Product Review Column from *QST* Magazine

January 1980

Apollo Products Cabinets

R. L. Drake R-7 Receiver

Soundpower SP100 Audio Speech Processor

Ten-Tec OMNI D Transceiver

Product Review

Conducted By Paul K. Pagel,* N1FB

The Ten-Tec OMNI D Transceiver

The OMNI D complete with the optional matching power supply and remote VFO. The bails on the transceiver and VFO may be used as support brackets as shown and double as carrying handles, or they may be removed entirely.

The Ten-Tec OMNI D Transceiver

Claimed Specifications

Frequency coverage: 160 to 10 meters, plus WWV receive at 10 MHz.
Modes: Ssb and cw.
Power output: 85 to 100 watts, typical.
Power requirements: 12 to 14 V dc, 850 mA receive, 18.5 A transmit.
Receiver sensitivity: Tailored from 2.0 μV on 1.8 MHz to 0.3 μV on 28 MHz for 10-dB S + N/N ratio.
Weight: 14-1/2 pounds (32 kg).
Dimensions: (HWD) 5-1/2 × 14-1/4 × 14 inches, less bail (140 × 362 × 356 mm).
Price class: OMNI D, $1120. 252 MO power supply, $140. 243 remote VFO, $140.

Once there was a valid argument that cw ops had to take a back seat when it came to equipment choice. That is to say, most transceivers appeared to be designed primarily for ssb use with cw "thrown in" as an afterthought. Then along came Ten-Tec. Anyone tuning the cw bands and listening to the descriptions of the equipment being used will attest to the fact that a great many cw ops have made a home for their favorite piece of Ten-Tec gear. Not only are they used in the house, but in the car, in campers, and while mountaintopping as well.

The latest offering from Sevierville is the B version of the OMNI. This updated model, complete with optional 1.8- and 0.5-kHz filters, noise blanker and model 243 VFO arrived at the Product Review desk one afternoon. That evening it was on the air.

General Description

The OMNI series transceivers are light in weight and ideally suited for mobile or portable use as well as fixed-station applications. A clam-shell aluminum cabinet houses the components and is finished with a black vinyl-covered top and bottom. A complementary-colored dark gray panel and satin-etched trim provide the finishing touches. The power supply may consist of any source capable of supplying 13.8 V dc at 18.5 A. The 252 MO supply was received with the review unit. This supply has over-current protection and is equipped with a front-panel-mounted meter. An optional over-voltage protection feature is available, too. This provides for instantaneous removal of the power supply output voltage should it rise above 15 volts for any reason.

The transceiver covers 160 through 10 meters with WWV reception at 10 MHz. There is also an AUX position for future band additions and the 10-MHz position may be converted for transmission should the need arise. The OMNI is fully transistorized. A total of 20 ICs, 44 transistors and 63 diodes is used along with 23 circuit boards. The only transmitter "tuning" necessary is the setting of the DRIVE and ALC controls for the desired power output. The receiver RESONATE control is peaked to optimize the preselector tuning when changing bands. There are no tuning or loading controls *per se*. The final amplifier transistors are warranted fully for the first year and prorated for 5 years. To check the "100-percent duty cycle" rating given the transceiver, we locked the key down at full power output (into a dummy load) for over an hour. During that interval, the output power decreased from 100 watts to 82 watts. No tuning touch-ups were made. The final-amplifier heat sink was warm to the touch after that episode, but not unduly so. A fan was used to cool the heat sink of the power supply, not that of the OMNI. (This procedural step is outlined in the power supply manual). Operation of the transceiver under conditions producing a VSWR of 3:1 (during antenna-matching-network adjustment) produced no failures.

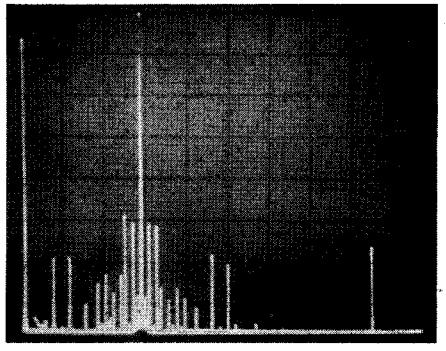

Fig. 1 — This photo shows a worst-case condition with the OMNI operating at rated input power on cw at 28 MHz. The vertical divisions are 10 dB each. Horizontal divisions are 10 MHz each. The spurious emissions close to the carrier frequency are 48 dB down with respect to the fundamental. Other spurs are at least 51 dB down. The OMNI D meets present FCC requirements for spectral purity.

The "B"(asic) Differences

There are a few differences between the earlier OMNI and the later OMNI B. The first units had a squelch control. This has been replaced by a notch filter which is quite effective in eliminating bothersome heterodynes . . . and there can be lots of those on 40 meters! A close look at the selectivity switch will disclose another change. The earlier OMNI had an audio active filter for use on cw which had three selectable skirt contours. The B model has both an optional 0.5-kHz cw crystal filter and a 1.8-kHz crystal filter for ssb. The audio filter is retained and used in conjunction with the crystal filters for providing additional selectivity. Both of these filters may be switched in cascade with the standard filter. The switching is arranged so the operator may simultaneously employ the audio filtering as well. Ten-Tec is offering factory conversion of the earlier OMNI series to the series B at a nominal cost.

The Receiver

The receiver employs an 8-pole ladder filter with a 2.4-kHz bandwidth and 1.7:1 shape fac-

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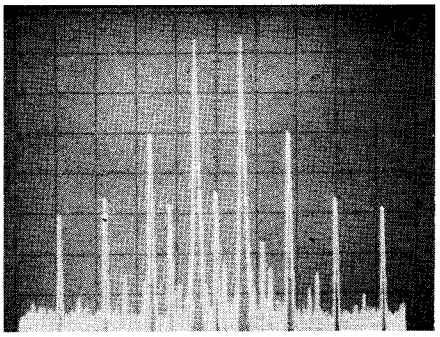

Fig. 2 — The output of the OMNI D during a full-power, 14-MHz, two-tone test. Each vertical division is 10 dB and each horizontal division is 1 kHz. The third-order products are approximately 30 dB down from the PEP level.

tor. The two optional filters available display a 1.8-kHz bandwidth, 1.8:1 shape factor for the narrow ssb filter and 500-Hz bandwidth, 1.9:1 shape factor for cw. A single-conversion system is used with a 9-MHz i-f. The rf amplifier stage is fixed-biased and has no agc applied to it. The rf-gain control is actually used to control the i-f gain. A quad diode, high-level, doubly balanced mixer circuit is used. This type of mixer circuit is characterized by its ability to handle high signal levels without being adversely affected. Receiver dynamic-range measurements were made in the ARRL lab. These are worst case figures developed at 80 meters: MDS (minimum discernible signal or noise floor) −128 dBm; blocking dynamic range 115 dB; IMD dynamic range 94 dB. This provides an input intercept figure of +13 dBm. At 20 meters, the following figures were obtained: MDS −139 dBm; blocking dynamic range 125 dB; IMD dynamic range 90 dB. The resulting input intercept figure is −4 dBm. The sensitivity of the receiver is tailored to produce a 10-dB S + N/N ratio with input signals of 2.0 μV on 160 meters and 0.3 μV on 10 meters.

There are a number of receiver "birdies" and the instruction manual points out a couple of strong responses that will be encountered. The strongest was that on 10 meters at 28.980 MHz (S9 + 20 dB). This response may be bypassed by switching to the next higher band segment and tuning appropriately below that segment edge. Other in-band responses were found at: 3.600 (S3), 7.181 (S3), 21.320 (S4), 29.234 (S4), and 29.984 (S4).

The tuning rate is a comfortable 18 kHz per revolution of the knob. A small amount of backlash was noted when tuning in one direction only. This is because of the action of the tension spring in the PTO. If present, backlash may be eliminated by simply loosening the setscrew on the knob and pushing the knob a bit further in toward the panel. Operators are cautioned that touching the metal insert or the knob skirt will shift the frequency of the PTO slightly. This is because the PTO shaft is above chassis potential. The actual frequency change is slight and during operation this never occurred unless a deliberate attempt was made to touch these areas. Frequency readout on the OMNI D is by means of six 0.43-inch LEDs. All are red in color with the exception of the 100-Hz unit which is green. The PTO stability is excellent. It took an awful lot of physical abuse to persuade the PTO to move a few hertz. The OFFSET control has two ranges: plus/minus 0.5 kHz and 5 kHz. This function is used for receiver offset tuning only and is disabled during transmit.

The RESONATE knob controls the preselector for the receiver. Care should be taken to ensure that the control is peaked correctly as it is possible to peak at an image frequency of the internal 9-MHz oscillator frequency on all but the two lower bands. One spurious response was noted while listening on 20 meters. An 80/40-meter inverted V was being used as a receiving antenna and the antenna-matching network hadn't been tuned for 20 meters. The response heard was that of a strong 16-MHz RTTY signal and resulted from mixing with the fifth harmonic of the VFO signal. The frequency of the signal was verified by means of a separate receiver. Even with the RESONATE control properly peaked, the signal was still audible. It wasn't until the matching network was tuned correctly for the band in use that the response was eliminated. This example underscored the usefulness of an antenna-matching network in rejecting unwanted signals. Use of a properly designed and matched-antenna system is also emphasized.

There is plenty of audio output both with the internal speakers (two bottom-mounted 2-1/2 inch [64 mm] types) and with headphones. In fact, Ten-Tec recommends a pad be used when employing low-impedance headphones. This consists simply of a couple of resistors which may be hidden within the body of the phone plug.

The Transmitter

The power output on all bands was in excess of 90 watts except on 160 meters. There, the power was measured at between 80 to 82 watts from one end of the band to the other using a Bird wattmeter and dummy load. On 10 meters, the output was a healthy 98 watts. QRP operation is readily accomplished by using the ALC and DRIVE controls to vary the level of output power.

The transmitter was subjected to spectrum analysis in the ARRL lab and the results are shown in the accompanying photos of Figs. 1 and 2. Audio quality reports received while operating ssb were complimentary. A high-impedance microphone is required and a standard 3-conductor plug is used for the microphone connector. A speech processor is not supplied with the OMNI, but since the reviewer is not an avid ssb DXer, it wasn't missed. VOX system sensitivity is excellent and it operates noiselessly. The VOX controls are readily accessible at the front panel and have no effect on the cw QSK operation of the transceiver.

QSK . . . now, there's where the cw enthusiast can really "do his thing"! Operating QSK allows you to hear what's happening on the frequency between dits and dahs. It can mean preventing the loss of a contact due to fading, QRM, etc., and gives the other operator(s) a chance to interject a comment now and then. This has the effect of lending a truly conversational air to a cw QSO. Two speeds are provided for QSK operation which should suit most any type of operating condition. The SLOW position has a smooth receive/transmit transition which "holds" between code elements. The FAST position allows the operator to hear between the code elements but is somewhat "noisier" to the uninitiated.

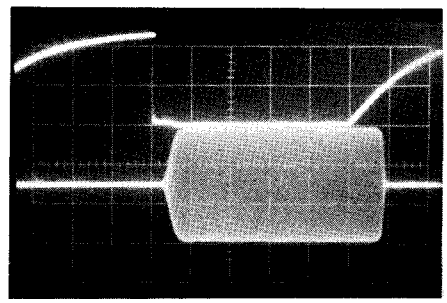

Fig. 3 — Two waveforms are shown: The upper waveform depicts the actual key-down time, while the lower is the cw output signal of the Ten-Tec OMNI D, series B, on 10 meters. Each horizontal division is 5 ms. The "make" of the wave differs slightly between bands (only 1-1/4 ms). Here, the wave is shown starting approximately 1-1/4 ms after key down. On 40 meters, this point shifts to approximately 2-1/2 ms after key down. "Make" and "break" time constants of approximately 5 ms will produce absolutely clickless keying. (An excellent treatise, "Some Thoughts on Keying," was presented by Goodman in April 1941 *QST*).

Unlike some VOX keying systems (commonly called "semi-break-in" keying), no part of the initial code element is lost in going from receive to transmit . . . it's instantaneous. A presentation of the keyed cw waveform is shown in Fig. 3. The cw monitor note is internally generated and both volume and pitch are controlled by two thumbwheel potentiometers located beneath the OMNI. These are accessible through a hole in the bottom plate and may be adjusted during operation.

A ZERO BEAT switch on the front panel allows the operator of the OMNI to adjust his transmit frequency exactly to that of the received signal frequency. When this button is depressed, the receiver carrier oscillator frequency is shifted a nominal 750 Hz to match the transmit frequency offset. The OFFSET control is automatically disabled. The operator then tunes the OMNI for an exact zero beat (or null) of the received signal. When the button is released, the receive and transmit frequencies will be the same and the beat note will again be heard.

The Remote VFO

The 243 remote VFO (optional) supplies more flexibility to the OMNI. In addition to the normal splitting of receive/transmit functions with the transceiver, there are two other positions available which allow *simultaneous* dual-frequency reception. The digital readout of the transceiver is not to be trusted during this mode as it will lock onto whichever VFO signal is the strongest or display random digits. To check the frequencies properly, the operator must switch to a single receive frequency position. The remote VFO readout is an analog readout and proved to be quite accurate.

The Ten-Tec OMNI appears to be ideally suited for the cw and ssb DXer. The rapid QSK and band-change features should appeal to many. RTTY enthusiasts will welcome the long-term power-handling capabilities of the final amplifiers, too. — *Paul K. Pagel, N1FB*

Presenting the Drake R-7 receiver. A synthesized, general coverage receiver, it offers a wide range of features. Covering the frequency range of 0 to 30 MHz, this receiver is at home in both the ham shack and the laboratory.

R. L. DRAKE R-7 RECEIVER

The beholder of this fine new product may regard it initially as just another "super-duper signal scooper," but it is, in fact, anything *but* just another fancy receiver. The Drake R-7 (model 1240) is a synthesized general-coverage (0- to 30-MHz) unit with no gaps in the frequency coverage.

The utility of this new product can be used to advantage in the ham shack or laboratory, with or without the many available options. Among them are the MS-7 speaker, i-f filters for 300, 500 and 1800 Hz. One can also purchase filters for 4.0- or 6.0-kHz bandwidths. Other accessories are the NB-7A noise blanker and Aux-7 range program/fixed-frequency board. The latter permits programming eight additional 500-kHz range segments in the 0- to 30-MHz range, irrespective of the existing eleven 500-kHz range increments.

Specific Circuit Features

The receiver front end employs a high-level doubly balanced mixer. As an enhancement to image rejection, the first i-f is derived at 48 MHz by means of "up-converting." Front-end bandpass filters are used from vlf through hf. A broadband preamplifier can be switched in from the front panel at all frequencies above 1.5 MHz. This adds 10 dB of front-end gain when it is needed.

A multiposition antenna selector switch is located on the front panel. It enables the operator to receive simultaneously with the R-7 and a TR-7 for split-frequency reception. Other positions can be used to select alternate antennas and outboard vhf and uhf converters. This receiver can be used for transceiving when utilized with the TR-7.

A tunable i-f notch filter is included in the circuit. It is used for reducing unwanted heterodynes from interfering strong signals. Electronic passband tuning is still another feature of the R-7. It can be adjusted for use with any of the filter bandwidths listed earlier.

There are three selectable age time constants in addition to an "off" position. Also, the receiver is equipped for digital and analog frequency readout. A front-panel switch enables the operator to use the internal counter as a 150-MHz external frequency counter, if desired. A 25-kHz calibrator is included for alignment of the analog dial.

A low-distortion "synchro-phase" a-m detector is included in the receiver. This circuit permits a 3-kHz a-m sideband response when using a 4-kHz filter. The technique provides better interference rejection than is possible with conventional systems. The principal application for amateurs would be in the monitoring of international shortwave broadcasts, but amateur a-m diehards might appreciate the feature also!

Performance

As one might conclude from reading the specifications for the R-7, the receiver dynamic range is excellent. The worst-case numbers were obtained on 80 meters with and without the preamp switched in. They are, with the preamp actuated:

Noise Floor	Blocking	IMD
−139 dBm	112 dB	91 dB

Without the preamp turned on:

Noise Floor	Blocking	IMD
−133 dBm	>120 dB	100 dB

The tests were based on the W7ZOI measurement techniques described in July 1975 *QST*. These numbers equate to a third-order input intercept of −2.5 dBm on 80 meters with the preamp turned off and +17 dBm with the preamp turned on. The League's product-analysis engineer reported difficulty in identifying the IMD responses, as they were among other responses within the receiver, presumably caused by the frequency synthesizer. Our present measurement capability prevents us from making definitive LO noise-floor measurements.

In actual amateur service at W1FB (two short blocks from W1AW), the receiver performed extremely well in the presence of very strong signals. There was no evidence of overloading when W1AW was operating. Image rejection appears to be excellent: Drake rates it at greater than 80 dB (48.05 MHz first i-f, 5.645 MHz second i-f and 50 kHz third i-f).

The antenna input impedance is 50 Ω. The audio output is rated at 2.5 watts with less than 10 percent total harmonic distortion (THD) into a 4-Ω load. The frequency drift checked out at 85 Hz after a 30-minute warm-up period. This is quite good, considering the power supply is built in and the heat from the many active devices contained in the circuit. — *Doug DeMaw, W1FB*

Drake R-7 VLF/HF Receiver

Claimed specifications

Sensitivity: 1.8-30 MHz less than 0.2 μV for 10 dB S + N/N with preamp on; less than 0.5 μV with preamp off. From 0.01 to 1.5 MHz, less than 1.0 μV.
Dimensions (HWD): 4.6 × 13.6 × 13 inches (116 × 346 × 330 mm).
Weight: 18.4 lbs (8.34 kg).
Power requirements: 100 to 240 V ac, 50/60 Hz, 60 watts, or 11 to 16 V dc at 3 A (13.8 V dc nom.).
Price class: $1300.
Manufacturer: R. L. Drake Company, Miamisburg, OH 45342. Tel. 513-866-2421.

THE SOUNDPOWER SP100 AUDIO SPEECH PROCESSOR

Many of the new transceivers and transmitters being sold today include either an rf or audio type of speech processor. Processors are designed to provide that extra "punch" on occasions when received signals at the other end are weak or the QRM makes the going tough. Rf speech processors employ clipping circuits and utilize expensive filters to "clean up" the signal. Most of these types of processors are

If you're looking to add a little more "punch" to your ssb signal, here's an accessory that may prove to be the answer. The Soundpower SP100 is simply installed in the mic line and provides a unique method of audio processing.

designed to be installed in the transmitter i-f circuit.[1] Audio processors, on the other hand, are plugged directly into the microphone jack and perform their function at audio frequencies.

The Soundpower SP100 audio processor is housed in a compact 5-3/16 × 2-1/2 × 2-7/16 inch (132 × 64 × 62 mm) cabinet. It is supplied with a female 4-conductor jack similar to Radio Shack 274-001. The review unit came with a mating power supply, the PS9, although any power source capable of providing 6 to 15 V dc at 30 mA may be used. A manufacturer's one-year guarantee accompanies the SP100.

During the review period, the SP100 was used with a Kenwood T-599D transmitter which does not have a built-in speech processor. Previous on-the-air reports indicated that the audio quality and "punch" of the transmitter alone were very good. In fact, many stations contacted had indicated that the "processor was working well" when none was in use! Under such circumstances, it appeared this would be a good proving ground.

Hooking up the SP100 proved to be no problem, though the instructions could have been made a little clearer. Two adjustments had to be made from the back of the unit — the gain and output level settings. My initial attempt at using the processor was not successful. Reports indicated too much gain or output and a correspondingly distorted signal. The instructions suggested the gain should be adjusted until the LED on the front panel was on almost continuously. With my Astatic 10-D microphone (a high-impedance microphone is to be used with the SP100), I found output quality to be better when the light was on only intermittently. In any case, the adjustment requires a fine touch, but once set, can be left alone.

As with any such piece of equipment, the proof of its worth is in the on-the-air reports. The station wattmeter indicated a significant increase in average output power with the SP100 in use. My on-the-air voice was definitely "different" as the processor is intended to utilize only those speech components that contribute to high articulation and intelligibility. In other words, concentrate the audio power at those frequencies most needed for communication. Operators who could already hear me well said the processor didn't help and most preferred that it not be used. But, when my signal was weak, the processor made a definite improvement in getting through. During a contest, a DX pile-up or even attempting a ragchew when QRM is rough, the SP100 will give you that added "edge" in intelligibility. — *Tom Frenaye, K1KI*

[1]Some rf speech processors, such as the Daiwa RF 440, are connected in the mic line. (See "Product Review," *QST*, April 1979.)

Soundpower SP100 Audio Speech Processor

Specifications

Input level: 0.5 to 500 mV.
Output level: Constant amplitude, adjustable 0 to 0.3 V.
Power requirements: 6 to 15 V dc, 0.01 to 0.03 A.
Weight: 1 pound (0.5 kg).
Case: Aluminum.
Color: Two-tone, gray and black.
Price class: Processor, $80; power supply, $6.
Manufacturer: Soundpower, P. O. Box 426, Bergenfield, NJ 07621.

APOLLO PRODUCTS CABINETS

Whether we like to believe it or not, eye appeal has a lot to do with our choice and appraisal of anything we buy, be it a car, house or a piece of electronic equipment. And no matter how good the design, how painstaking the circuit assembly, the finished product of any homemade piece of amateur equipment can be made or broken by the enclosure chosen to house the assembly. If your eyes haven't been captured already, a glance at Figs. 4 and 5 should get your mental "gears" in motion if you're contemplating another construction project.

Apollo Products has a cabinet, enclosure, box, housing or reliquary for virtually *any* item you may have that's looking for a home. The panels are made of 20-gauge brushed-chrome steel and may be finished with a touch of wood-grained adhesive-backed vinyl or baked enamel. Covers have a baked-on wrinkle finish of different colors. Certain chassis are nickel-plated copper to exhibit good rf conductivity. All cabinets are fully assembled and supplied with rubber feet.

Some of the units shown in Fig. 5 are supplied with red dpdt rocker switches. There's even a ready-made housing for an antenna-matching network. That's not all — there are more items available than meet the eye in the two photos. For instance, Apollo also manufactures small aluminum chassis which may be used to fabricate a coaxial switch — complete with prepunched holes for the SO-239 connectors and the switch. A catalog and price list are available from: Apollo Products, Box 245, Vaughnsville, OH 45893. — *Paul K. Pagel, N1FB*

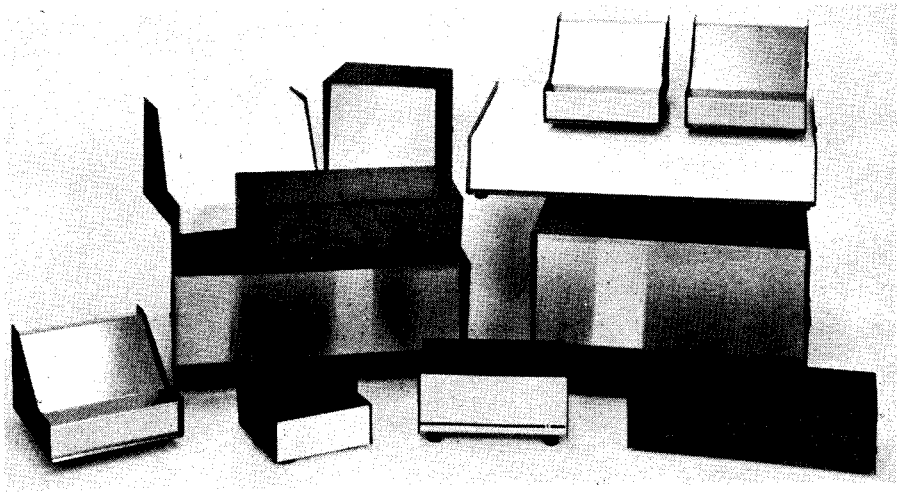

Fig. 4 — Here's a sampling of the offering from Apollo Products. The smaller, sloping-front cabinets are ideal for mounting meters and make perfect housings for smaller pieces of test equipment.

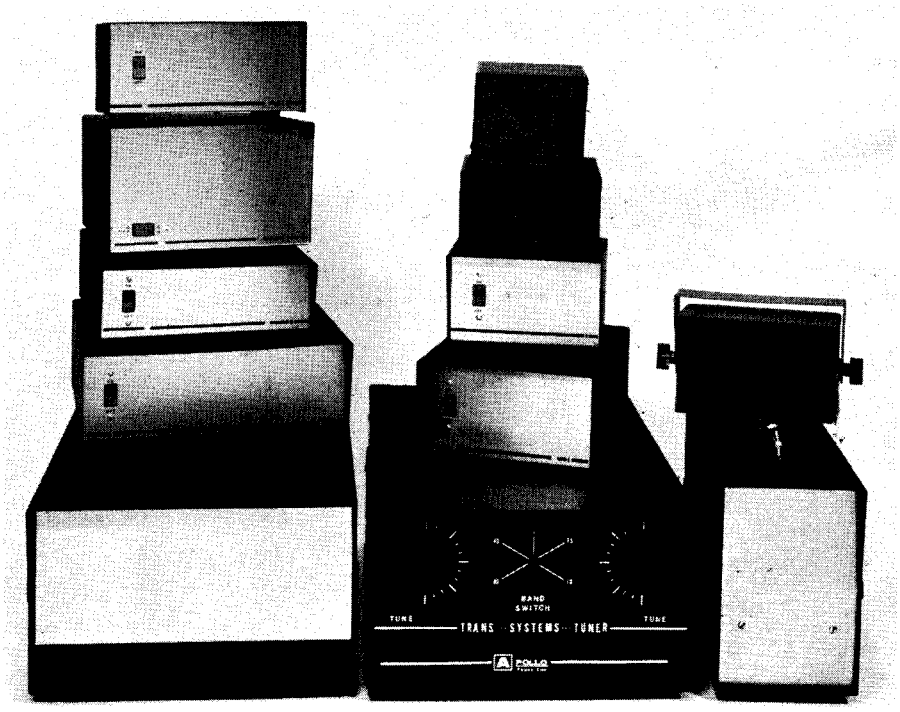

Fig. 5 — Power supplies, antenna-matching network, amplifier or oscilloscope — one of these cabinets should fit the bill for your next project.