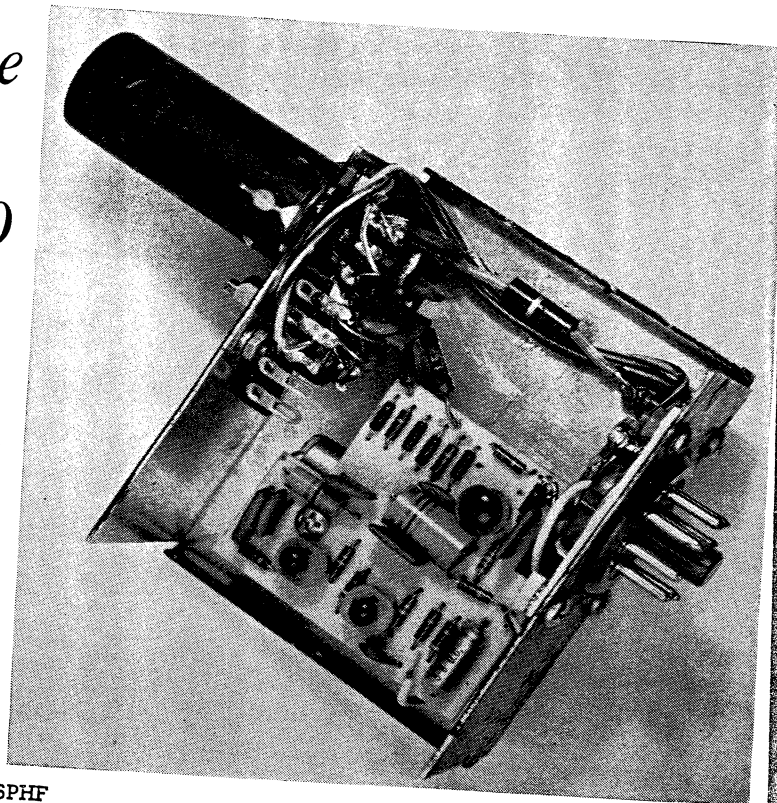


A Solid State Product Detector

For The HRO-60

The adapter plugs into the n.b.f.m. socket in the receiver, using an octal plug (Amphenol 86-CP8) mounted on one edge of the chassis. The 6BA6 i.f. stage and its i.f. transformer (hidden by the tube shield) are on the opposite edge.



BY DAVID PALMER,* W6PHF

A silicon-diode ring product detector and i.f. stage in a module improve the c.w. and s.s.b. operation of an old standard receiver.

SEVERAL features of the design of the HRO-60, characteristic of the era in which it was built, suggested that a modernization project was justified: an excellent backlash-free dial mechanism, essential for the precise tuning of s.s.b. and c.w., and a large chassis with octal sockets in the most desirable locations for module installation, would produce a receiver that would compare very favorably with more modern receivers.

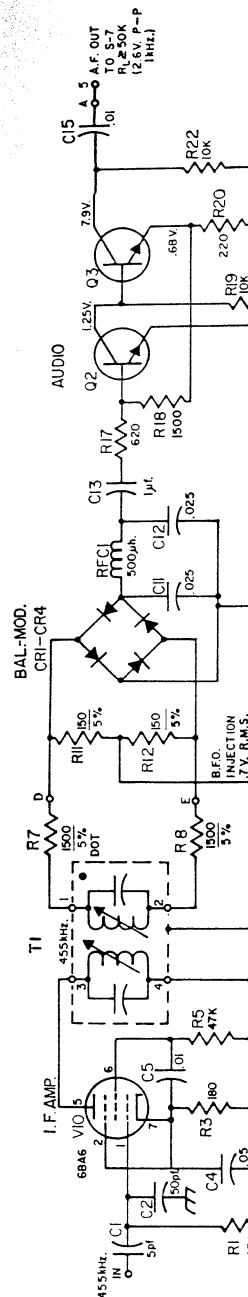
In the late 1940s, when the HRO-60 was designed, narrow-band frequency modulation was considered a potentially popular mode of amateur communication, and in order to increase the versatility of the receiver, National pro-

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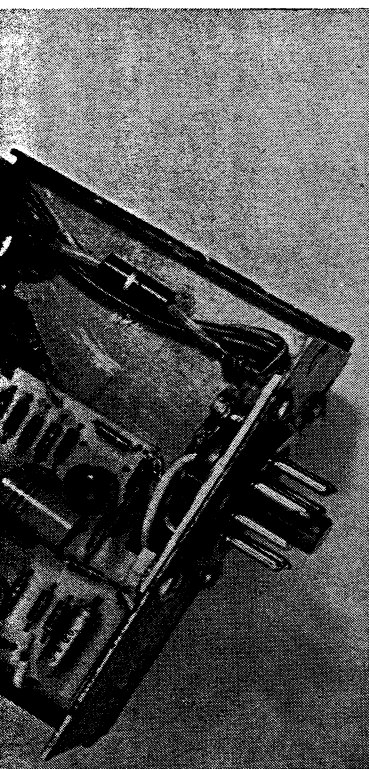
vided an octal socket in the power-supply compartment for an n.b.f.m. adapter. With the exception of connections to the b.f.o. and a positive 20-volt power source, all of the necessary circuits are accessible at socket X-1, greatly simplifying the installation of the product detector. Use of a module provides a very convenient method of servicing the product detector if it should become necessary.

Desirable characteristics of the product detector are very low intermodulation distortion, no output without the presence of both signals, and very low noise and susceptibility to magnetic and electrostatic fields. Eight different vacuum-tube product-detector circuits were tried with varying degrees of success, none completely satisfactory from a performance standpoint.

Circuits originally intended as balanced modulators were investigated as they must of necessity possess all the characteristics desired in a product detector. The first circuit studied was the ring, originally intended as a modulator for multiplexed land lines. As perfect balance was not required in order to eliminate the



Detector



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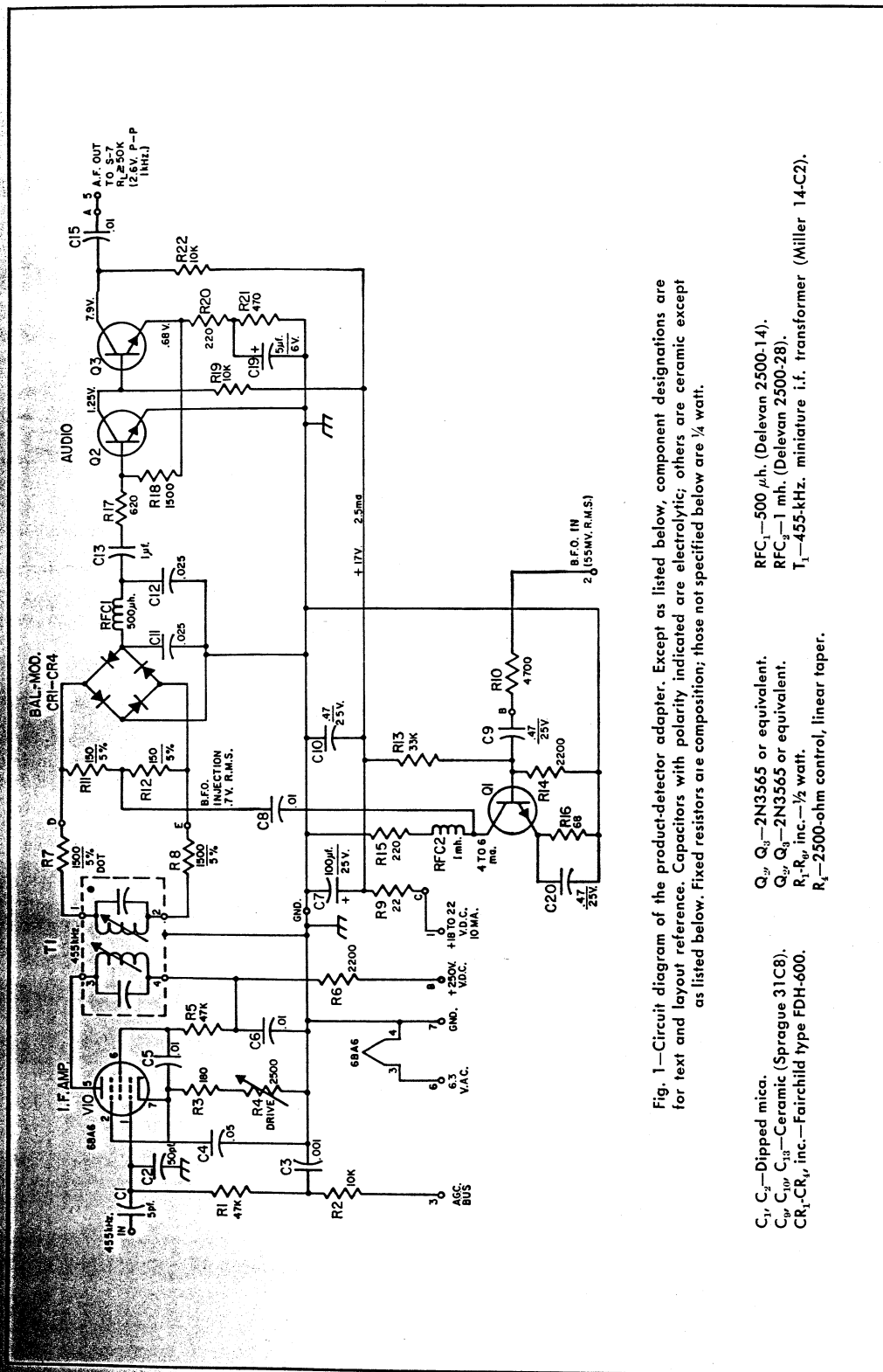
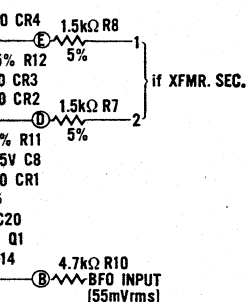


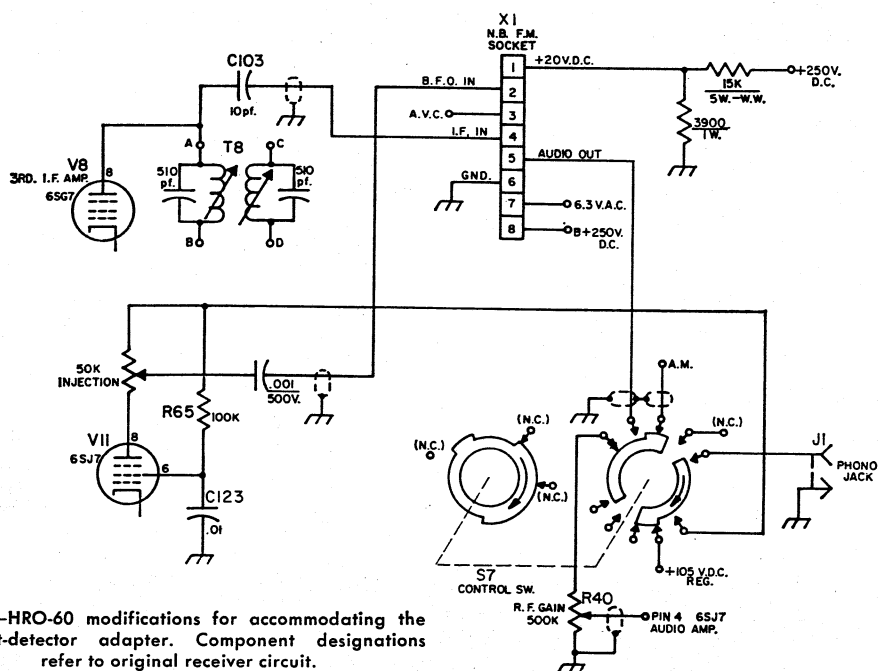
Fig. 1—Circuit diagram of the product-detector adapter. Except as listed below, component designations are for text and layout reference. Capacitors with polarity indicated are electrolytic; others are ceramic except as listed below. Fixed resistors are composition; those not specified below are 1/4 watt.

- C₁, C₂—Dipped mica.
- C₃, C₄, C₅, C₆—Ceramic (Sprague 31C8).
- CR₁-CR₄, inc.—Fairchild type FDH-400.
- Q₁, Q₂—2N3565 or equivalent.
- Q₃, Q₄—2N3565 or equivalent.
- R₁-R₁₀, inc.—1/2 watt.
- R₁₁—2500-ohm control, linear taper.
- RFC₁—500 μh. (Delevan 2500-14).
- RFC₂—1 mh. (Delevan 2500-28).
- T₁—455-kHz. miniature i.f. transformer (Miller 14-C2).

The board has been etched and cleaned.



circuit board.



it should be cut to size with a hack saw and the edges smoothed with a file, after which the holes for the component leads should be drilled with a No. 57 drill. Soldering the components is made easier if the photo resist is removed with a solvent and the copper side of the board is pretinned.

Automatic gain control on c.w. and s.s.b. is possible and even desirable with the existing detector, but modification of the a.g.c.

The ring product detector has been used for over a year under widely varying conditions; from 20 db. over 9 signals to ones barely readable in QRM and QRN, and during DX contests on both c.w. and s.s.b. Under all circumstances the very low noise and distortion considerably reduce listening fatigue and allow separation of c.w. signals differing by but a few cycles that would, with a nonlinear detector, be either difficult or impossible to copy.

QST--