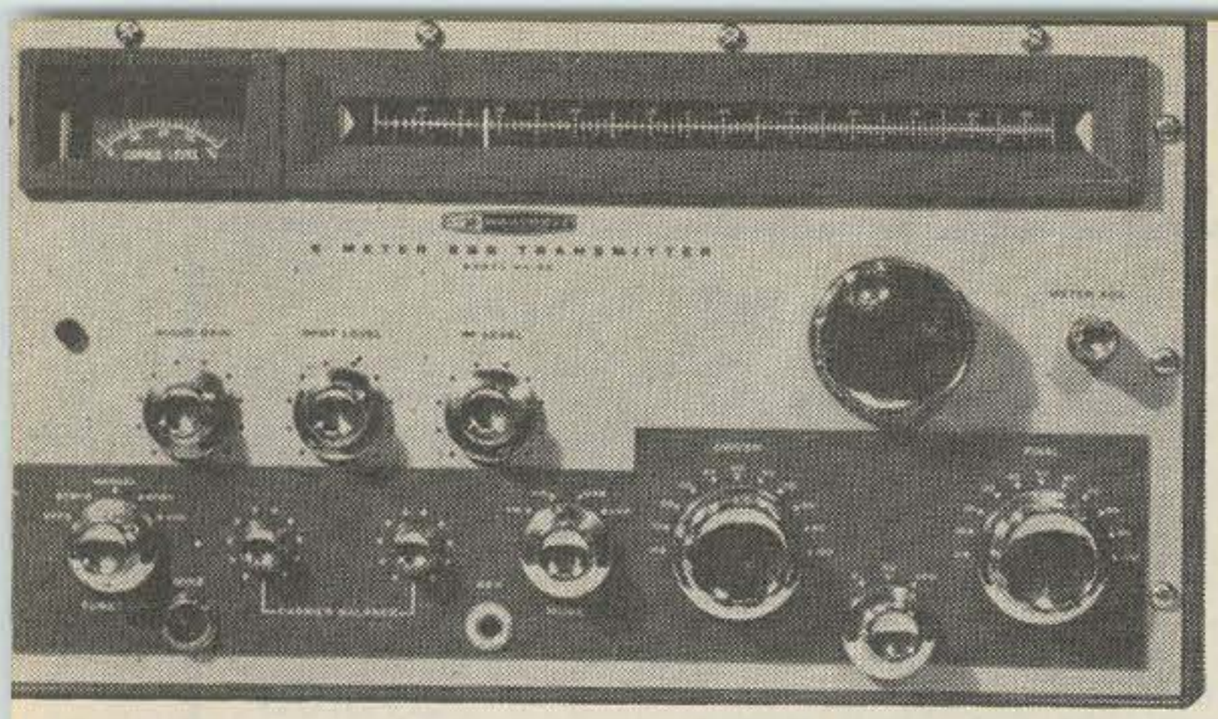

# Heath 6M SSB Transmitter

Kent Mitchell W3WTO

Almost every metropolitan area of the United States has experienced a boom in 6 meter activity during recent years . . . due in no small respect to Heath's introduction of their now famous 5 watt power house, the "Sixer." Then too, and especially during band openings, quite a few of the boys may be heard modulating a Heath 120 watt "Seneca." Indeed, our most popular VHF band might sound altogether different without Heathkits. Now however, 6 meters is going to sound different *with* Heathkits . . . namely the HX-30. This new SSB transmitter is going to become as popular as sliced bread!

A complete, self-contained unit (not a "transverter"), the HX-30 offers a frequency coverage of 50.0 to 54.0 megacycles in four, 1 megacycle steps, an ultrastable fine tuning VFO, and excellent on-the-air audio characteristics with unwanted sideband suppression on the order of 40 db. Carrier suppression is 50 db below maximum rf output.

Providing 10 watts peak envelope power output SSB, 10 watts of CW, and 2.5 watts with AM, the rig may be used as an exciter for a linear amplifier (such as Heath's HA-20, to be featured in a later article), or run "barefoot" with excellent results.

The single sideband signal is generated in this transmitter by the phasing method. Beginning right at the mike input, let's follow the audio through the rig until it emerges from the antenna coax jack as a single sideband rf signal. The heart of the rig is the balanced modulator shown in Fig. 2. A speech amplifier not only boosts the mike input, but attenuates the audio frequencies below 300 cps and above 3000 cps, which experience has shown to be the only really necessary range for good voice intelligibility. The audio is now split into two equal, but 90 degree out of phase signals by an audio phase shift network. Amplified by V3A and V3B, these voltages are applied to the grids of balanced modulators V4 and V5. An rf carrier is generated at 11.5 mc by a crystal controlled oscillator V2B and also applied to the grids of the balanced modulators after it too has been split into two 90 degree out of phase signals. So now, at the grids of V4 and V5 we have two separate carriers being combined with modulation. Here is where we eliminate the carrier and produce the desired single sideband signal. Both balanced modulators, consisting of two triodes each, V4A, V4B and V5A, V5B, each have their grids connected in parallel for rf, and in push-pull for audio through. The plates of each balanced modulator are connected in push-pull through a common tank circuit and are 180 degrees out of phase with each other. The

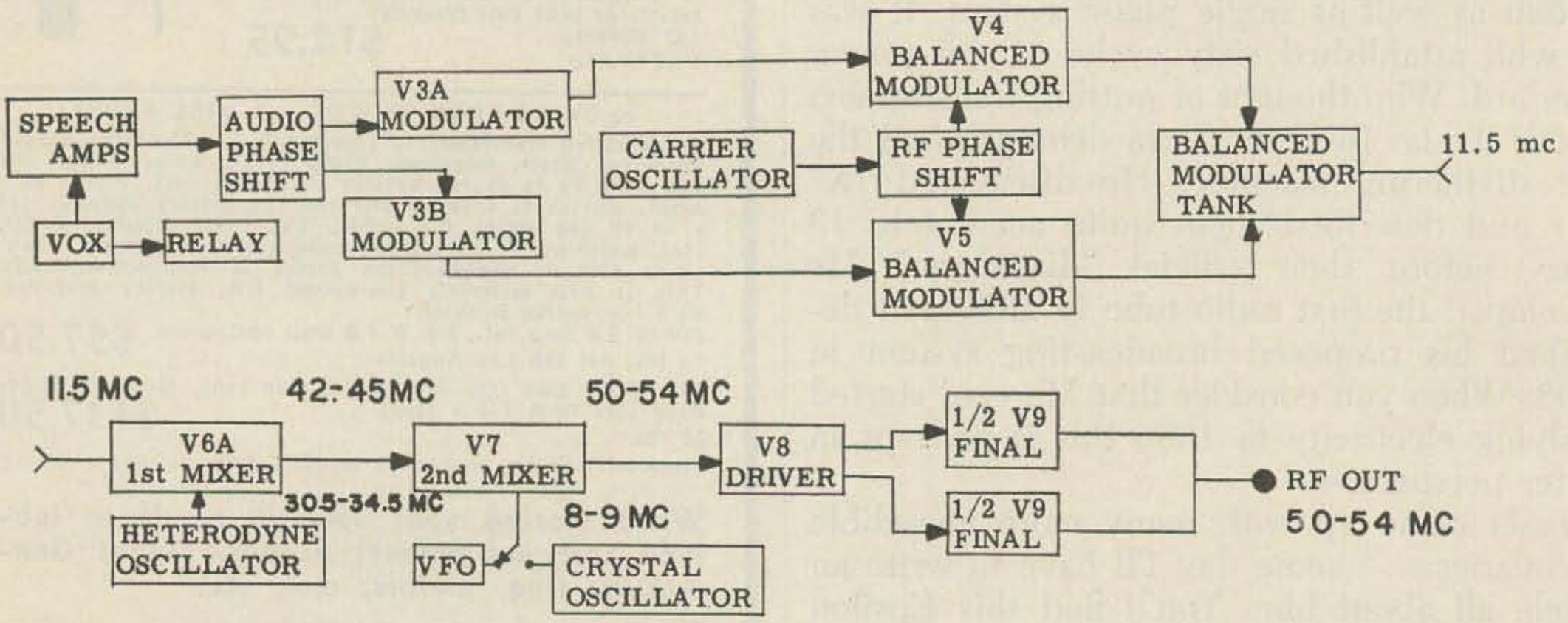


FIGURE 1
HX-30 BLOCK DIAGRAM

product of all these phase relationships results in the carrier being balanced out and four sidebands containing the audio, with two in-phase sidebands combining and two out of phase sidebands canceling . . . leaving only a single sideband signal. A more detailed explanation of how this phasing occurs may be found in several good texts available, such as the *Single Sideband Communications Handbook*. Howard W. Sams and Co., Inc. ($6.95 from Radio Bookshop). Two CARRIER BALANCE controls on the front panel of the HX-30 are pots in the cathode circuits of the balanced modulators and enable their output voltages to be adjusted for equal amplitude.

Transition from upper sideband to lower sideband, and vice versa, is performed simply by reversing the phase of the audio signals on the grids of the balanced modulators. Placing the MODE switch to the AM position removes the audio from the grids of V5, unbalances V4A and V4B, thereby reinserting the carrier in the output at T4 and combining it with two out of phase sidebands . . . or in other words, giving us a conventional AM signal. The CW mode is produced in a likewise manner, with the exception of removal of audio from both the balanced modulators.

So, we now have a SSB rf signal at 11.5 mc, a long way from 6 meters, but from here

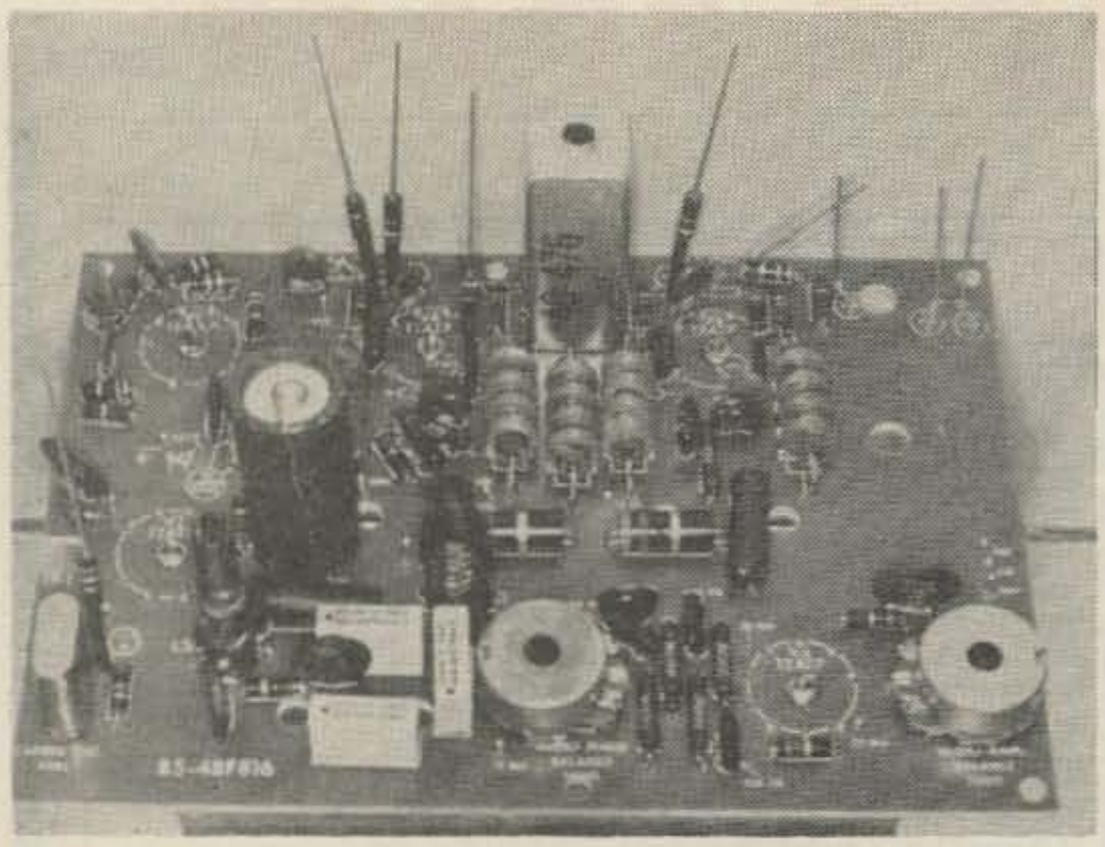

Fig. 2

on out the rest is easy. The 11.5 mc signal is coupled to the pentode section of a 6U8 tube operating as a mixer, where it is heterodyned with the output of a crystal controlled oscillator, the triode section of the 6U8. When the oscillator crystal frequency is 30.5 mc, the output of the mixer is 42 mc. When this 42 mc signal is heterodyned in the second mixer, a 6CB6 (V7), with the output from the VFO or an 8 to 9 mc crystal, we will have a 6 meter

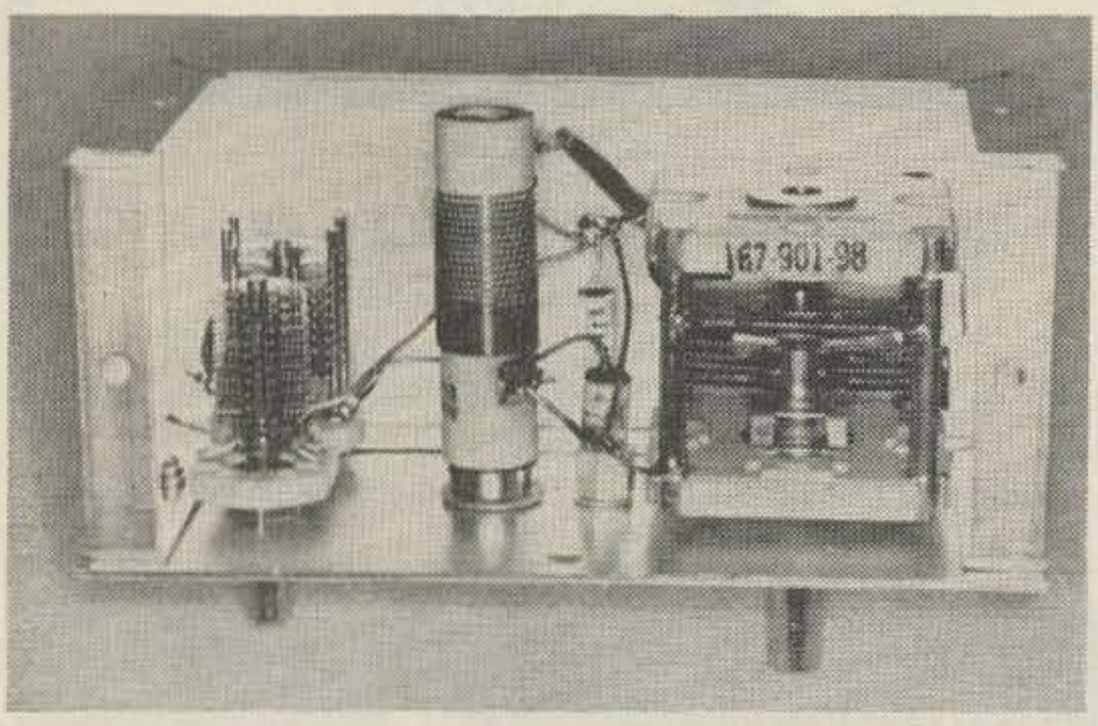

Fig. 3

signal, between 50 and 51 mc. Other 1 mc segments of the band may be covered by changing the first oscillator crystal to the appropriate frequency. A 31.5 crystal will cover 51 to 52 mc, a 32.5 mc crystal will cover 52 to 53 mc, and a 33.5 crystal will provide an output between 53 and 54 mc. Output of the second mixer is coupled to a 6AK6 driver amplifier (V8) and then to the 6360 final amplifier, operating as a push-pull Class AB1 amplifier. Link coupling is employed from the final to the rf output jack.

Assembly of the HX-30 is a pleasant and satisfying task, easily accomplished within the 30 hours mentioned in the Heath ads. Actually, I required 29 hours, in spite of the fact that I was taking notes and photographs as construction progressed, having this article in mind. Rapid assembly is made possible by the use of four heavy duty etched circuit boards and three precut and laced wiring harnesses. Obviously, a great deal of forethought and planning went into this transmitter, both

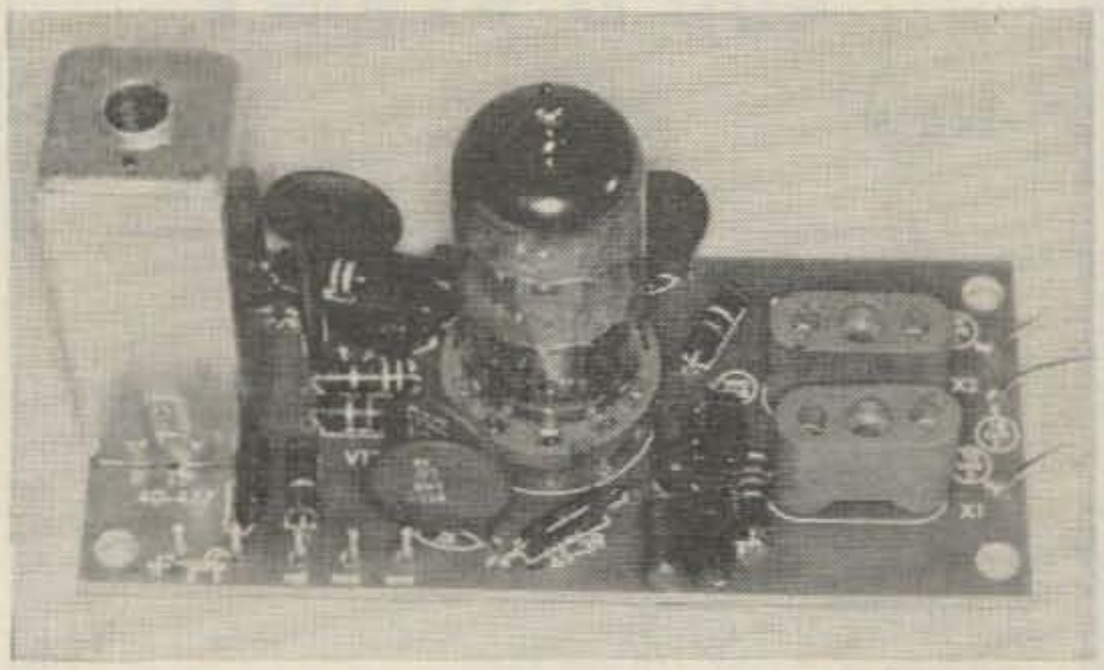

Fig. 4

mechanically and electrically. To cite one example, the tubes and circuit components are located on opposite sides of the etched circuit boards. When the boards are mounted, the tubes protrude upward through the chassis, thereby isolating the components from tube heat. Another example along the same lines is the complete isolation of the VFO tank circuit from other circuits. Fig. 3 shows the interior of the VFO tank compartment, prior to its complete shielding. On the right is the VFO frequency capacitor, to the left are a bandspread trimmer and a temperature compensating capacitor. Fig. 4 is a close-up of the VFO circuit board. Note the two crystal sockets which are for optional crystal control, utilizing the triode section of the 6CH8 VFO as a Colpitts oscillator. Figure 5 shows the completed VFO assembly. The large fine toothed gear visible in the background is a portion of the VFO gear drive assembly. Providing exceptionally smooth VFO tuning, the helical gears give a ratio of approximately 45 kc per turn of the spinner knob. Nine inches on the slide rule type dial equals only one megacycle of the 6 meter band! Compare that to your present 6 meter VFO or receiver dial.

Alignment of the completed kit is simple and requires a minimum of time and effort. An unusual feature is the use of test point jacks and a test probe connected to the front panel meter for alignment. The meter is then normally used as a rf power output indicator and to null out the carrier. The initial adjustment of the audio phase and amplitude controls require an oscilloscope for optimum suppression of the unwanted sideband, but once set need no further attention.

Other features of the HX-30 well worth mentioning include complete shielding of the

final tank assembly, copper plated cabinet interior, built in VOX and anti-trip circuitry, and grid block keying along with a key click filter for clean CW signals. Although the rig was basically designed for SSB operation, it will produce good signals with other modes of transmission . . . no skimping was done here. Also, all Heathkits now include a sufficient supply of multi-core solder at no extra cost. Another pleasant surprise was the inclusion of five free log books and a fine simulated leather vinyl cover.

On the air tests resulted in reports of excellent audio quality, no trace of carrier and very good suppression of the unwanted sideband. Several QSO's were made with stations 75 miles over the Blue Ridge mountains, quite a haul for only 10 watts on 6 meter ground wave, and a feat that is hard to duplicate with a lot more watts of AM from this QTH. Needless to say, sideband really gets through.

Even as I was testing my own HX-30, I heard several other local stations using them on the band. Haven't you ordered your HX-30 yet? See you on 6 meter sideband!

. . . W3WTO

**Fig. 5**

### SPECIFICATIONS

**Frequency Coverage**—50.0 to 54.0 megacycles in four, 1 megacycle segments. VFO or crystal control.
**Emission**—SSB, selectable upper or lower sideband. AM (inserted carrier with low level, amplitude modulation).
**RF Power Output**—SSB (P.E.P.) 10 watts
AM 2.5 watts
CW 10 watts
**Carrier Suppression**—50db or more below maximum output.
**Unwanted Sideband Suppression**—40db or more below maximum output at 1000 cps input.
**Distortion Products**—30db or more below maximum output at 1000 cps input.
**Hum and Noise**—40db or more below maximum output.
**Output Impedance**—50 to 75 ohms, unbalanced.
**Crystals**—11.5 Carrier oscillator (furnished) 30.5 First heterodyne oscillator (furnished), providing operation between 50.0 to 51.0 mc. Crystals for higher band operation are not supplied.
**Audio Frequency Response**—300 to 3000 cps.
**Keying**—Grid block keying with key click filter.
**VFO Tuning Knob Ratio**—Approximately 45 kc per turn.
**Power Requirements**—117 VAC 60 cps @ 95 watts.
**Dimensions**—16⅝" wide, 10⅛" high, 10" deep.
**Weight**—40 pounds.
**Price**—$189.95