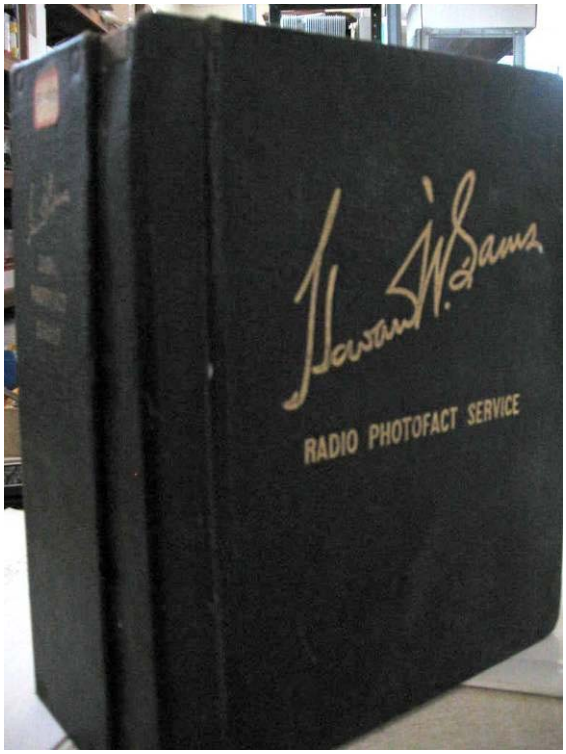
Howard W Sams Radio Photofact Service, Vol 4, # 31 - 41
EN-Genius Reviewer: Dennis L Feucht

by Howard W Sams & Co, Inc, 2924 East Washington Street, Indianapolis 6, Indiana; "B" fast-action binder hardbook; pages: 4.2 inches of them; 1948; priceless

And now for something a little different in electronics book reviews! From half century ago comes a *book* -- or, more like a manual -- one of a large set that became an electronics institution for decades: the Sams Photofacts. The publication is shown here.



In the days when radio-TV repair shops were commonplace, electronics repairmen would rely upon the open disclosure of the electronics of consumer devices -- mainly radios, TVs, and phonographs -- from the Howard W Sams company. They published packets of technical information on essentially every consumer electronics radio or television made in America, and for a few dollars, a repair shop could buy a subscription or individual folders to add to a growing collection. The Sams company still exists in Indianapolis as Sams Technical Publishing, at website: http://www.samswebsite.com/about.htm

There they give some company history:
Founder Howard W Sams saw a market gap that no one was filling -- the need for service technicians to have schematics and other service guidelines for the radios they were repairing. Thus began the long and illustrious history of PHOTOFACT.

The Photofacts were superb in their organization and presentation of product information. Not only were the circuit diagrams complete and carefully drawn, later Photofacts included waveforms at various nodes, illustrated from oscilloscope photographs. Parts were listed and described. This particular collection of Photofacts, from January through April of 1948, immediately preceded the introduction of television photofacts, as announced in folder # 40, the first page of which is shown below. This announcement reveals the manner of thinking within the Sams company and offers a refreshing openness and informality lost today amidst efforts to legal protect the company from foolish users while at the same time inundate them with inane safety precautions. In 1948, the electronics industry was far more relaxed, as individuals were expected to take responsibility for their own affairs. At this earlier time, the seeds of a later ominous development were being sown in that for some manufacturers "servicing is being handled exclusively by contract service organizations that are closely tied to the parent factory." For Sams, the "primary concern has always been for the independent service shop". At first, most manufacturers controlled after-sales product servicing, though unlike today, independent service shops were plentiful.

IMPORTANT ANNOUNCEMENT

THE FIRST PHOTOFACT FOLDER ON A TELEVISION RECEIVER

WILL APPEAR SOON IN PHOTOFACT

The TELEVISION RECEIVER will be a popular table model produced by a nationally known manufacturer.

There's an interesting story about this receiver and the PHOTOFACT Folder that covers it.

On September 25, 1947, the manufacturer of this Television Receiver asked us to prepare his complete service data. We are preparing service manuals for many manufacturers on their conventional receivers, an activity that is separate and distinct from the production of Standard PHOTOFACT Folders. It was our feeling that we could do a good job on Television. We knew that the Television Receiver couldn't be processed by the regular PHOTOFACT techniques applied to conventional sets. We realized that we would have to process TELEVISION differently. We knew we had to get our feet wet—so we said: "Sure—ship us the TV receiver and we'll tackle it." It was a mutual problem and our combined efforts solved it.

On February 26, 1948, we delivered the finished package—38 pages of text material, 9 photographs, and 8 line drawings, including the schematic. While we had the help of the manufacturer's engineers, EVERY WORD OF DATA AND EVERY ILLUSTRATION COVERING THIS TV RECEIVER ORIGINATED IN OUR LABORATORIES.

Although our engineers have been active in Television since its earliest commercial beginning, actually we cut our eye-teeth on producing Television PHOTOFACTS on this model. For five months, we studied hundreds of new problems involved in preparing complete and accurate servicing data on a Television receiver. We worked out dozens of new and original processing methods. We established exclusive PHOTOFACT techniques of analysis suited to Television Receivers, and especially for Service Technicians' use. This was the test set, the guinea-pig that established the PHOTOFACT standards by which we are now processing all Television receivers.

We have set up an entirely new processing line for Television sets, staffed by a highly trained specialized group of analytical engineers. We have in our laboratories at present practically every Television receiver that has appeared on the market. We are in the process of examining and testing them all. We have compiled much data on each—in fact, SUCH A STUDY AND ANALYSIS IS NOW A CONTINUING PHOTOFACT ACTIVITY.

Standard PHOTOFACT Folders have brought you advantages never before possible—advantages of completeness—accuracy—uniformity—useability—economy—PLUS exclusive features with which all of you are familiar—advantages that have made your work easier, saved your time and enabled you to make more money. NOW—PHOTOFACT Folders ON TELEVISION RECEIVERS WILL BRING YOU THE SAME ADVANTAGES.

Our first Television PHOTOFACT Folder will help you to compare for yourself the present conventional servicing data on Television with the PHOTOFACT Television method. That comparison will show you *facts* that are very important to your future in Television.

Present servicing data on TV receivers is in the form of the manufacturers' own service data preparation. Each such presentation requires in the neighborhood of fifty or more pages per receiver. Look at those pages. You'll make these discoveries:

1. Each manufacturer must do a "selling job" on *his own* receivers (this is understandable). A good many of the 50 or more pages are spent on installation instructions. These pages have nothing to do with the actual servicing of the set.
2. The manufacturer's data is specialized to stress that the set covered is *different* from all other TV models. This means pages of details that have nothing to do with the actual servicing of the set.
3. Many of these 50 or more page presentations cover receivers on which there has been only limited production and sales limited to a few markets. Naturally, we intend to use a good bit of judgment on the sets we cover in PHOTOFACT Folders. In some instances, production has been relatively limited. In some other instances, servicing is being handled exclusively by contract service organizations that are closely tied to the parent factory. Our primary concern has always been for the independent service shop, and accordingly our coverage will be limited to those sets likely to come into such shops. To ask you to pay for information on other receivers would indeed be unfair.
4. Many of the TV receivers will have their servicing closely controlled by the manufacturer's own service organization for some time to come. You'll probably have little occasion to service many of these models at the present time.
5. Each manufacturer must write his instruction book as if his television set were the only one of its kind in existence; and if this were actually so, we would never have the temerity to suggest that his method of presentation could be improved. The fact remains that like radio receivers, television receivers of different makes and models have some similarity in their circuits. When service data is prepared to a uniform standard for all makes and models, a number of most important benefits will be derived. A uniform presentation allows the skill and know-how you acquire on one model to be carried over to the next. It means that data common to all makes of sets can be reduced or condensed to its proper proportions; and adequate emphasis placed on the true differences—the unusual features—the deviations from standard. The use of the PHOTOFACT system does much to remove restrictions of experience that make you feel more competent to repair one make TV receiver than another. In other words, you don't have to spend hours studying service manuals to discover features which are a variation of conventional practice uniquely presented.

Now, let's stack these facts against PHOTOFACT Television Folders. We process each TV set independently and objectively to best serve your need.

The data you get in PHOTOFACT is ALL USEFUL. EVERY WORD, EVERY PICTURE, HELPS YOU. In half or less than half the number of pages, we give you more useful, more complete, more understandable data. Our presentations are UNIFORM—text and diagrams alike. We treat each TV set the same so you don't have to hunt for the information you need. You'll see the relationship and resemblance between various TV sets. We take the mystery out of the servicing problems because we treat the set as a TV set and not as the special product of any one manufacturer. We get out our Television Folders on sets that have been widely sold and distributed—so that each Folder is actually USEFUL TO YOU WHEN WE MAKE IT AVAILABLE.

From every angle—presentation—completeness—uniformity—AND COST—you'll be ahead of the game by standardizing on and using PHOTOFACT. You get more for your money because we are an independent service organization of service technicians doing an unbiased, original job for the RADIO SERVICE TECHNICIAN AND FOR HIM ALONE.

OUR POLICY IS TO GIVE YOU WHAT YOU NEED AND WANT. With Television PHOTOFACTS servicing will be easier, quicker; and repairing will be more profitable because of the saving in time. This is the fundamental philosophy that is behind every PHOTOFACT activity.

PHOTOFACT Television Folders will help you as no other TV service data can. You will have the first one soon—in PHOTOFACT.

Photofact subscriptions began with a newsletter and sometimes tutorial material. TV circuitry was new to most repair technicians in the late 1940s, and textbook-style coverage of basic circuit principles added to the value of the Photofact service. In Vol 40 announcing television, some circuit theory is offered (see below).

CHAPTER 2

CATHODE-RAY - - BEAM DEFLECTION SYSTEMS

RC CIRCUITS

The elements in a cathode-ray or picture tube provide an emitter or source of electrons, a means of forming an electron beam and accelerating its speed, and a phosphor surfaced screen which will flouresce or glow when bombarded by the stream of electrons. They also provide for the movement of the beam horizontally and vertically to form a frame of light, or raster, on the face of the picture tube.

The voltage or current waveforms which are required for deflecting the electron beam are obtained from sweep generators which are followed by special wave-shaping circuits. The sweep generators are triggered by the synchronizing pulses which are clipped from the transmitted signal. This makes possible the synchronization of the sweep circuits in the receiver with those of the transmitter. The formation of certain waveshapes is required in order to obtain a linear sweep. This waveshape may be a sawtooth, as is required for electrostatic deflection, or a more complex voltage waveform used to obtain a sawtooth current flow in magnetic deflection coils. Some circuits are designed to pass a waveform with a minimum of distortion, while others are designed to effect great distortion when generating, amplifying, or passing a waveform. The behavior of these distortion circuits can best be understood by studying a charging or discharging capacitor in series with a resistor.

It is elemental in radio theory that when electrons flow through a resistor, a voltage or IR drop is developed across that resistor.

The value of voltage developed by a current flowing through a resistance is found by applying Ohm's law:

$$E = I \times R$$

where E is in volts, I in amperes, and R in ohms.

A further study of fundamentals reveals that a capacitor is capable of storing or holding a charge of electrons. When charged, one plate contains more free electrons than the opposite plate; when the capacitor is completely discharged, both plates contain the same number of free electrons. The difference in number of electrons is a measure of the charge that exists across the capacitor. When the accumulation of electrons on one plate exceeds the accumulation on the other plate, a potential difference exists across the terminals of the capacitor, and this potential will continue to increase until it equals, for practical purposes, the applied or charging voltage. The value of voltage developed by a charging capacitor is computed by applying the following equation:

$$E = \frac{Q}{C}$$

where Q is in coulombs, C in farads, and E in volts. One coulomb is the quantity of electrical charge transferred if one ampere flows for one second.

R-C CIRCUIT CHARGING: A capacitance and a resistance employed in a voltage divider circuit, as shown in Figure 43, develop a pressure or potential across their respective terminals. This circuit is commonly known as an R-C circuit, to which both Kirchoff's and Ohm's laws apply. Referring to the graphs and diagram in Figure 43, the voltage divider AB of the circuit diagram is shown in various time positions on the graph after closing the switch. As time progresses, the voltage Ec on the capacitor gradually increases, while the voltage developed across the resistor Er gradually decreases.

When the switch is closed, electrons are displaced from the upper plate of the capacitor, thus developing a positive charge causing electrons to be attracted to the lower plate through

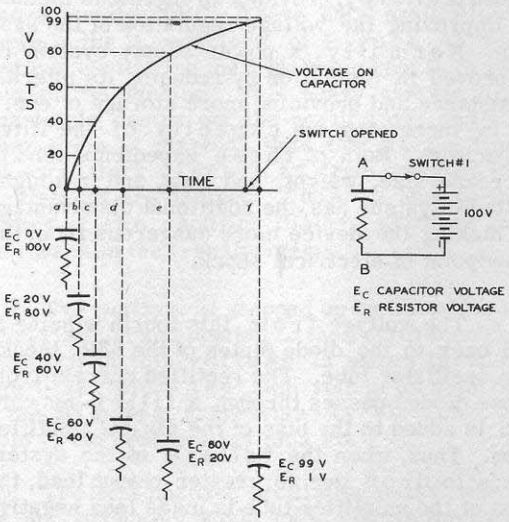
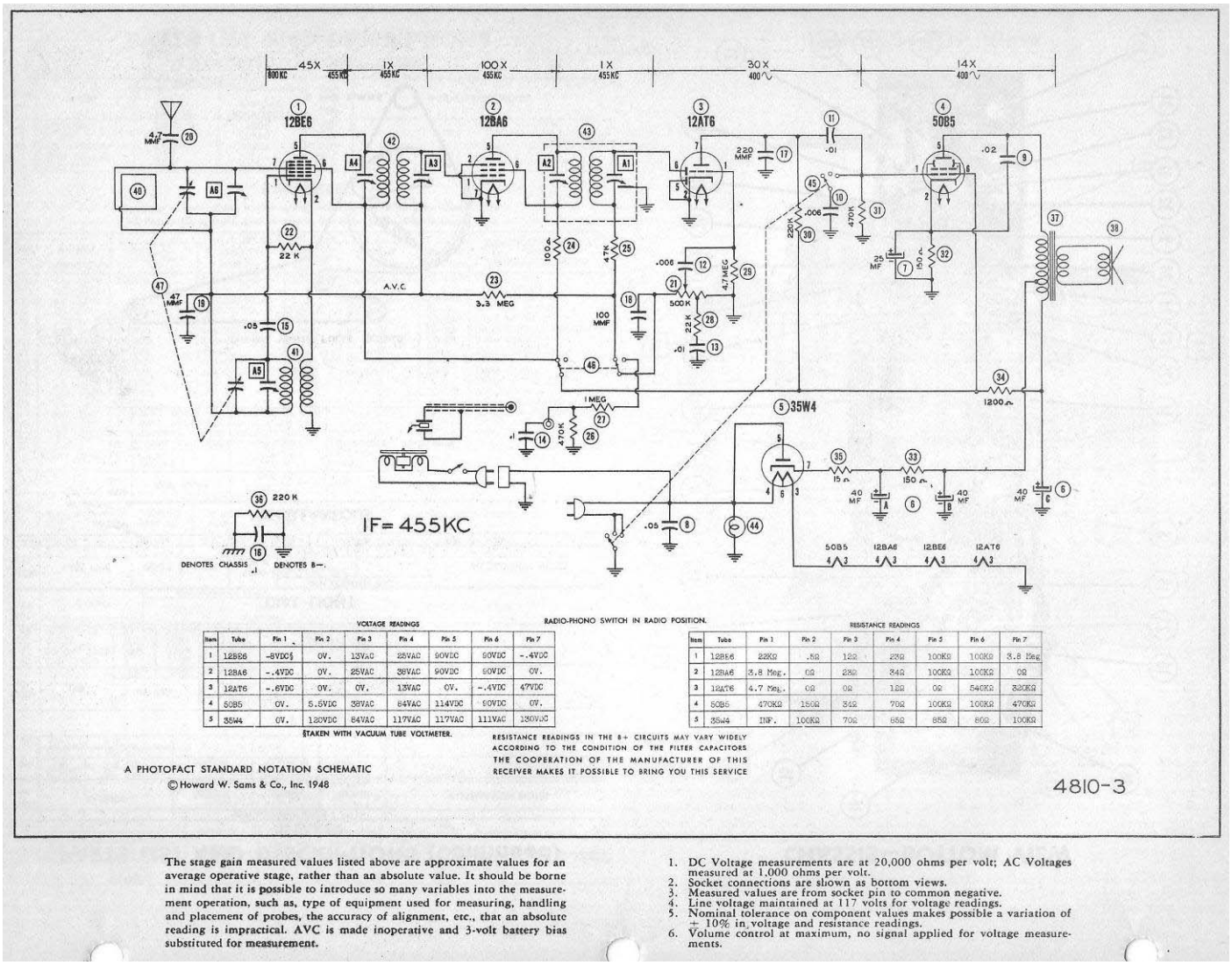


Fig. 43. Resistor-Capacitor Charging Curve

Reminiscent of some earlier Tektronix Circuits Concepts books in style and depth of explanation, the Sams Chapter 2 on CRT beam deflection systems begins with RC circuits because they are the starting point for explaining sweep generator circuits and their sawtooth waveforms to technicians. The series RC network is described in some detail, for it has the making of a crude ramp generator if the time constant is kept much longer than the sweep time. Circuit descriptions were illustrated, as shown, and causal: “When the switch is closed, electrons are displaced from the upper plate of the capacitor …”

The electronics technology of the time was based on thermionic valves (vacuum tubes), as the following circuit diagram makes clear. This 5-tube AM superhet radio was a forerunner of the *All-American Five*, a refined, minimalist tube radio design that persisted until the end of the vacuum tube era. It was not until the 1950s that the 7-pin *miniature* tubes replaced the octal tubes used in this receiver, a Bendix Model 613 phonograph-radio combination.



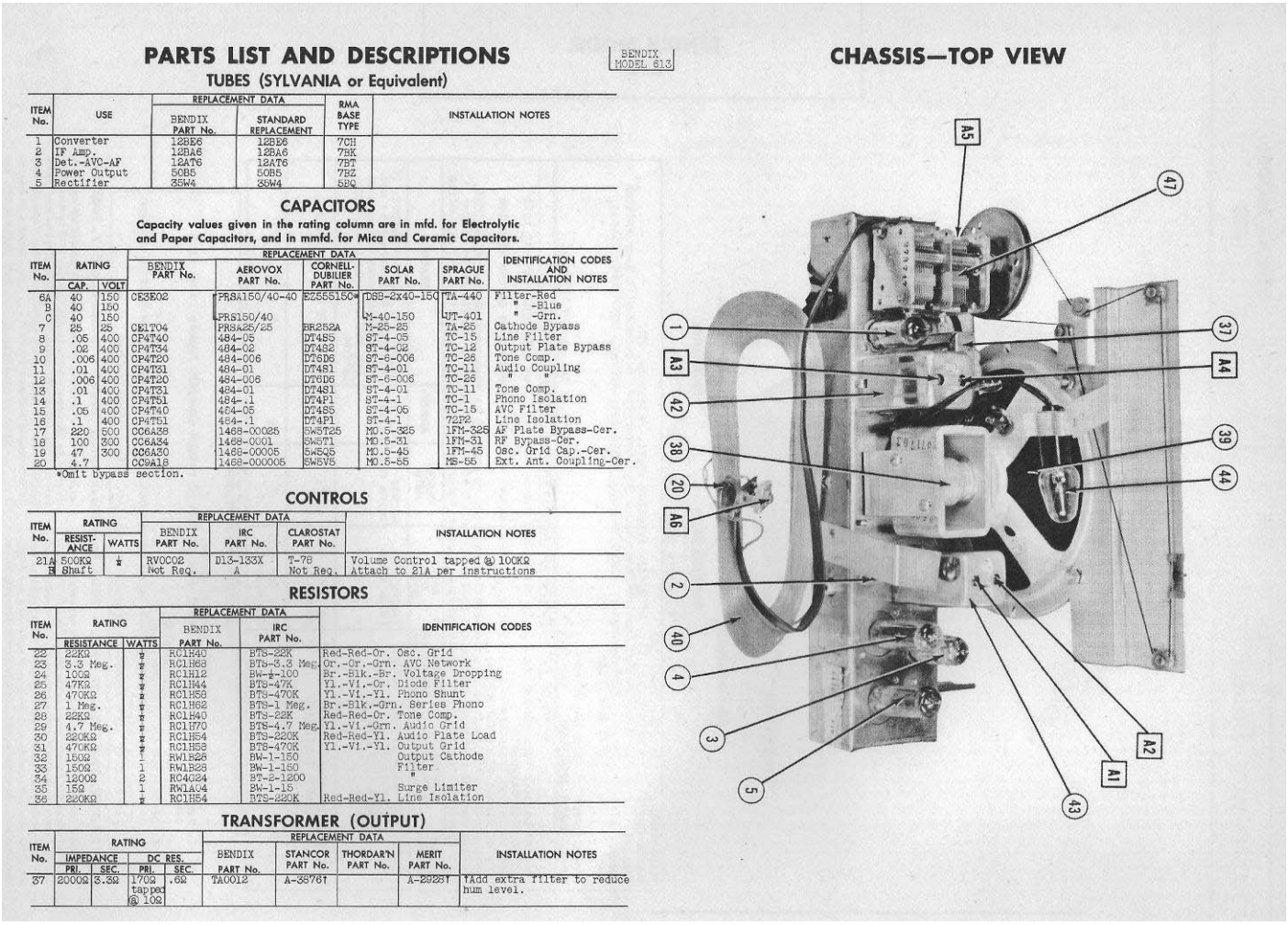
Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7
1	12BE6	-8VDC§	0V.	13VAC	25VAC	90VDC	90VDC	-.4VDC
2	12BA6	-.4VDC	0V.	25VAC	36VAC	90VDC	90VDC	0V.
3	12AT6	-.6VDC	0V.	0V.	13VAC	0V.	-.4VDC	47VDC
4	50B5	0V.	5.5VDC	36VAC	84VAC	114VDC	90VDC	0V.
5	35W4	0V.	130VDC	64VAC	117VAC	117VAC	111VAC	130VDC

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7
1	12BE6	22KΩ	.5Ω	12Ω	23Ω	100KΩ	100KΩ	3.8 Meg.
2	12BA6	3.8 Meg.	0Ω	28Ω	34Ω	100KΩ	100KΩ	0Ω
3	12AT6	4.7 Meg.	0Ω	0Ω	12Ω	0Ω	540KΩ	330KΩ
4	50B5	470KΩ	150Ω	34Ω	70Ω	100KΩ	100KΩ	47KΩ
5	35W4	INF.	100KΩ	70Ω	65Ω	85Ω	80Ω	100KΩ

The stage gain measured values listed above are approximate values for an average operative stage, rather than an absolute value. It should be borne in mind that it is possible to introduce so many variables into the measurement operation, such as, type of equipment used for measuring, handling and placement of probes, the accuracy of alignment, etc., that an absolute reading is impractical. AVC is made inoperative and 3-volt battery bias substituted for measurement.

1. DC Voltage measurements are at 20,000 ohms per volt; AC Voltages measured at 1,000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 10% in voltage and resistance readings.
6. Volume control at maximum, no signal applied for voltage measurements.

The circuit diagram was always accompanied by a parts list with a photo of the hardware and arrows pointing to the components itemized in the list. The first page of the Bendix 613 parts list is shown overleaf.



PARTS LIST AND DESCRIPTIONS

BENDIX MODEL 613

TUBES (SYLVANIA or Equivalent)

ITEM No.	USE	REPLACEMENT DATA: BENDIX PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RMA BASE TYPE	INSTALLATION NOTES
1	Converter	12BE6	12BE6	7CH	
2	IF Amp.	12BA6	12BA6	7BK	
3	Det.-AVC-AF	12AT6	12AT6	7BT	
4	Power Output	50B5	50B5	7BZ	
5	Rectifier	35W4	35W4	5BQ	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	BENDIX PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	SOLAR PART No.	SPRAGUE PART No.	IDENTIFICATION CODES AND INSTALLATION NOTES
6A	40	150	CE2E02	PRSA150/40-40	E2555150*	DSS-2x40-150	TA-440	Filter-Red
B	40	150						" -Blue
C	40	150		PRS150/40		M-40-150	UT-401	" -Grn.
7	25	25	CELT04	PRSA25/25	BR252A	M-25-25	TA-25	Cathode Bypass
8	.05	400	CP4T40	484-05	DT4S5	ST-4-05	TC-15	Line Filter
9	.02	400	CP4T34	484-02	DT4S2	ST-4-02	TC-12	Output Plate Bypass
10	.006	400	CP4T20	484-006	DT6D6	ST-6-006	TC-26	Tone Comp.
11	.01	400	CP4T31	484-01	DT4S1	ST-4-01	TC-11	Audio Coupling
12	.006	400	CP4T20	484-006	DT6D6	ST-6-006	TC-26	" "
13	.01	400	CP4T51	484-01	DT4S1	ST-4-01	TC-11	Tone Comp.
14	.1	400	CP4T51	484-.1	DT4P1	ST-4-1	TC-1	Phono Isolation
15	.05	400	CP4T40	484-05	DT4S5	ST-4-05	TC-15	AVC Filter
16	.1	400	CP4T51	484-.1	DT4P1	ST-4-1	72P2	Line Isolation
17	220	500	CC6A38	1468-00025	SM5T25	MO.5-325	1FM-325	AF Plate Bypass-Cer.
18	100	300	CC6A34	1468-0001	SM5T1	MO.5-31	1FM-31	RF Bypass-Cer.
19	47	300	CC6A30	1468-00005	SM5Q5	MO.5-45	1FM-45	Osc. Grid Cap.-Cer.
20	4.7		CC9A18	1468-000005	SM5V5	MO.5-55	MS-55	Ext. Ant. Coupling-Cer.

*Omit bypass section.

CONTROLS

ITEM No.	RATING: RESISTANCE	RATING: WATTS	BENDIX PART No.	IRC PART No.	CLAROSTAT PART No.	INSTALLATION NOTES
21A	500KΩ	½	RV0C02	D13-133X	T-78	Volume Control tapped @ 100KΩ
B	Shaft		Not Req.	A	Not Req.	Attach to 21A per instructions

RESISTORS

ITEM No.	RATING: RESISTANCE	RATING: WATTS	BENDIX PART No.	IRC PART No.	IDENTIFICATION CODES
22	22KΩ	½	RC1H40	BTS-22K	Red-Red-Or. Osc. Grid
23	3.3 Meg.	½	RC1H68	BTS-3.3 Meg.	Or.-Or.-Grn. AVC Network
24	100Ω	½	RC1H12	BW-½-100	Br.-Blk.-Br. Voltage Dropping
25	47KΩ	½	RC1H44	BTS-47K	Yl.-Vi.-Or. Diode Filter
26	470KΩ	½	RC1H58	BTS-470K	Yl.-Vi.-Yl. Phono Shunt
27	1 Meg.	½	RC1H62	BTS-1 Meg.	Br.-Blk.-Grn. Series Phono
28	22KΩ	½	RC1H40	BTS-22K	Red-Red-Or. Tone Comp.
29	4.7 Meg.	½	RC1H70	BTS-4.7 Meg.	Yl.-Vi.-Grn. Audio Grid
30	220KΩ	½	RC1H54	BTS-220K	Red-Red-Yl. Audio Plate Load
31	470KΩ	½	RC1H58	BTS-470K	Yl.-Vi.-Yl. Output Grid
32	150Ω	1	RW1B28	BW-1-150	Output Cathode
33	150Ω	1	RW1B28	BW-1-150	Filter
34	1200Ω	2	RC4G24	BT-2-1200	"
35	15Ω	1	RW1A04	BW-1-15	Surge Limiter
36	220KΩ	½	RC1H54	BTS-220K	Red-Red-Yl. Line Isolation

TRANSFORMER (OUTPUT)

ITEM No.	RATING: IMPEDANCE PRI.	RATING: IMPEDANCE SEC.	RATING: DC RES. PRI.	RATING: DC RES. SEC.	BENDIX PART No.	STANCOR PART No.	THORDAR'N PART No.	MERIT PART No.	INSTALLATION NOTES
37	2000Ω	3.2Ω	170Ω tapped @ 10Ω	.6Ω	TA0012	A-3878T		A-2923T	Add extra filter to reduce hum level.

CHASSIS—TOP VIEW

Consumer electronics repair has changed somewhat over a half century. Most consumer electronics is manufactured, and much of it also designed, in countries foreign to the USA. Some manufacturers of consumer products continue the policy of attempting to control the after-sale product, with maintenance policies that discourage *total product ownership* by the buyer. They offer no technical product information to anyone but their authorized service centers. The buyer becomes a captive market for after-sale repair services of *the factory* or authorized repair facilities which often charge enormous prices for board swaps when component-level repair was what the customer desired. The failed component might have cost a dollar or two and have taken a competent technician a half hour to locate. The board might run into the hundreds of dollars. It is consequently hard to imagine the former era of widespread cooperation of radio and TV manufacturers with Howard W Sams, as reflected in the following notice which appears on every circuit diagram I viewed in the manual:

> THE COOPERATION OF THE MANUFACTURER OF THIS RECEIVER MAKES IT POSSIBLE TO BRING YOU THIS SERVICE

The entire consumer electronics industry in the past was essentially open source. (So were electronics instrument suppliers such as Tektronix, H-P, Fluke, and Wavetek.) This openness has diminished, as companies washed out and in the first-to-market product development spin cycle have become protective of their marginally-better designs and expect customers to continue to buy their products at an increasing rate while dispensing the previous failed iteration to the garbage dump. (*Repeat sales* takes on a new meaning.) Recourse to the Howard W Sams manuals, though somewhat of an escape into the past from this madness, is

also a refreshing reminder of what the electronics industry should again be. In this case, history hopefully will repeat itself.