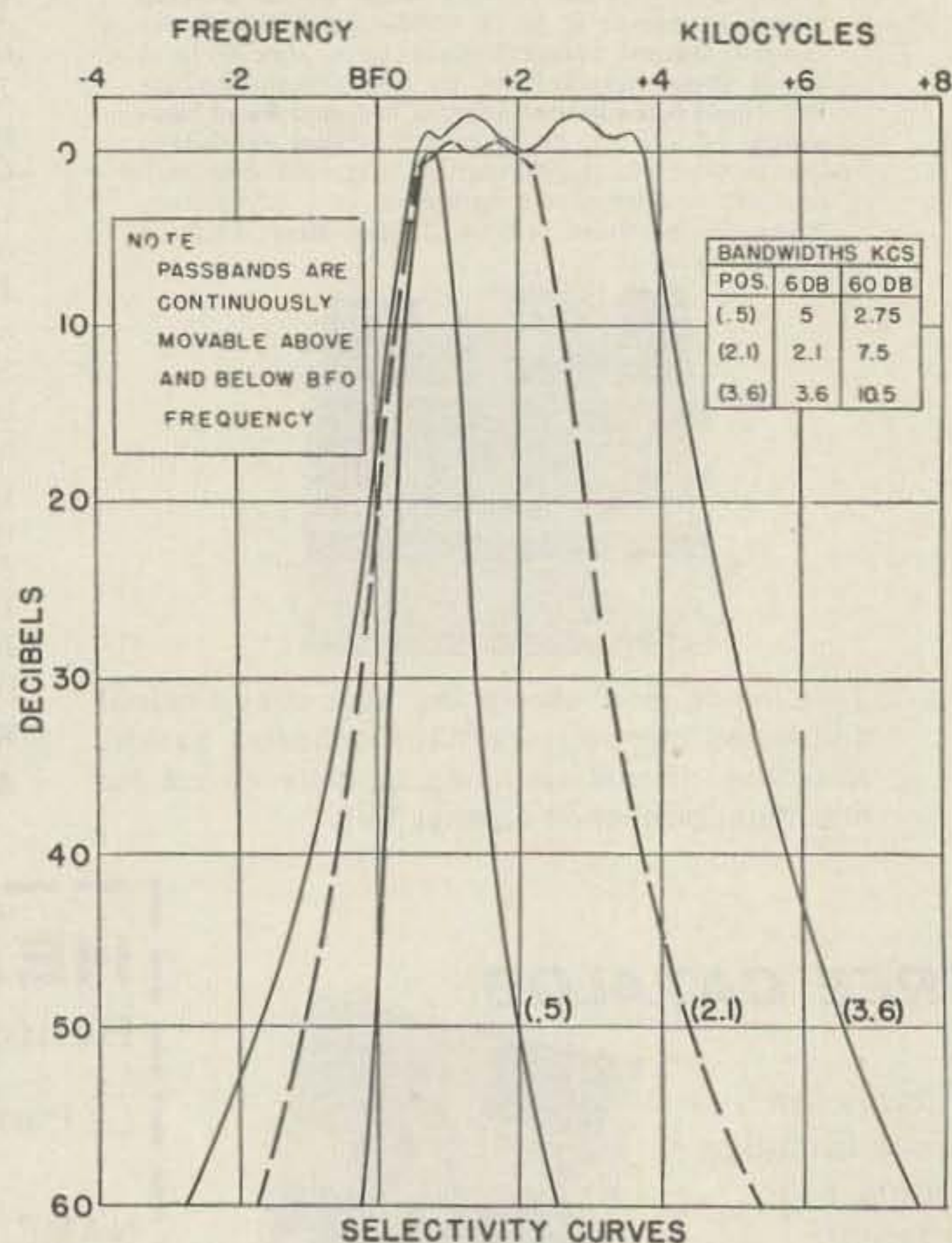
product detector and BFO. No provision is made for tuning the BFO. This is indeed a radical change from conventional circuits. Let us, for a moment, analyze the two usages of the BFO. First, the BFO is used to create a beat frequency when the BFO is heterodyned against the CW signal. This example may be thought of as two frequencies beating against each other to result in an audio tone when the received CW signal is present. In using this receiver for CW, it is necessary to select the desired tone by the main tuning dial and then positioning the PASSBAND control for the desired operation. In order to achieve single-signal selectivity it is usually most convenient to present the PASSBAND control to either 1 or 2. This action selects the upper or lower sideband of the heterodyne. Strong adjacent channel interference can usually be eliminated by carefully tuning the PASSBAND control to drop the interfering signal off the edge of the passband. When the Q-multiplier is used, the selectivity is increased very greatly. In peak operation the Q-multiplier provides a frequency selective boost of 20 to 30db.

The second usage of the BFO is as a reinserted carrier oscillator. The reinserted carrier provides a signal for the sidebands to heterodyne against thus producing the original audio modulation. The PASSBAND control selects the sideband that is used to heterodyne against the reinserted carrier. The advantages offered by a product detector are twofold. First, the amplitude of the incoming signals, sideband intelligence, does not have to be matched against a fixed amplitude of BFO to result in a condition of 100% modulation. Since the process of detection is one of frequency conversion only enough signal to cause a heterodyne is necessary. Secondly, only the audio products are heard in the output and no other signal or signals have any control in the output. In diode detectors it is common for a strong signal, that may be 10 or 20 kc off-frequency, to capture the detector and block it. This is impossible in a product detector due to the basic nature of the frequency conversion process. With ALL types of modu-

lation it is possible, with this receiver, to turn the RF GAIN control to the full CW position (maximum sensitivity) and leave it there. In fact, for all practical purposes don't bother with it. The AF GAIN control is all that is needed to control the output of the receiver.

A diode detector is provided for the reception of AM signals. This is a common type of circuit and will not be discussed in detail. It will be found that the PASSBAND control is a boon even for AM. A common situation is that interference may be predominate on one sideband but not on the other. In this case it is only necessary to tune the sideband that has the least amount of interference. And best of all—this principle really works to wonderful benefit in this receiver. The more discriminating users will be somewhat unhappy about the limitation of fidelity which results from the bandpass of 3.6 kc. It should be remembered that this receiver is not designed for High Fidelity. Its purpose is communications and toward this end some "fidelity" is intentionally lost.

Both the AM detector and the AVC detector circuits are fed from an amplifier stage. This is provided primarily to compensate for the relative inefficiency of the AM detector and to provide additional amplification prior to the AVC rectifier. A network in the output of the AVC detector is provided to allow "fast attack and slow decay" action. A discharge time of 0.05 second is provided in the fast AVC position (F. AVC). This time is lengthened to 0.75 second in the slow AVC position (S. AVC). The longer period is usually preferred at this station since it allows a small



period of time before maximum sensitivity is restored. A terminal is provided on the rear of the chassis to provide additional capacitance to increase the decay period. In the STBY position, the STDBY-RCV switch permits full negative bias voltage to be provided to the AVC controlled circuits thus muting the receiver. Access is provided at the rear of the chassis so that this function can be provided by an external circuit such as a switch or relay.

Audio

Post detector amplification of the audio signal is provided by a 6AV6 triode amplifier. It should be noted that in the output of the product detector there is a low-pass filter that has a 3-kc cutoff frequency to further limit the high frequency response of the product detector. The power output stage is a 6AQ5 in a conventional-type circuit. The audio output is available at the front of the receiver at a phone jack. When headphones are plugged into the jack, audio power is automatically removed from a loudspeaker that may be connected to terminals on the rear of the chassis. While not overwhelming, the audio output is adequate for all normal purposes. If additional power is desired, for some reason, little problem is presented in connecting an auxiliary power amplifier to the receiver.

Summary

The *if* skirt selectivity of this receiver is almost as sharp as that provided by mechanical filters or crystal filters and is a pleasure to use. The stability factor is of the highest order. In general, this is undoubtedly one of the finest receivers to be produced for the Amateur market. It has been a very pleasant discovery to find that the PASSBAND control functions just the same as the bandpass tuning control on the Collins 75A-4. The serious CW operator will be completely satisfied with the selectivity, but, again, complete satisfaction is a matter of several hundred dollars more.

Recent correspondence with the factory has disclosed that a noise limiter can be installed and recent production modifications added for the nominal sum of \$15. It is expected that these changes will be incorporated in future models of this very fine receiver.

It should be noted that any small non-linearity in tuning can be corrected, in a limited range, by sliding the dial glass with a pencil eraser. No attempt was made to design the tuning mechanism as a frequency meter. For virtually all operating requirements the calibration of the dial is unusually good.

All four units checked by the author have indicated good consistency of manufacture. In summary-summary, this receiver is very highly recommended as an excellent communications receiver.

Order Now from WRL's Supermart of Values

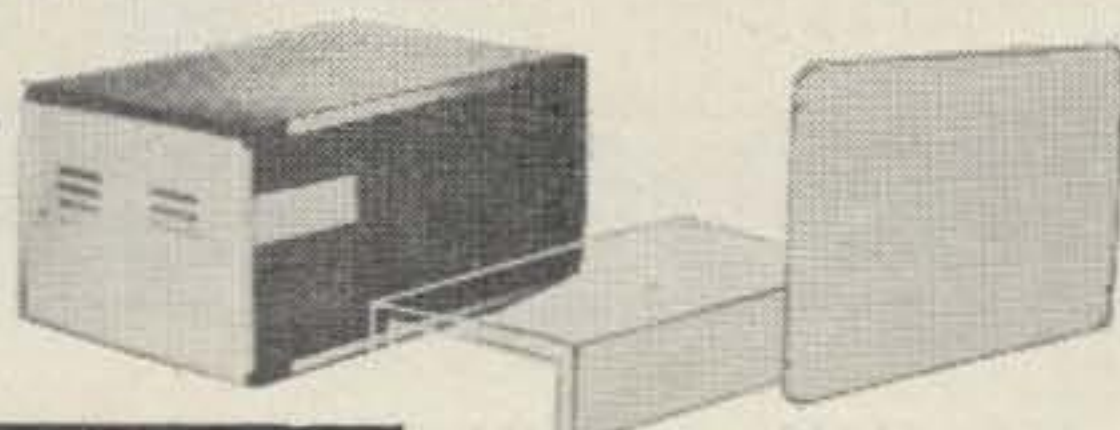


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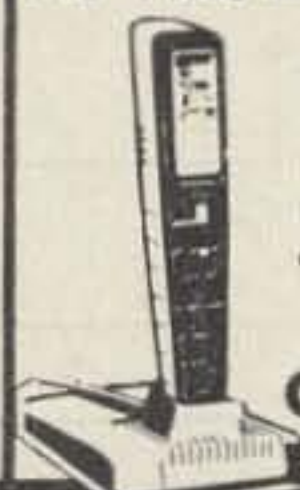
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