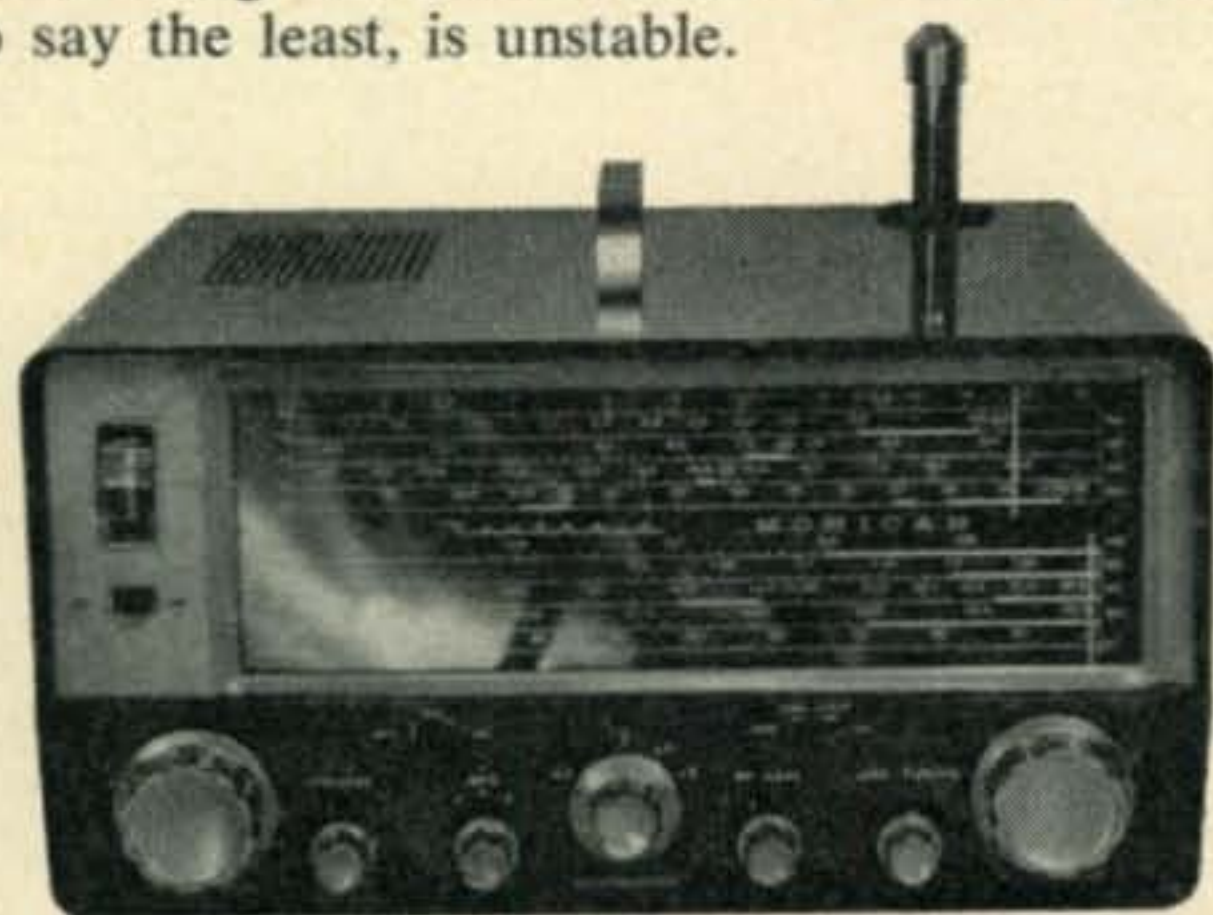


The Heath GC-1A Receiver Kit

BY DONALD L. STONER*, W6TNS

LATELY I have been receiving quite a bit of mail on the subject of the Heath GC-1A. Generally, the letters read something like this; "Tell me, off the cuff, is the Heath GC-1A really as good as it appears to be? Are there any simple modifications which will improve its performance?"

Ordinarily a kit or equipment reviewer is expected to exhibit self restraint and objectivity when doing his job. I confess at the outset, and "on the cuff" so to speak, that the new GC-1A has me excited. *I like it!* After reviewing the circuit features with me, I think you will also. The Heath Company is to be congratulated for introducing this receiver into a market which, to say the least, is unstable.



I believe I can safely say that there is no other wired receiver that will provide the same dollar value as the GC-1A. Its performance equals or exceeds any receiver (wired) in the \$130 price class.

Specifications

The Heath GC-1A is a 10 transistor receiver of the general coverage type. It is calibrated between 550 kc and 30 mc in five ranges and separate electrical bandspread is provided on all amateur frequencies, plus the Citizens Band. Although it is advertised as a general coverage receiver, it is quite capable of communications receiver performance. A 455 kc i.f. is used to obtain a 3 kc bandwidth at the 6 db points. A 2 microvolt signal is required for a 10 db signal-to-noise ratio. The average image rejection is 30 db.

*VHF Editor, CQ.

Eight size "C" flashlight cells power the receiver, or a 117 volt a.c. power pack is available for fixed station operation. The battery life is approximately 400 hours.

These specifications are right out of the Heath manual, and the receiver lives up to every one of them. Two points should be brought out, however. The shape factor provided by the four i.f. filters is approximately 4 to 1, and the 60 db bandwidth is approximately 12 kc wide. The *average* image rejection (taken at approximately 15 mc) is better than 30 db. However, at 30 mc this figure drops below 30 db, with the exact amount of rejection depending on how carefully you align the front end.

Circuitry

The r.f. section uses three premium RCA "drift"-type transistors which have 100 mc alpha cutoff ratings. There are no short cuts taken in the design of the front end. Each stage and band has a separate coil (15 total) and the coil-bandswitch assembly occupies four-fifths of the total chassis area. In addition, each band has an individual slug and trimmer for tracking the r.f., mixer, and oscillator at each end of the dial. Five-percent capacitors are used in the front end signal circuits, along with copper-stator tuning capacitors, to insure low-drift performance.

R.F. Section—A 2N1396 Q_1 is used in a common base configuration for constant alpha gain. R.f. from the 52 ohm input is applied to the emitter. When using the whip antenna, the signals are coupled to the "hot" end of the antenna coil in use. A.v.c. voltage is applied to the r.f. stage. The r.f. gain control varies the bias, for forward conduction, applied to the base of Q_1 .

Mixer—The amplified signal from Q_1 is capacitively coupled to the mixer transistor (Q_2 , a 2N1225) from low impedance points on the r.f. coils. This stage operates in the common emitter configuration and the oscillator energy is injected into the transistor emitter. A different coupling capacitor (between oscillator and mixer) is switched into the circuit on each band, thereby maintaining the correct injection current on all ranges.

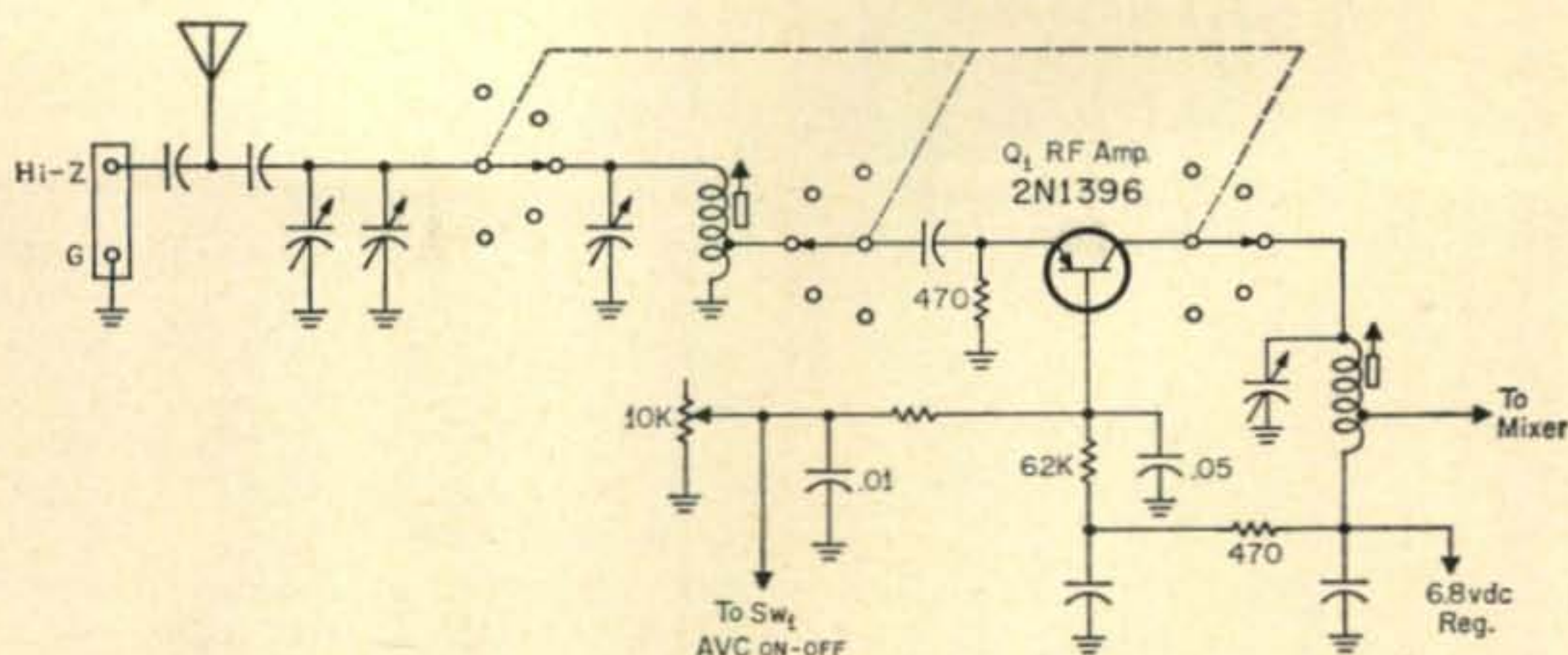


Fig. 1—Circuit of the Heath GC-1A r.f. stage. Transistor Q_1 is an RCA drift-type with an alpha cutoff of 100 mc. Each of 5 bands has an individual slug tuned coil and trimmer in each stage of the rf., mixer and oscillator.

Oscillator—The local oscillator (Q_3) is another 2N1225 operating in the common-base configuration. A zener diode regulates the power source. Changes in potential, caused by heavy current drain in the Class B audio stage, or aging batteries, have no effect on the oscillator frequency. A section of the oscillator band-switch selects the proper RC feedback components to maintain the oscillator level across the band in use. The remaining switch section selects the coil to be used. The oscillator is always 455 kc above the incoming signal. Therefore all stations are converted to 455 kc and applied to the i.f. amplifier.

IF Section—The GC-1A i.f. strip uses three 2N373 RCA "drift" type transistors (Q_4 , Q_5 and Q_6). The input transformer (T_1) matches the mixer to the 1st i.f. stage, which is also connected to the a.v.c. line as shown in fig. 2. An "S" meter in the collector circuit measures the current drawn by this stage when the a.v.c. voltage changes. The output of this stage drives a Clevite ceramic "Transfilter." (Z_1 , Z_2) These units were described in the July 1959 issue of *CQ*¹. They provide excellent bandpass characteristics in addition to matching the i.f. collector to the following base. In addition, "Transfilter" emitter bypass units (Z_3) are used to increase

the i.f. selectivity. These filters have near-zero reactance at 455 kc, but stage degeneration rises sharply on each side of this frequency. Only two interstage and two emitter bypass "Transfilters" are needed to obtain the 3 kc bandwidth at 6 db down.

The last i.f. stage (Q_6) is transformer coupled to the diode detector and audio amplifier. The collector signal on the last i.f. stage is also rectified to provide an a.v.c. voltage.

B.F.O.—The beat frequency oscillator uses a 2N409 operating in the common-base configuration, with feedback between collector and emitter as shown in fig. 3. The frequency of the beat oscillator is adjusted by a front panel potentiometer which varies the potential on a diode capacitor. This stage is also stabilized by the zener diode.

Audio—The audio section consists of a 2N407 driving a pair of 2N407's in class B. The circuit is slightly different than you may be used to in this application, for a "bootstrap" or "long-tail pair" configuration has been used to eliminate the need for an output transformer. Although a 35 ohm speaker is used, either 8

¹ Stoner, D. L., "SEMICONDUCTORS," *CQ*, July, 1959, page 81.

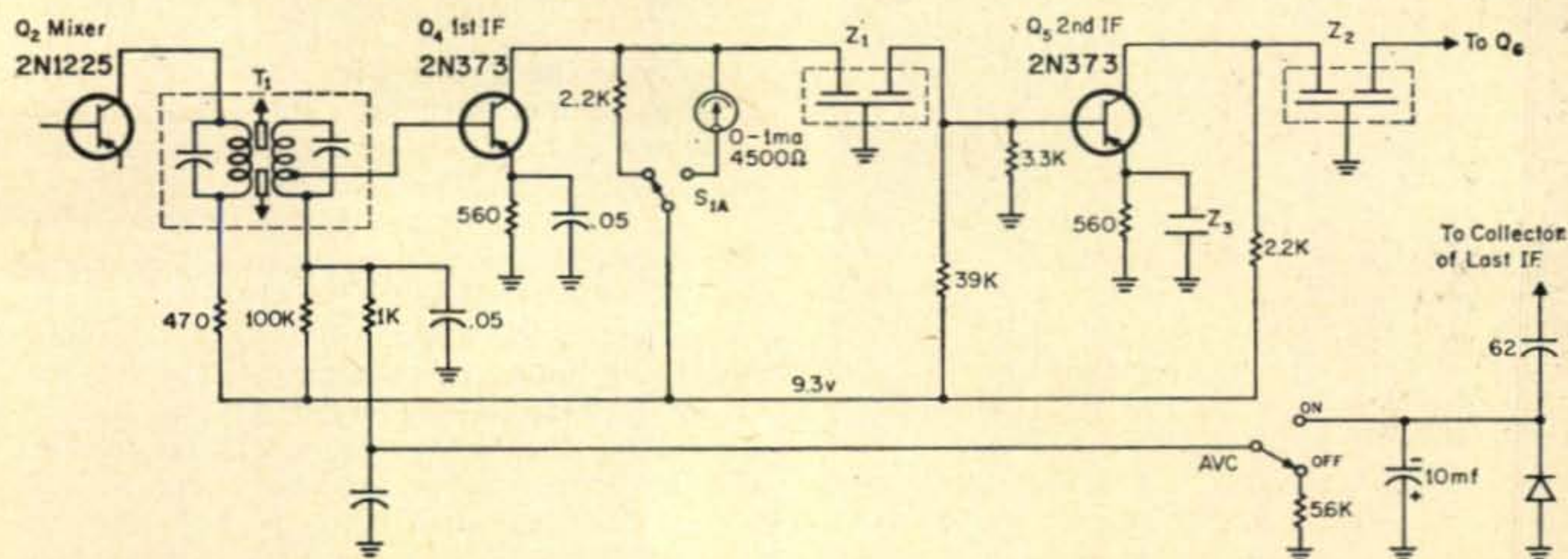


Fig. 2—Partial circuit of the i.f. stages of the Heath GC-1A. Only two conventional i.f. transformers are used for input and output. The i.f. response is further shaped by the filters, Z_1 , Z_2 and Z_3 as explained in the text.

or 2,000 ohm headphones will provide ear shattering volume. A pair of compensating diodes automatically adjust the operating point of the output stage with changes in temperature and-or battery potential.

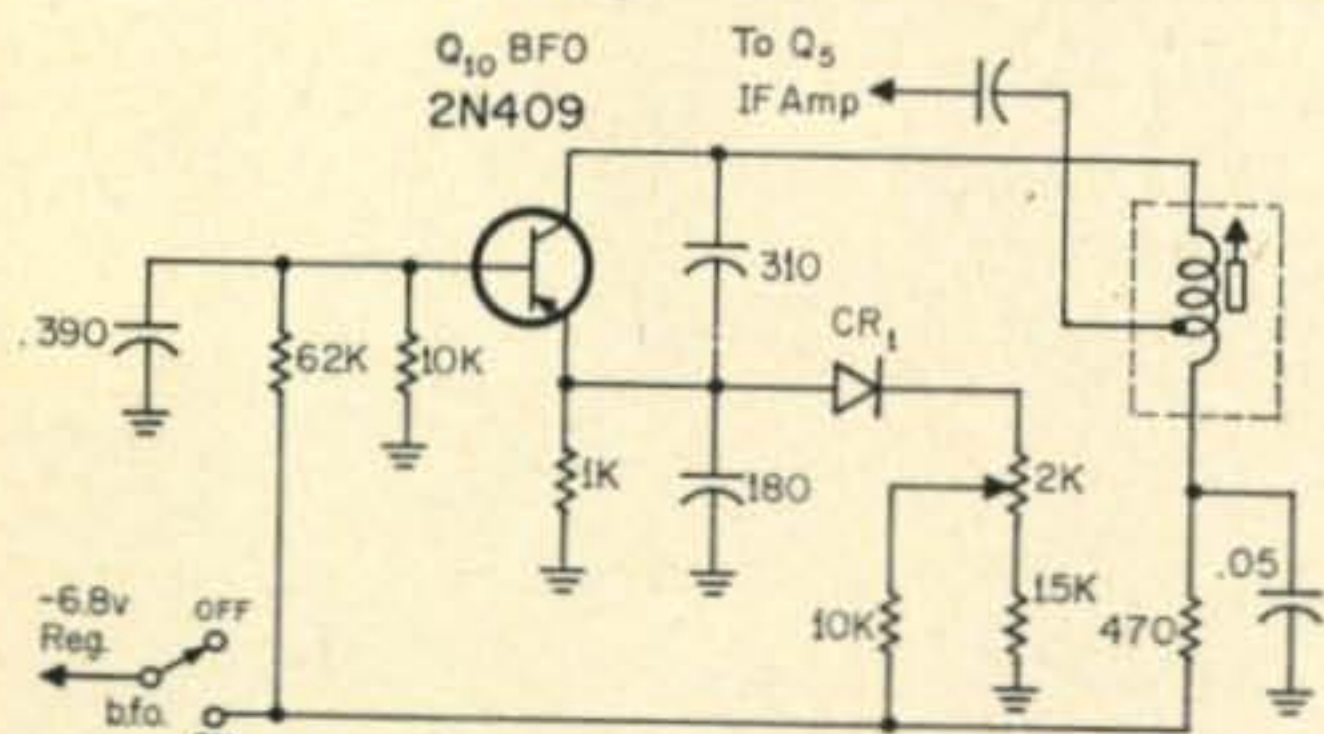


Fig. 3—B.f.o. circuit employed in the Heath GC-1A. Tuning is accomplished by varying the voltage applied to CR₁, a diode variable capacitor.

Mechanical

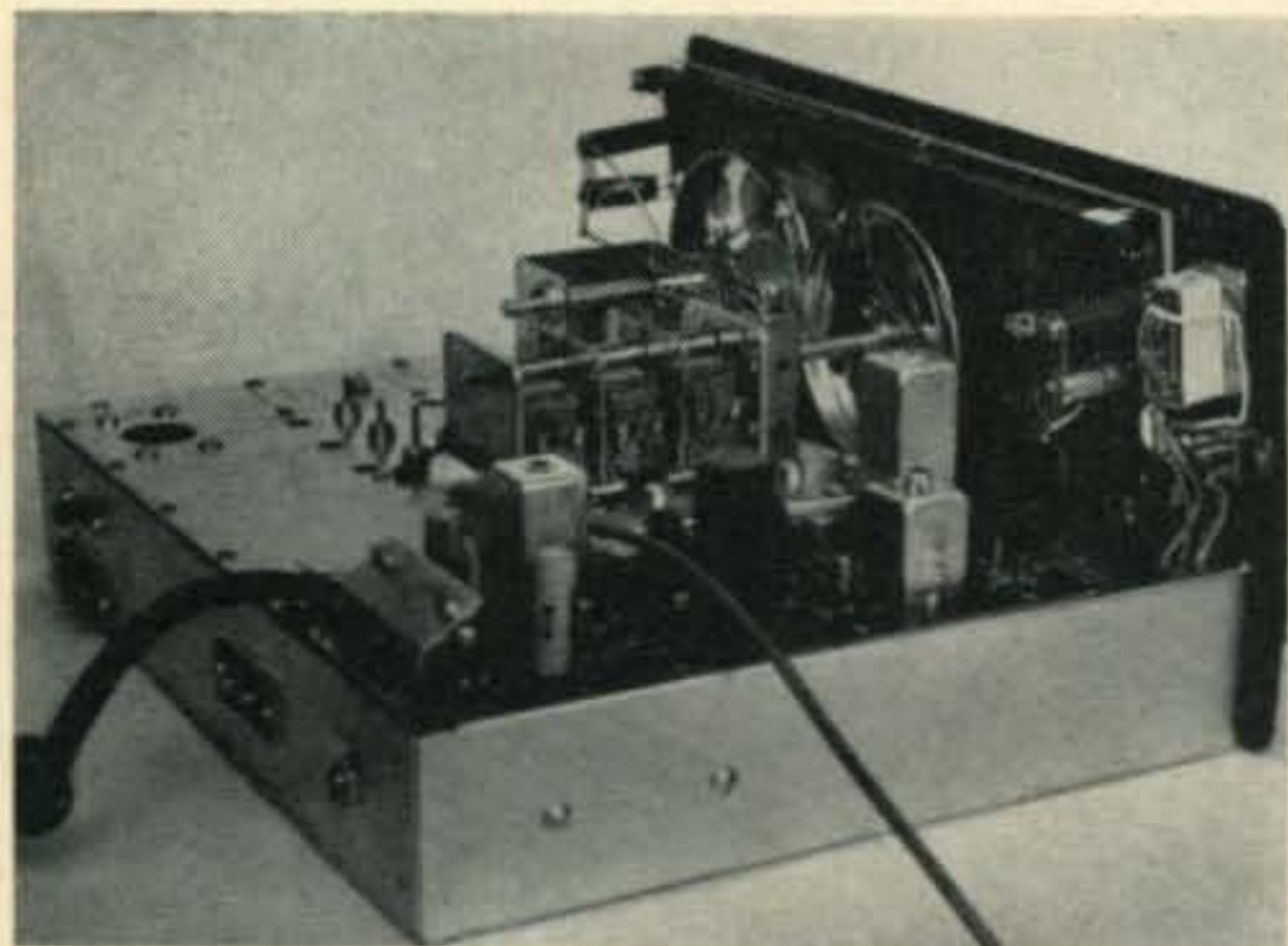
The GC-1A has several interesting mechanical features. The r.f. mixer, and oscillator sections are completely isolated by heavy shields, which also serve to mount the bandswitch and front end transistors. The variable capacitors are securely mounted to the heavy chassis, providing excellent mechanical stability.

The battery pack is very clever. It plugs into the rear panel and may be easily interchanged with the a.c. supply.

Observations

The GC-1A is not what you might call an easy kit to build. Although the instruction manual makes it as painless as possible, anything this complex is bound to be a time consuming project. Also you are required to work in some rather tight spots in the r.f. assembly. Plan on about 35 hours to construct, test, and align the GC-1A.

The GC-1A gives you the impression that it is just as hot on 10 meters as it is on 75. It's

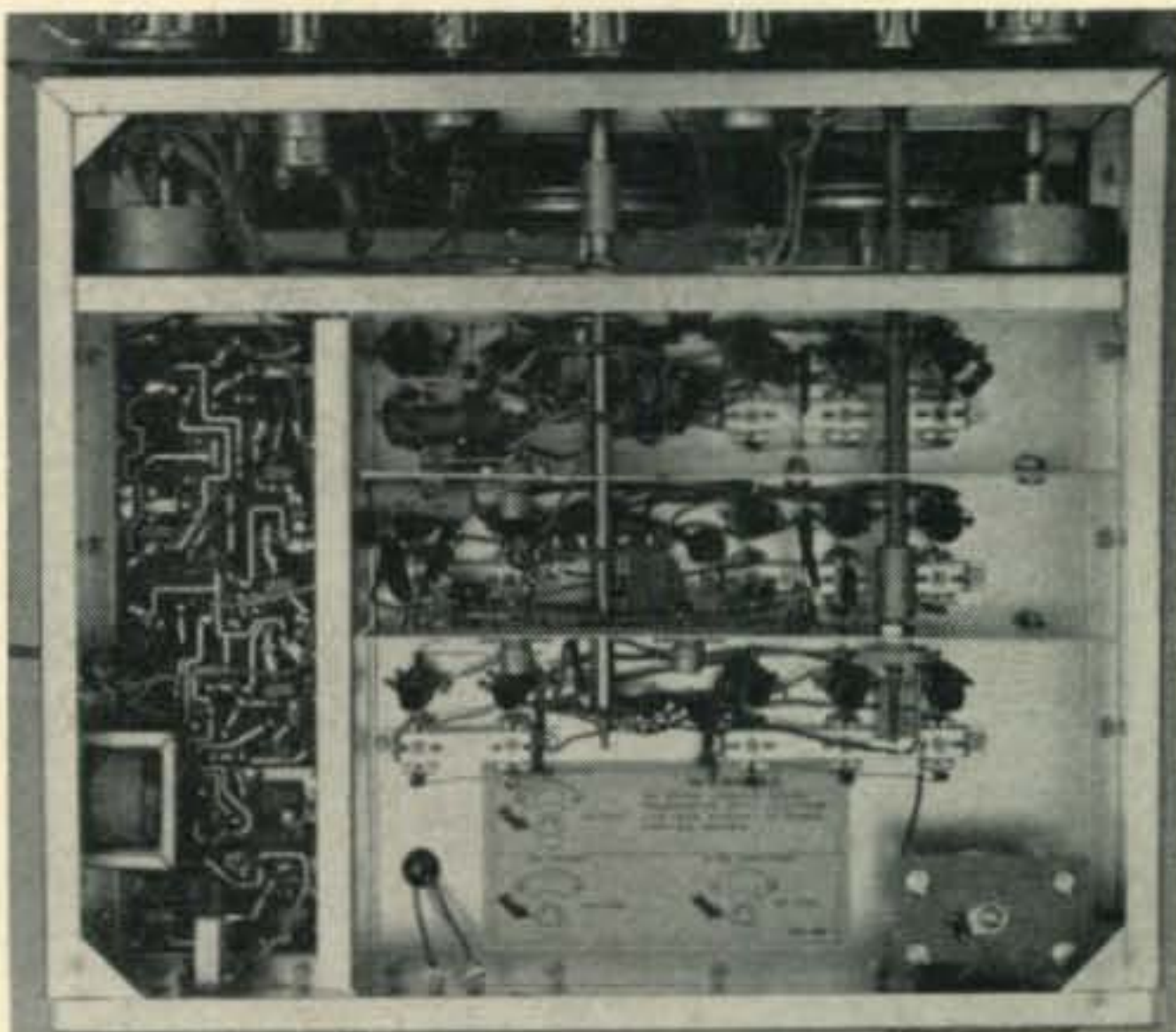


Side view of the Heath GC-1A. The i.f. and audio strip is in the foreground. The balance of the chassis is occupied by the r.f. section. The three gang tuning capacitor is mounted in the center of the chassis and to the rear of it is the single section bandspread capacitor that tunes the oscillator.

not just an illusion either. It will pull in anything on 10 that the comparable vacuum tube receiver can detect. The high-alpha transistors used in the front-end provide a truly excellent noise figure on 10 meters.

The dial accuracy is uncanny considering it is a printed production item and covers many megacycles, rather than a few hundred kilocycles.

At this point everyone is wondering about stability. Someone has been spreading a rumor that transistors are not as stable as vacuum tubes. The writer hesitantly admits that there is some truth to the statement, but hastens to add that you wouldn't know it by listening to the GC-1A. The only instability which can be traced to transistors in this receiver is a strange "warble" on s.s.b. stations. This is caused by random arrival of minority carriers in the oscillator transistor and is not a fault of the receiver. Some receivers will exhibit the effect, others will not. You can improve the s.s.b. reception by swapping the front end transistors around. In most cases s.s.b. sounds the best when r.f. amplifier and oscillator are reversed.



Bottom view of the Heath GC-1A transistorized general coverage receiver. The bulk of the area is taken up by the front end, with the i.f. strip along the left side. The front end stages are isolated from each other by shielding. The plate in the lower right supports the whip antenna.

This change does not seem to affect receiver performance on 10 meters, for all front end types used in the GC-1A come from the same family.

The bandspread tuning capacitor only tunes the oscillator section. It was noted that, on 10 meters, the sensitivity and image rejection suffered slightly when using bandspread to tune the receiver lower in frequency.

The skirt selectivity of the receiver can be improved noticeably by adding a lower termination impedance to the Clevite filters. This is accomplished by connecting a .002 mf disc capacitor between the filter output (base connection) and ground. Start with a 500 mmf capacitor on each filter and increase the value

[Continued on page 90]

Heath GC-1A [from page 46]

until the greatest selectivity is obtained. The capacity value may not be the same for both filters.

Conclusion

If you are inclined to write and ask, I'll tell you the same thing "off the cuff." Priced at \$109.95 the Heath GC-1A is an excellent buy and I like it! ■

DX [from page 58]

HS1X	via WA2WCB.
I1SVZ/M1	G. Rustichelli, I1SVZ, Via F. Dall Ongaro 81, Rome, Italy.
JA3BEU	1-775 Kurehachō Ikeda, Osaka, Japan.
JA3CUK	21-2 Kikawa higashinocho, Higashiyo-dogawaku, Osaka, Japan.
JA3DDG	439 Hiranonodochō, Higashisumiyo-shika, Osaka, Japan.
JA3TC	Box 48, Toyonaka, Japan.
KA7DR	CMR #3, Box 8056, APO 929, San Francisco, Calif.
KC4AAC	via KØYKJ.
KC4AAD	via WØBAT.
KG4CY	Box 12, Navy 115, c/o FOP, N.Y.
KJ6CA	Det. 1, 1957 Communications Group, Johnson, Is., APO 105, c/o PM, San Francisco, Calif.
KV4CM	via WØGEK.
ex-KX6CO	CWO James D. Jardine, SAC Test and Evaluation Unit, IT&T Corp. Box 285, Paramus, N.J.
MP4TAC	10 Ave Rd., Gosport, Hants, England.
OK3EA	Harry Cincura, MD., Drotarska 383, Bratislava, Czechoslovakia.
ex PK2AA	F. Heyer, Hilversum, Holland.
SM5ZS/ZC6	Wo/2 Bo Engren, Swed BN, UNEF, BPO, Beirut, Lebanon.
SVØWO	Gordon E. Nelson, Box 564, Athen, Greece or via ISWL or 6930th RGM
(Crete)	Box 507, APO 291, c/o PM, N.Y., N.Y.
SVØWT	Box 808, Irakilon Air Stn., Irakilon, Crete.
TA2BK	via DJ2PJ, Hadi, Teichmann, Molt-
(ex TA5EE)	kestrasse 16, Nienburg/Weser, Ger-
TT8AG	many
TU2AK	via W3KVQ.
UA2AB	Andrea, Box 1813, Abidjan, Ivory Coast.
UA2BD	A. E. Lakir, Box 78, Kaliningradsk Oblast, USSR.
UC2CS	S. Buratevich, Box 136, Kaliningradsk Oblast USSR.
UG6AB	Eduard Khomenko, R. Luxemburg 128, Apt. 26, Minsk 36, USSR.
UT5LL	Ul Aeriana 73, Erevan, Armenia, USSR.
VE3BQL/SU	Viktor Kharchenko, Lenin Blvd. 22 Apt. 3, Simferopol, 6, Crimea, USSR.
VP2AF	E. C. Veal, UNEF Base Post Office, Beirut, Lebanon.
VP2AR	William Martin, Market St., St. John, Antigua.
VP2DG/VP2	via W3KVQ.
VP2GAC	Dean, c/o Cable and Wireless, Mont-
VP2LD	serrat.
VP2SH	via W4OPM.
VP2SY	via W4CKB.
VP3YG	R. L. Nelson, c/o Dept. Arigo, St. Vincent Island, BWI.
VP4BY	via K2MRB.
VP5BP	via G2BVN.
VP5LG	via VE6BY.
VP5MJ	via VE3CJ.
VP8BP	Richard Gleason, CEW-2, U.S. Naval Facility, Navy No. 104, c/o FPO, N.Y., N.Y.
	via KØTYO.
	via G8FC.

VP8DW
VQ1DR
VQ2JN

VR4CV
VU2RM
VU2NR
W6QMN/KB6
WA4FPK/KL7
XE2RCC
XWØGZW
XW8AL
YN1AW

YVØAA

ZD6HK
ZD6PR

ZA2BAK
4S7WP
5A1TW
5A3CAD

5H3HH
5N2EBL
5N2NFS
5N2RSB
5T5AB
5T5AD

6O1ND

6W8BQ
6W8DE

9N1MM
9Q5PW
9U5KU

Box 185, Fort Stanley, Falkland Is.
via W2TSD.
P. O. Box 203, Lusaka, Northern Rhodesia.
via K6EC.
via W3KVQ.
via WØZSZ.
via K6HAU.
via KL7DVB.
via XE2OK.
via K5GZW.
via K4KTR.
via P. O. Box 2113, Managua, Nicau-
ragua.
Radio Club of Venezuela, P. O. Box 2284, Caracas, Venezuela.
Box, 24, Blantyre.
P. Rackham, Box 16, Mzuzu, Nyasa-
land.
Box 28, Tirana, Albania.
via W3KVQ.
Box 372, Tripoli, Libya.
I. Trays, c/o Mr. Burnett, 56 Albany St., Edinburgh 1, Scotland.
via W2CTN.
E. B. Lloyd, Box 114, Ibadan, Nigeria.
via K9QIZ.
via K3MNJ.
as listed in call book under FF7AB.
via B. P. 100, Nouakchott, Mauretania (Nouakchott).
c/o American Embassy, Mogadiscio, Somali Rep.
via W9RKP.
Saint Hilaire, Box 3033, Dakar, Sen-
egal.
via W3KVQ.
via HB9GX.
Jim, Box 76, Kitega.

Propagation [from page 60]

are expected to be similar to conditions that existed during the spring of 1952.

VHF Ionospheric Openings

A considerable increase in sporadic-E propagation is expected to result in occasional 6 meter openings during May. Openings are most likely to occur between 9 A.M. and 1 P.M., and between 5 P.M. and 9 P.M., Local Standard Time, between distances of approximately 1000 and 1400 miles. DX openings between stations in the southern part of the United States and Central America may be possible on 6 meters as a result of sporadic-E propagation.

A fairly large meteor shower, the *Aquarids*, is expected to occur during the first week of May. This should result in some meteor-reflection type openings on 10, 6 and 2 meters.

May is usually a month of very little auroral activity. If auroras do occur, however, there is the likelihood that 6 and 2 meter propagation may be possible for distances up to approximately 1200 miles as a result of auroral reflection or scatter. Auroral activity is most likely to occur during below normal or disturbed propagation periods (see "Last Minute Forecast").

This month's Propagation Charts contain data for short-skip openings between distances of 50 and 2300 miles, and special forecasts for Hawaii and Alaska for May & June. DX Propagation Charts for May appeared in last month's column.

73, George