Heathkit of the Month #95:
by Bob Eckweiler, AF6C

Heathkit

STEREO HI-FI EQUIPMENT
Heathkit A-1
High Fidelity Monaural Amplifier kit

Introduction:
It's been awhile since a Heathkit hi-fi or stereo product was covered. The A-1 seems a good choice as a historic product that started the lucrative Heathkit audio kit business.

Heathkit announced the A-1 amplifier **(Figure 1)** in their November 1947 flyer shown in **Figure 2**. In *Radio News* magazine it first appeared in a January 1948 ad. The A-1 was Heath's third or fourth kit offered, appearing after the O-1 and V-1, and possibly the T-1 which appeared in the same flyer. Like earlier kits it was not given a model designation in the ads. However, the A-1, T-1 and V-1 did carry their model number on the front panel. Not so for the earlier O-1 [1].

The A-1 sold for $14.95 and remained in production until the A-2 was announced in the August 1948 Heathkit flyer.

The Heathkit A-1:
The A-1 is a four-tube amplifier (one tube is dual section) designed for a crystal phonograph pickup or a radio tuner. Its first *Radio News* ad describes it as *"…a push-pull 25 watt amplifier"* with *"excellent fidelity"*.
Other features mentioned are:

1. RCA power transformer.
2. Oil filled condensers.

Here is a link to the index of Heathkit of the Month (HotM) articles:
http://www.w6ze.org/Heathkit/Heathkit_Index.html

Figure 1: Heathkit A-1 High Fidelity Amplifier. Photo courtesy of Keith Greenhalgh.

3. Tone control.
4. Phase inverter circuit.
5. Quality output transformer.
6. 3 Ω [2], 8 Ω and 15 Ω speaker outputs.

As with almost all Heathkits, all tubes, parts and instructions are included, including a *"formed and punched chassis"*. The tube lineup is shown in **Table I**.

After the first ad, the 25-watt rating was rarely mentioned again. It did appear occasionally in ads in various magazines. Data sheets for two 1619 vacuum tubes in push-pull shows a typical max. output of 17½ watts, so Heath's numbers seem inflated a bit. The amplifier kit shipped at 20 lbs.

When the A-1 was introduced the flyer ad stated: *"A fortunate purchase of best quality Thordarson output transformers has enabled us to supply a high fidelity … 25 watt amplifier at the amazing price of $14.95"*. An interesting detail is that the parts layout shown in Figure 2. and other early ads are different

Heathkit A-1 Amplifier Tube Lineup

5Y3GT	Dual Diode	Full Wave CT Rectifier
½ 6SN7	Triode	Preamplifier
½ 6SN7	Triode	Phase Splitter
1619	Pentode	½ Push-Pull Amplifier
1619	Pentode	½ Push-Pull Amplifier

Table I

from the production A-1s. Later ads show the correct production layout (**Figure. 3**). The early drawing is probably that of the prototype which often happened in early Heath ads.

The Questionable A-1 Schematic:

While researching Heathkit flyers and magazine ads for history of the A-1 an interesting discovery was made. After no ads for the A-1 appeared in two sequential flyers, the next flyer (August 1948) introduced the A-2: an "*Improved Heathkit Push-Pull High-Fidelity Amplifier Kit*". Also in the flyer, in the *Tips and Comments* section, the following announcement appeared: "***Heathkit Amplifier Owners***—*If you wish the new improved amplifier circuit, we will be happy to send it. Please enclose stamped self-addressed envelope*". Since the date on the only A-1 schematic that can be found on the Internet is dated August, 13, 1948, this schematic is very likely the "*new improved amplifier circuit*" that Heathkit sent out. Another clue is that the schematic shows a 6SL7 high mu dual triode instead of the A-1's low mu 6SN7. All the A-1 ads only mention using a 6SN7. Also the 6SL7 has a better than three-fold higher amplification factor, and the A-2 ad also states "*…the gain has been tripled*".

If anyone has an older A-1 schematic, or original parts list please contact the author [3]. The schematic should show a 6SN7 tube in the circuit.

Heathkit A-1 Controls and Connections:

The A-1 has only two controls; both located on the front chassis panel. The controls (L to R) are **TONE** and **VOLUME**. Three connections are on the back chassis panel (L to R when facing the rear). They are a 1/4" phone jack for the input signal, an octal socket for speaker connections (see **Table II** for pinouts), and the AC line cord. There are no internal amplifier adjustments.

Surplus Parts:

Early on Heathkit was able to sell their kits at low prices because they purchased tons of WWII war surplus electronic. The transformers, chokes, tubes and bathtub and oil-filled capacitors used in the A-1 all came from surplus purchases as electronic components flooded the market after the war ended.

Figure 2: Introductory A-1 ad from November, 1947 Heathkit flyer showing prototype layout.

Speaker Output (Octal Socket)			
PIN 1:	COM	PIN 5:	unused
PIN 2:	3 Ω [3]	PIN 6:	unused
PIN 3:	8 Ω	PIN 7:	unused
PIN 4:	15 Ω	PIN 8:	unused

Table II

Heathkit A-1 Design:

Among the transformers purchased were a large quantity of RCA power transformers. Heath offered them individually for 98¢ each in an ad in the Nov. 1947 issue of *Radio News* **(Figure 5)**. Having a 100 volt primary probably limited sales, but Heath decided this transformer would work in a hi-fi audio amplifier, and proceeded to use it as the basis of the A-1. **Figure 4** shows the terminals for the power transformer. The 5 V winding supplies the rectifier tube filament, but the 6.3 V winding is too small to provide power to more than one tube; the 6SN7 heaters draw 0.6 A, already above the specified current. Heath searched for a useful output tube that has a 2.5 volt heater; because the 2.5 V winding is center-tapped, a tube with a filament, instead of separate heater and cathode, could be used. The surplus 1619 pentode was in large supply and fit well. Heath described the 1619 as a military type 6L6, though they had more differences than just filament voltage. The 100 volt transformer

Figure 3: A-1 ad from February 1948 flyer.

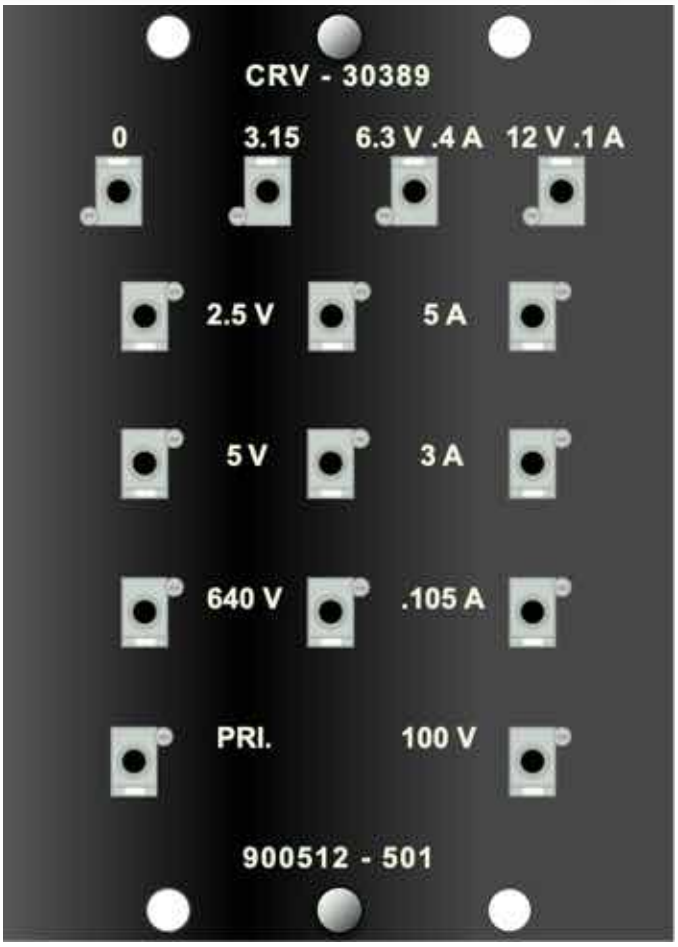

Figure 4: Detail of terminals on bottom of RCA power transformer. Drawn from photo by Keith Greenhalgh.

primary issue was resolved with a 25 Ω 25 watt series dropping resistor, adding some additional heat and power consumption.

Heath obtained a batch of surplus Thordarson output transformers that have a good match to a pair of 1619 tubes in push-pull. They have a tapped secondary for 3.2, 8 and 15 Ω speaker loads. Evidently the supply of this transformer was somewhat limited.

The circuit is rather basic; the first section of a dual triode 6SN7 is a simple class-A amplifier with a gain of less than 20. No specification for input signal level is given other than requiring a phonograph with a crystal pickup or a tuner (on the order of 1 Vrms as a guess). The second half of the 6SN7 is a

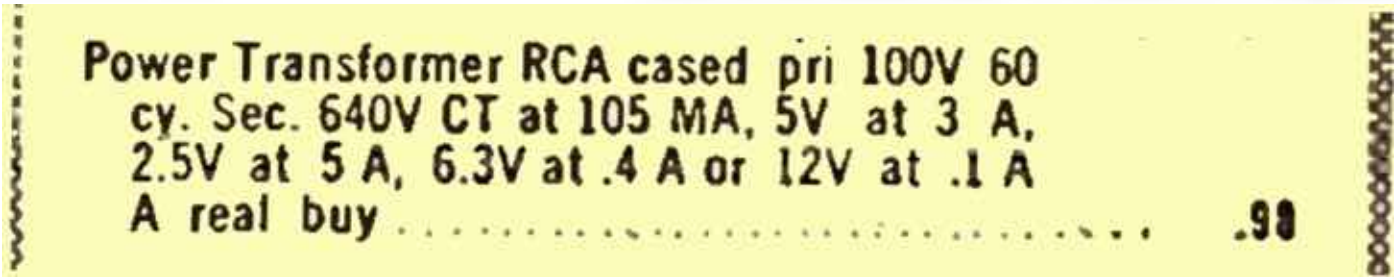

Figure 5: A Heath Ad from the November 1947 issue of *Radio News* listing the power transformer used in the A-1.

phase splitter. The signals are obtained from the voltage drop across equal resistors in the cathode and plate circuits. Ideally these signals are identical but 180° out of phase. The out-of-phase signals each drive one of the 1619 output tubes in class AB_1.

Sometime during the production run of the A-1 the supply of Thordarson output transformers ran out. Heath was able to find a substitute made by Chicago Transformers. The replacement transformer has only 3.2Ω and 8Ω speaker outputs; the 15 Ω output is missing. The change first showed up in the February 1948 flyer (Figure 3). The change is not mentioned in the ad, other than where the 15 Ω should have been specified there is a gap.

Evidently Heath got a good price on a large quantity of the replacement output transformers because the kit price stayed at $14.95 with the change, and that price continued through the production of the A-2 and A-3.

Heathkit A-1 Notes:

If you're curious about the extent of Heathkit's surplus purchases, you need only look at their January 1948 *Radio News* ad, shown in **Figure 6**. It mentions preparing a catalog listing for over 100,000 transformers and chokes that they had available for sale.

The RCA power transformer used in the A-1 continued to be used in the A-2 and A-3. In their January 1949 flyer, Heath commented that they were down to a 60 day supply, and when the transformers were gone the price will rise. The A-3 remained for sale through 1949 and much of 1950, so either Heathkit found some more, a way to cut prices or their estimating was off?

The dual 8 µfd 475 volt oil-filled capacitor (located just to the right of the RCA power transformer which occupies the left rear corner of the chassis), another high quality surplus item from WWII, continued to be used in the A-2 but was replaced in the A-3.

The Heathkit Schematic:

As of this writing no copy of the early A-1 schematic or parts list has surfaced. Attached as **Figure 8** is what is believed to be the schematic available to A-1 owners to update their amplifiers to the A-2 circuit. Heath did not put component values on their early schematics, instead they used the part number Heathkit assigned to the component. **Table III** correlates the schematic part numbers to the actual component values.

Old Heathkit Part Numbers:

Early on Heathkit used a convoluted part numbering scheme. The old part numbers consist of one or two letters followed by a two

Figure 6: Heathkit's Large surplus transformer buy!

or three digit number. The letter(s) represented the category of the first kit the part was used in, and the number, which started at 10^4, was just a sequential number. For instance O12 (a 100 KΩ ½ watt resistor) is the third component used in the O-series oscilloscopes, and A10 is the first component used in the A-series audio amplifiers. Note that A-10 is specified as 47 KΩ to 51 KΩ meaning Heath would supply whichever component it had on hand. Either component would work properly in the circuit. **Table IV** lists some of the letter prefixes and the kit group they belong to. Some prefixes cannot be traced back to a specific series; perhaps they are products that never left the drawing board?

This numbering system quickly got out of hand, and in the very early 50's Heathkit came up with a later part numbering system which is a number followed by a dash followed by another number. The first number designates the part category and the second number (occasionally followed by a letter or series of letters and numbers) designates the specific part in that category. An example is:

100 KΩ ½W: Old #: O-12 New #: 1-26

Later, Heathkit computerized their part numbering, resulting in some minor changes.

Conclusion:

There is a lot of history in the early kits. Heath was just starting a business that put them at the top of the electronic kit business which they dominated for around 45 years.

In the next article a basic oscilloscope kit will be discussed. A 1960s beginner's scope that was in production for ten years, and has a lot of history behind it. At least one member of the OCARC club has fond memories of it, as does a well-known author of Heathkit product books.

A-1 Schematic Parts List

A10	Resistor 47,000 - 51,000 Ω
A11	Resistor 270 KΩ
A12	Resistor 220 Ω 2 watt
A16	Choke 6H 80 ma
A17	Output Transformer
A18	Vacuum Tube 1619
A21	Shielded wire
A27	Resistor 25 Ω 25 watt
A28	Capacitor 0.5 µf 250V
G42	Vacuum Tube 6SL7
K10	Resistor 2700 Ω
K14	Capacitor Electrolytic 25 µf 25V
K17	Phone Jack 1/4"
O11	Resistor 10 KΩ
O12	Resistor 100 KΩ
O17	Resistor 1 MΩ
O24	Capacitor 0.01 µf 1000V
O58	Potentiometer 100 KΩ
O62	Capacitor 0.25 µf bathtub
O66	Vacuum Tube 5Y3
O78	Line Cord
T13	Capacitor 0.01 Paper
T15	Capacitor Electrolytic Dual 8 µf 475V
T16	Potentiometer 1 MΩ

(Refer to Figure 8)

Table III

Heath's Old Part Number Prefix List (Partial List)

A	A-series Amplifiers
BE	BE-series Battery Eliminators
C	C series Condenser Checkers
FM	FM-series Tuners
G	G-series Signal Generators
IB	IB-sereis Impedances Bridges
K	K-series All-Wave Receivers
O	O-series Oscilloscopes
S	S-series Electronic Scope Switches
SG	SG-series RF Signal Generators
T	T-series Signal tracers
TC	TC-series Tube Testers
TS	TS series TV Alignment Generators
V	V-series VTVMs

Table IV

Figure 7: ⬇ Before and ⬆ After Restoration [5]

Acknowledgements:

I have to thank Keith Greenhalgh for making this article possible. He actually owns an A-1, and it is the only one out in the wild known to Chuck Penson - WA7ZZE and me; others must exist [6]. Keith got this amplifier in a used, incomplete and decrepit condition, lacking documentation and even a schematic. **Figure 1** shows the restored amplifier after Keith performed his magic. Keith sent me many detailed photos of the amplifier before, during and after restoration.

Chuck also helped make this article possible. My research started with his recent book "*Heathkit Hi-Fi and Stereo Products*" [7] which offered some important information on the A-1. The photo in the book led me back to Keith Greenhalgh. Chuck provided a schematic marked A-1. Though it turns out likely to be a late schematic Heath offered to allow A-1 owner to update to the A-2, it is still the best schematic yet found.

73, from AF6C

Notes:

1. Heath Co.'s first electronic kit, the O-1 Oscilloscope.
2. Actually spec'ed at 3.2 Ω.
3. af6c@w6ze.org
4. Some documentation part numbers used numbers between 1 and 9.
5. Photos and restoration by Keith Greenhalgh.
6. A photo of a different A-1 was recently removed from Flickr. Its source and owner is unknown.
7. ***Heathkit Hi-Fi and Stereo Products*** 2018 by Chuck Penson WA7ZZE - ISBN 978-0-692-09843-1. Available from Amazon.

Remember, if you are getting rid of any old Heathkit Manuals or Catalogs, please pass them along to me for my research.

Thanks - AF6C

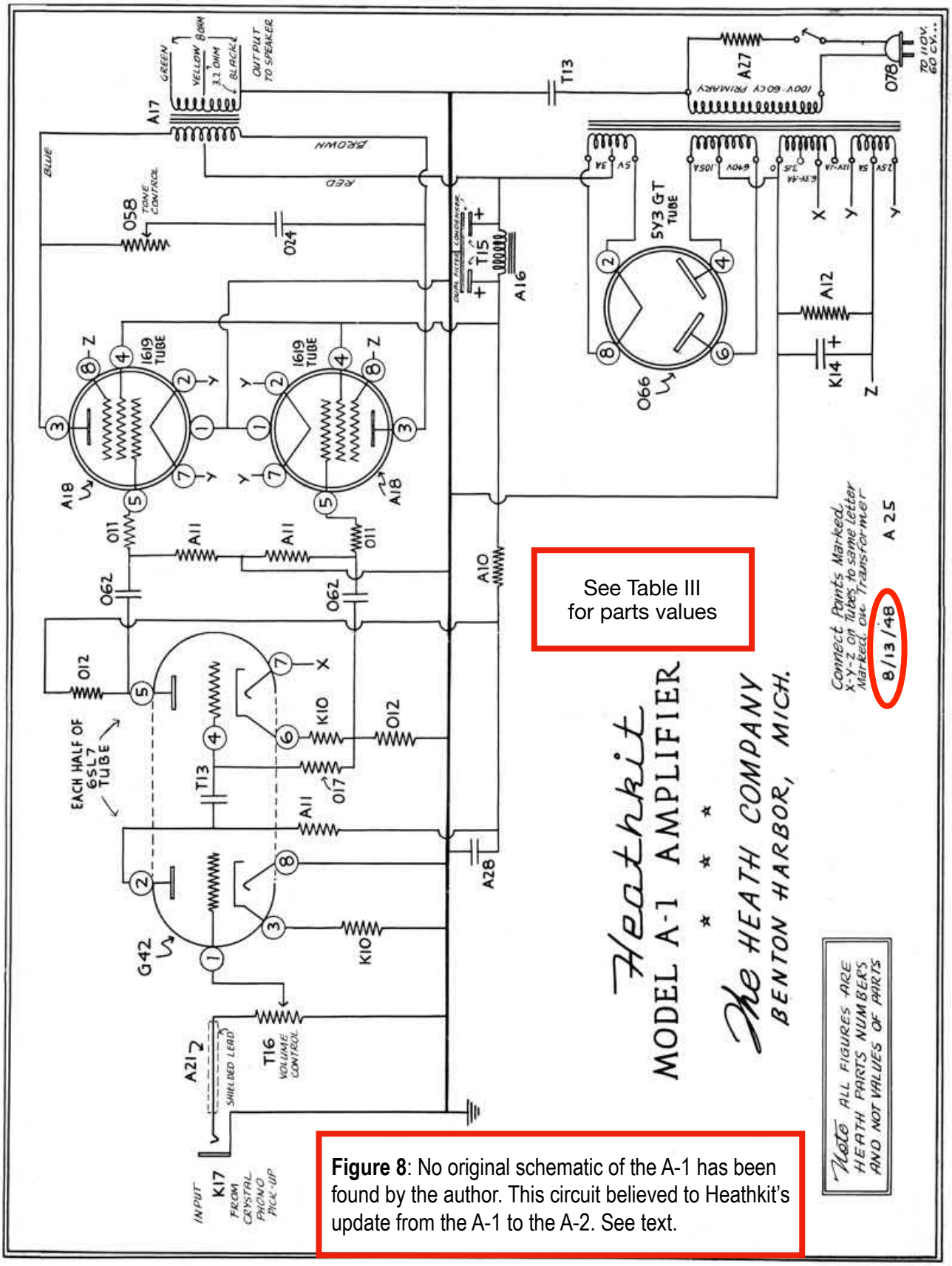

Figure 8: No original schematic of the A-1 has been found by the author. This circuit believed to Heathkit's update from the A-1 to the A-2. See text.