Johnson Directional Coupler and Indicator

Although the economy-minded ham can buy the E. F. Johnson 250–37 Directional Coupler and put together an indicator from the instructions furnished with the coupler, most customers will also probably buy the 250–38 Directional Coupler Indicator. It would be rather difficult to duplicate at home the attractiveness of the 250–38, with its gray sloping cabinet and large plastic-housing meter.

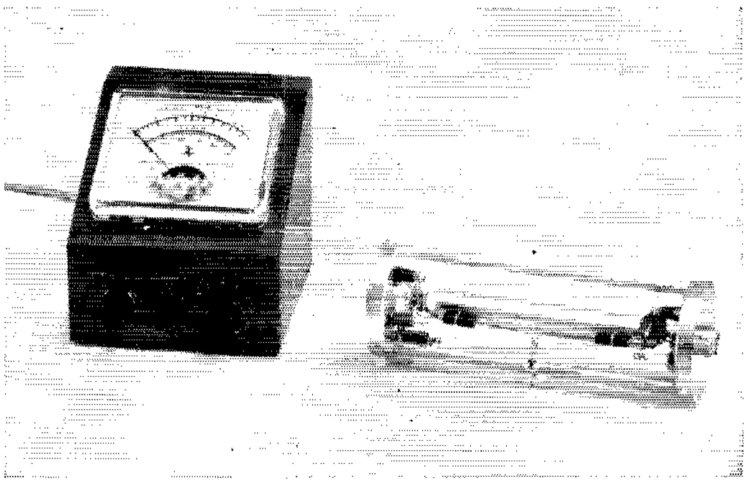
The coupler bears a resemblance to the Monimatch and other reflectometer-type couplers, but it differs in several interesting ways. Designed to work in 52-ohm line up to 150 Mc., and to handle levels of signals from peanut whistles to full kilowatt transmitters, the coupler is itself a section of 52-ohm line. Housed in a 2¼-inch diameter tube, an inner conductor tapers out from the connectors to a diameter that minimizes any impedance "bump." Since the associated resistors, diode rectifiers and by-pass capacitors are *inside* the coaxial line and could be exposed to the field, considerable care has been exercised to dress the leads so that undeserable couplings are avoided.

Leads for metering are brought to color-coded nylon tip jacks at the ends of the coupler, and to put the coupler to use the owner connects his coaxial cable to the SO-239 coax receptacles at each end and the meter to the tip jacks. Instructions provided with the coupler suggest a number of ways the coupler can be used, such as s.w.r. measurement, antenna coupler adjustment, determination of antenna radiation resistance and the measurement of amplifier input impedance.

The indicator has two scales, one labeled "Standing Wave Ratio" and the other marked "Power." Actually, the power scale is only a relative one, very useful for detecting a change in output (trouble in the rig) but not to be expected to deliver absolute readings. The s.w.r. scale has been carefully calibrated, however, and its readings are accurate within the limitations of s.w.r. measurements at the generator (transmitter) end of a line.[1]

—*B. G.*

[1] Goodman, "The Versatile S.W.R. Indicator," *QST*, June, 1958.



At the left the indicator and at the right the coupler with cover removed so that the internal construction can be seen.

The Knight Receiver

Strictly speaking, the title should read "The Allied Knight-Kit De Luxe All-Band Amateur Receiver 83YZ2726," since that is what the manufacturer (Allied Radio of Chicago) calls it in the catalog and on the cover of the instruction book. Somehow it is a little hard to visualize a ham telling another over the air that he's using an "83YZ2726"; he is much more likely to use the simple title above. And we suspect there will be a lot of these receivers used; the price of the kit is well below that of any completed receiver of comparable quality, and the design is such that no more than 22 to 25 hours construction time will be required by most assemblers.

The story of the Knight receiver is in the mechanical end of things, not the electrical. After all, it is asking a little too much to expect radical circuit engineering in a receiver designed to sell at such a low price. The Knight uses a sound straightforward circuit; one stage of r.f. amplification, two 455-kc. i.f. stages, and a Q multiplier for selectivity. The block diagram in Fig. 1 pretty well tells the story; nine tube envelopes conceal a 15-tube circuit. Following the

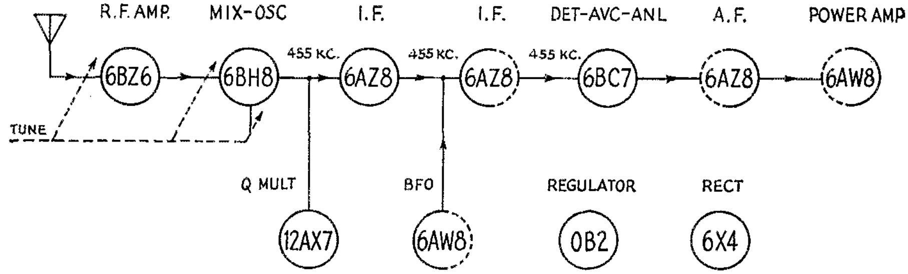


Fig. 1 — Block diagram of the Knight receiver.

6BZ6 r.f. stage is the triode-pentode 6BH8 oscillator-mixer stage; the oscillator is the triode section in a grid-tickler grounded-cathode circuit, and the pentode mixer has grid-circuit injection. The pentode portions of the 6AZ8s are used in the i.f. amplifier, and the triode section of the second 6AZ8 is used in the audio-amplifier stage following the 6BC7 triple-diode detector-a.v.c.-automatic noise limiter circuit. The triode in the first 6AZ8 isn't used at all; we thought at first it might be used in the (optional) 100-kc. crystal calibrator, but investigation showed that this addition carries its own tube.

The *Q* multiplier circuit provides for either null or peak operation; in the peak condition the selectivity is quite sufficient for good single-signal c.w. reception with little or no trace of "the other side of zero beat."

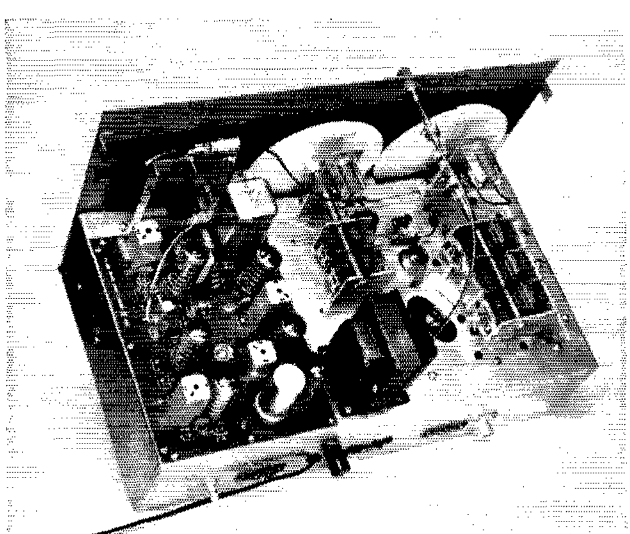
Although the b.f.o. is quite loosely coupled to the grid of the second i.f. stage (as it should be to avoid overloading the stage), the amplified b.f.o. reaching the diode detector is sufficient for good s.s.b. demodulation without pampering of the r.f. gain. The diode noise limiter uses the well-known series circuit to provide automatic noise limiting during a.m. reception. The (optional) S meter reads the variation in cathode bias voltage on the second i.f. stage as the a.v.c. voltage applied to the grid reduces the cathode current; a.v.c. is applied to both i.f. stages and the r.f. stage, while manual gain varies the cathode voltage of the r.f. and first i.f. stages.

In the power-supply department, the operating plate voltage runs around 180 volts, apparently in keeping with the philosophy of "lower voltages mean less heating and drift." The regulated voltage provided by the 0B2 is applied to the high-frequency oscillator.

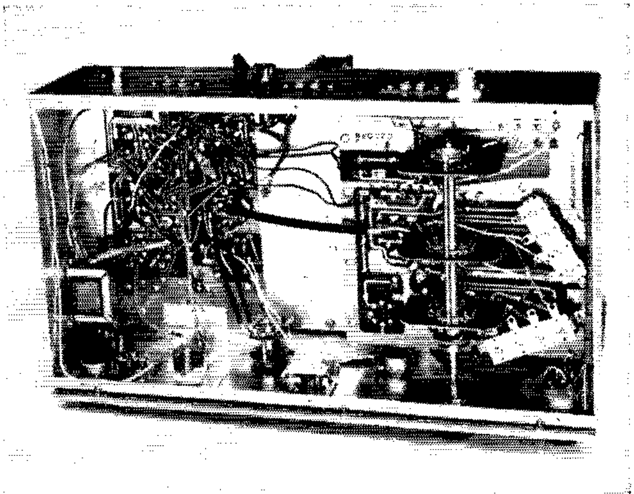
Both of the dials use planetary reductions to slow down the tuning. The band-set drive takes 2½ turns of the knob to cover any of the four ranges: 0.54 to 1.65 Mc., 1.6–4.6, 4.4–12.4 and 12–30 Mc. Bandspread requires 2½ turns for 80 meters, 1¾ for 40 and 20, 1 for 15 and 1¼ for 10 meters.

Mechanical

A glance at the photographs shows that two printed-circuit boards are used in the construction of the receiver. The band-switch sections also utilize printed circuits; this single feature practically eliminates the possibility for wiring error around the (usually) tricky band-switch circuits. Assembling the parts on the printed-circuit boards has been made truly easy; the components are identified on the boards and in the instruction book. As a further convenience, the resistors are packed on sheets of cardboard



A feature of the Knight receiver is the use of printed circuits. The one shown in this top view carries the i.f. and audio section of the receiver. Note the use of a 3-gang capacitor for band-set tuning and a 2-gang capacitor for band spread. Logical, since the antenna trimmer (driven by the arching flexible shaft) can take care of the minor trim in the input circuit required over a ham band.



Looking at the underside of the chassis, one can see the two main printed-circuit assemblies. That on the right (r.f. section) also includes printed-circuit switch assemblies. Terminals at the rear of the receiver provide for antenna (plain wire or coax), speaker connections and remote switching standby-receive of the receiver.
An optional 100-kc. crystal calibrator unit can be bolted to the bare chassis at the center.

in numerical order, making it an easy job to locate R_{23}, R_{43} or any other. As a double check, the instruction book gives the proper color coding for the resistor to be used.

Anyone who has much to do with wiring kits, or correcting wiring errors of newborn hams, knows that the No. 1 problem is soldering. The Knight receiver kit includes a folder on "How to Solder" *and* enough solder to wire the receiver and then some. The solder is included because one common mistake in radio soldering is to use acid-core solder or solder with too high a melting point. Obviously, this printed-circuit work will require attention to soldering details, but it isn't at all difficult once you get the "feel" of it. Just don't be in such a hurry that you don't study the soldering instructions first; if you are a beginner, read the folder and practice your soldering before starting the receiver.

With the wiring errors fairly well eliminated through the use of printed circuits, the inexperienced constructor of a Knight receiver can only come a cropper during the alignment procedure. If he doesn't have or can't borrow a signal generator for the initial alignment, he can follow the "Alignment on the Air" instructions. We had someone else align this receiver after assembly, using the on-the-air method. Checking later with a signal generator, we were able to effect only minor improvement in the i.f. The front-end alignment depends to a large extent on one's ability to furnish signals of known frequency for checking, and here it is rather hard to hit the right spots without a signal generator or a good knowledge of marker signals. However, this is a problem with any receiver built at home. Since most kits are finished on Sundays or during evenings when the radio stores are closed, the two alignment tools furnished with the kit are a very welcome touch.

A 46-page instruction book gives all of the information necessary to assemble, wire, align, install and use the receiver. It even tells hams and s.w.l.'s when to listen on the various frequencies. All in all, it's hard to see how the constructor who takes the time to learn to solder before carefully following the instruction book step-by-step procedure can go wrong. — *B. G.*

Strays

Needing a neat operating desk but one which wouldn't permit touching of the equipment by unauthorized personnel, the radio club members at Freehold Regional High School in New Jersey put together this knotty pine and plywood cabinet. Measuring 22 inches deep, 48 inches wide and 54 inches high, it is mounted on small casters so that it may be moved from one spot to another in the electronics shop of the Industrial Arts Department. The operating shelf folds up to form a lid which is fastened with a padlock. Although not done on this model, individual drawer locks could also be installed. The fellow in the photo is K2SLJ. *(K2SLI photo)*