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VOLUME 14 NUMBER 1



Curtain Time

The Itinerant TV Service Technician

It has been common practice to do light TV servicing – mainly tube changing – in the home. Judging by the comments of some large service facilities of all sorts, customers' home service will be expanded in the future to where virtually all troubles will be remedied in the home. Only in extreme cases will chassis be pulled.

This approach to TV servicing will, more than likely, result in other changes too. It is going to mean a greater investment in test equipment – portable equipment which can be taken into the home. This means that test equipment manufacturers will have to design equipment specifically for this purpose.

It is going to give the small independent operator the opportunity to survive. It has been the general opinion that TV servicing set a limit on the minimum number of personnel required by a service facility because of the to-and-fro movement of a TV receiver. Doing most of the service in the home enables a TV service facility to operate with whatever number of technicians the facility wishes to place in the field – as few as one man.

Another practice associated with this kind of service is the use

of the rolling parts stock, that is, the replacement parts stock will be in the truck which is driven to the job. This is being done to a limited extent today and is proving successful. In fact, the roving service truck idea was talked about years ago - at the advent of television, but it did not gather too much momentum, except as applied to receiver and antenna installations. Now it looks like it will become an everyday occurrence.

The idea will be accepted by the public. Even though the average housewife is not too happy at the prospect of having one of her rooms cluttered with servicing equipment, it still is the lesser of the two evils relative to all the possibilities of what can occur when the chassis is removed from the home. In the mind of the public anything can happen after a chassis is pulled – even to having to pay a ransom to get it back. Having it serviced in the home will reduce the period during which the receiver is inactive. It will cut the travel time cost, to say the least.

Once the practice blooms, it will be necessary for all service facilities to follow suit. This is becoming evident today in the form of the responses received by those shops that advertise service in the home. They outpull the ads which do not make the same offer.

Doing extensive TV servicing in the home will place a greater than ever premium on technically qualified men. In fact, successful operation cannot be carried on in any other way. Properly handled, it should minimize repeat calls because it is possible to demonstrate the performance of the receiver before the technician leaves; also it means freedom from the complications of operating a receiver in one location and servicing it in another, where completely different receiving conditions prevail.

All in all, major service in the customer's home offers interesting possibilities. Let's see what happens.

The OPS Price Order for TV Service

The price order covering TV service has yet to be issued by the OPS. According to reports it will be done, providing the regulatory body will remain after the new administration becomes active. We have not changed our ideas as expressed in the November, 1952 issue of SUCCESSFUL SERVICING. We feel that the problem of diagnosis of TV receiver troubles, the "bugs" which frequently develop in TV receivers – in general the behavior of electronic equipment makes it necessary to treat the repair of these devices differently than ordinary electrical and mechanical equipment.

It is reported that the contents of the proposed regulation has the approval of TV service facilities. We hope that diagnosis time was given its full due apart from the time required for the repair.

John F. Rider



Here Is the Tested and Proven **RADIART UHF-TV ANTENNA** that Gives Continued

Peak Performance



1

6

Here's a speedy conversion unit for present TV antennas that brings in UHF signals. Easy to install fits most present TV antennas. No need to experiment or take chances! RADIART offers you an ULTRA HIGH FREQUENCY TV antenna that is TRIED... TESTED AND PROVEN! The new U-4 is a COMPLETELY NEW antenna developed after months of research and testing! It is a stable operating, broad band antenna of uniform gain covering the entire UHF spectrum, with a very low standing wave ratio. COMPLETELY FACTORY PRE-ASSEMBLED for speeding installation!

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- 🖈 Uniform Gain . . . Low Standing Wave Ratio
- 🕷 300 Ohm Terminal Impedance
- May Be Stacked . . , Measures 12 x 12 x 5 inches

THE RADIART CORPORATION CLEVELAND 13, OHIO VIBRATORS . AUTO AERIALS . TV ANTENNAS . ROTORS . POWER SUPPLIES

Replacement Parts in TV Receivers

Part I - Capacitors' (cont'd)

This is the third in a series of articles on "Replacement Parts in TV Receivers." "Capacitors" will be continued next month.

DIFFERENCE BETWEEN CAPACITORS

The various names which appear in the capacitor family tree designate both physical and electrical differences in the components and in the behavior and suitability of the component for different classes of service. As to the physical differences in dimensions, these require no special comments other than to say that, in the final analysis, the suitability of a capacitor on this basis, is determined by its location in the receiver.

Mica Capacitors. The differences between foil mica and silver mica capacitors are manifold. The foil type, or ordinary "molded" mica is made up of alternate slabs of active surface (usually metal foil) and mica dielectric. The assembly is compressed under high pressure and housed in a molded case, usually of brown bakelite, although yellow bakelite also is used for this purpose. The uniformity of closeness of the foil to the dielectric slab determines in a great measure the electrical behavior of the device. This behavior is a function of the materials used, the pressure applied when the unit is encased, and the expansion or contraction of the casing under the influence of varying temperature. This in turn gives rise to changed spacing between the active surfaces and the dielectric, and a change in capacitance.

The variation in capacitance under varying temperature conditions is minimized by the use of yellow bakelite, but since the foil type represents a category of component, certain conditions of behavior are acceptable. Thus the usual brown bakelite mica capacitor is acknowledged to possess certain operating characteristics and is used on that basis.

The tendency toward change in capacitance with variation of temperature has given rise to a sub-classification. This is the deliberately engineered temperature coefficient mica capacitor, wherein the capacitance changes by a prescribed amount per degree C. change in operating temperature. This type was popular years ago for correcting circuit behavior with changing temperature, but, as is discussed in detail later, it has been supplanted by the ceramic dielectric unit.

The silver mica variety, whether of the "postage stamp" or "button" shape, uses a deposit of silver on the two sides of the mica dielectric. This produces a firm bond

by John F. Rider

between active surface and dielectric. Moreover, the assembly is housed in either red or yellow bakelite; that is, in material which maintains its dimensional stability with changing temperature. The result is a capacitor which is very efficient. electrically; is much more stable in capacitance than the ordinary mica; can be produced to a much greater degree of accuracy relative to capacitance rating; in general is much more suitable for use in all critical circuits under varying conditions of frequency (including UHF), temperature and humidity. It too is available in a variety of temperature coefficient characteristics, although in the main it is a positive temperature coefficient capacitor.

Manufacturing know-how enables producers of mica capacitors to deliver an end

<u></u>
New RIDER TEK-FILE Packs
with
Replacement Parts Listings
available this month!
Pack 62. Gamble-Skogmo, G.E.
Pack 63. G.E., Hallicrafters
Pack 64. Hallicrafters, Hoffman
Pack 65. Hoffman, Jackson, Magnavox
Pack 66. Majestic, Meck, Montgomery Ward
Pack 67. Motorola, Muntz, National, Olympic
Pack 68. RCA, Philco
Pack 69. Sylvania, Tech-Master, Trav-Ler, Vidèo Productş
The following Packs will not be released
until February, 1953, but are included in
this month's index for your convenience
and for future reference:
Pack 70. Motorola
Pack 71. Packard-Bell, Philco
Pack 72. RCA
Pack 73. Western Auto, Westinghouse
Pack 74. Radio Craftsmen, RCA, Sears Roebuck
Pack 75. Sentinel, Sparton, Spiegel, Starrett, Stewart-Warner
Pack 76. Stromberg-Carlson, Sylvania
Pack 77. Westinghouse, Zenith
For the individual models included in
these Packs, refer to the TEK-FILE INDEX
in this issue.

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product which displays prescribed characteristics relative to an increase or decrease in capacitance within prescribed limits for unit changes in operating temperature. This establishes the "class" or "characteristic" of the capacitor. Since the set designer weds the characteristic of the capacitor to the circuit requirements, it is a relatively important consideration in the matter of replacement. In essence, the characteristic is a designation of the temperature coefficient of the capacitor. More about this later.

The comparative superiority of the silver mica capacitor over the ordinary foil mica type does not make the latter a bad unit. It is an excellent capacitor and enjoys a great variety of uses; it is simply that where frequency stability is a very important item, and the frequency is controlled by capacitance (as for example in oscillators and other critical tuned circuits) the silver mica unit is preferred.

The use of mica as a dielectric provides high insulation resistance. This is true for both kinds of active surface construction; hence the mica capacitor is frequently used for d-c isolation (and coupling) where d-c leakage must be kept very low. To minimize the absorption of moisture in humid atmosphere, and also to keep surface leakage between the connecting wires low, the complete capacitor often is coated with a layer of wax.

Ceramic Capacitors. Ceramic capacitors are available in a number of types. Neglecting physical differences, the ceramic unit is highly efficient electrically. Constructionwise, regardless of the shape, it consists of a metallic deposit on the opposite surfaces of a ceramic dielectric with connecting leads soldered to the active surfaces. The result is a very stable capacitor, and one in which, by selection of the ceramic dielectric material, a variety of electrical characteristics can be achieved. One of its paramount virtues is a relatively high value of capacitance in a small, compact-sized unit. In this respect it is superior to all other types of capacitors.

Another feature stemming from the easy control of the specific composition of the ceramic dielectric, is the ability to manufacture a capacitor which will *change* in capacitance in a definite direction and decrease or increase by a predetermined amount with changes in operating temperature. While this is possible with the foil type of mica capacitor, it is much more easily controlled in the ceramic, with the result that the latter variety of temperature compensating capacitor has displaced the

(Continued on page 26)

Successful Servicing, January, 1953

Using An A-M Signal Generator etc.

(Continued from page 3) The height and vertical linearity controls should then be adjusted until the height of the blanking bar is uniform regardless of its position on the screen.

Although the vertical height and linearity controls can be adjusted for reasonably good linearity without a test pattern or test equipment, the adjustment of the horizontal linearity control does require some type of a pattern on the screen. An incorrect adjustment of the height and vertical linearity controls is more noticeable on the ordinary program than is an incorrect adjustment of the horizontal controls. This does not mean that the horizontal adjustments can be overlooked, however, since the owner will see a number of programs on which a circle will be used, and if this is not a reasonably true circle, a return service call will probably be required.

The signal generator can also be used to make this adjustment without removing the chassis from the cabinet. The only additional items required are a .01- μ f capacitor and a piece of thin spaghetti. The location of the first video amplifier tube must also be known. This tube can, of course, be identified if a circuit diagram is available. If a diagram is not on hand, the tube layout will ordinarily indicate the video amplifier tube or this tube may be recognized by its location on the chassis.

Addition to TV 10 and TEK-FILE Pack 67

National TV Model 1701

VOLTAGE CHART

Tube No.	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
v 1	5	0	6.3 AC	0	80	80	0	1
V2	96	96.	6.3 AC	0	-3.5	-2.5	0	
V3	45	0	0	6.3 AC	90	90	.4	
V4	45	0	6.3 AC	0	90	90	. 5	
V5	45	0	0	6.3 AC	90	90	. 6	
V6	0	0	0	6.3 AC	90	90	.7	
V7	-2.5	2	0	6.3 AC	. 5	0	-3	
V8	0	6.3 AC	4 to -2.5	-2.5	.4	160	0	115
V9	90	-9	4.5	0	0	0	0	0
V10	20	0	0	6.3 AC	20	6	0	
V11	0	0	6. 3VAC	0	13	NC	-9	
V12	NC	NC	6.3VAC	0	320	-90	0	
V13	NC	0	350	350	27	0	6. 3VAC	0
V14	25	220	13	-7	120	13	6. 3VAC	0
V15	NC	6. 3VAC	1.7	TP*	-18	NC	0	3 20
V16	HV REC	TIFIÈR					2	
v 17	NC	280	540	NC	360	NC	6. 3VAC	6. 3VAC
V18	PICTUR	E TUBE						-
V19	0	0	0	6. 3AC	88	90	. 6	
V 20	96	140	340	90	94	96	90	
V21	88	92	42	92	280	150	92	
V22	0	90	320	250	90	90	90	105
V23	NC	390	0	0	360	0	NC	390
V24	88	88	92	92	92	NC	80	

*Tie point



Fig. 7. Pattern produced by signal generator with 157.5 kc modulated by 400-cycle audio.

A number of manufacturers are also including test jacks located at various points in the circuit which can be used for troubleshooting or signal insertion. One of these test jacks is usually located at the output of the video detector or the input to the first video amplifier. If a test jack is available the output of the signal generator can be connected to this point through a .01- μ f capacitor by inserting one end of the capacitor, bent to make proper contact, into the test jack.

If a test jack is not available at this point in the circuit, contact can be made by connecting the .01- μ f capacitor to the grid pin on the first video amplifier tube. A piece of thin spaghetti should cover both of the capacitor terminal wires so that only about one-quarter inch of wire is exposed at the end of each wire. One end can then be bent so that it will fit snugly over a miniature pin, and the other end can be bent to fit over an octal pin. Either end can then be used depending on the tube used in the receiver. The spaghetti will prevent a short either to the chassis or to some other tube pin.

The channel selector should be sent on a blank channel and the r-f output cable of the signal generator connected to the unused end of the .01-mf capacitor. The output of the signal generator should be unmodulated and the frequency adjusted for some harmonic of the horizontal sweep frequency of 15,750 cycles, such as the tenth harmonic which is 157,500 cycles or 157.5 kc. This will produce about ten vertical dark and light bars across the screen as shown in Fig. 6. The spacing of these bars can then be used to adjust the horizontallinearity control. If more bars are preferred the frequency of the signal generator can be increased; if fewer bars are desired the frequency can be decreased. The vertical bars will sync in at harmonics of the horizontal-sweep frequency. If the audio modulation is not turned off the bars will be wavy as shown in Fig. 7.

If either a cross-hatch generator or an a-m signal generator must be used, it should be remembered that these instruments are only substitutes for the test pattern. If a pattern can be used it should be preferred although reasonably close linearity adjustments can be made with instruments.

The Quick Diagnosis

or

Working Under Pressure

by John D. Burke

finish the cabinet . . . man came to my shop and insisted on paying for my work.

The back . . . oh no . . . screws mostly missing. Watch out for that tube neck . . . sticks out! If the back drops . . . bang goes the picture tube. Hey! Better take a look at the front before pulling off the back. What's the complaint? Plays a while - then goes crazy. Hmmm - at least this one's got the hold controls on the front . . . Ah, not enough width . . . 5U4 or more? Gee, I hope it doesn't use a 6CD . . . haven't got one with me Lousy intermittent. Picture's solid now. Try to speed up the craziness . . . rotate band switch. Turn set on and off . . . rotate hold controls. The people will think I'm ruining their set - swinging these knobs so fast. Those fix-it books - TUUUUUURN SLOOOOWLY - got everybody nuts. 'Fraid to turn a knob. Never forget the old pair that thought the set should be turned off before changing stations!

O.K. – there she goes. Sync. Is it both vert and hor? Vertical very unstable . . . horizontal, no sync at all. Oh, oh – breaks into multiple images sideways. Nice. Hope its just the oscillator. Nice, clean, simple – through in a wink. Maybe the horizontal amplifier, too. Hope not. Rough to explain that tube's price. Off with the back . . . where's my junk? Ah, ah, somebody's broken the cheater off the back. No need to use my cord . . . always forgetting them . . . such a hurry to get out after the job is done I forget the cord.

How about the controls? Marked on the chassis . . .? Those engineers should have to work on some of their own monstrosities. What is this . . . intercarrier or conventional? Looks intercarrier. How many tubes in the sync . . . Mmmm. Horizontal oscillator – where the devil is it? The places they put tubes! Ah, at least this one has a spring mount base. That's the baby . . . oh, oh . . . wait . . . don't pull it or you'll blow a fuse!

Off with the cord , . . change tubes . . . hope this *new* one is good! Now . . . let's see . . . before turning it on . . . Where's the fuse? In the box. Good. Lucky. Better open her up before turning it on again. May see something. Some case, that last one! Somebody just laid a new fuse on top of the old one! That set sure acted crazy. How about finger smears on the tubes? Yeh, they've been in here. Just feeling to see if they are hot. Hey! How about the trap . . . have they been at it, too? Yeh! Mm . . . doesn't look like they moved it. It looked O.K. when the set did play before . . .

Would the horizontal oscillator tube being bad explain lack of vertical sync? Might. If vertical draws voltage from the damper – damper works off horizontal . . O.K. Let's see how she works . . . look at the people watching me! Every move I make. Probably figure I'm trying to cheat them . . . they should know. If I get out of this without a shop job, or an argument, I'll be happy.

Set's two years old . . . plenty trouble due any minute now. Original picture tube . . . funny, it looked bright in spite of its age . . . O.K. . . . she holds. How's that hold control? Whoops! Got to readjust the back to permit centering of front control. Where's that mirror . . . That's alright . . . I'll just hold my own. Thanks! Wonder if it was just the tube? How long should I let it play to be sure? Oh-oh-look at that width jumping! In and out an inch on each side! . . . Damper? Sound seems steady . . . vertical, too. Must be the 6BG - variation in screen current, maybe . . . lucky it's not a 6CD . . . lucky if it is just the tube. Hate to put one in . . . Nobody believes a tube can be foureighty. When they hear six-sixty for a 6CD . . . Man! . . . Ouch! That tube's hot! Prv it out with a screw driver . . . burn your fingers! . . . Alright. Try again. When they saw that second tube come up their eyebrows went up too! Width . . . good . . . steady.

Focus? Where is it? Um, um. Linearity? Just a touch-O.K. That does it. How about the glass? Not too bad. Does the front come off? No! Too bad. I'm not going to pull out the chassis for that little dirt on the face. If I did, I'd surely be blamed for every future trouble. "It was working fine till you pulled out the chassis!" Glad this thing wasn't a series filament job . . . hate em.

Oh! Look at that ghost on Channel 91 Sneak a look at the people . . . are they

(Continued on page 29)

What goes on in the head of a TV repairman when he goes into a house or apartment to "take a look" at a TV set?

Within the space of a very few minutes a *torrent* of thought surges through his head. Yet, to the observer, it would seem that the repairman has little on his mind.

From years of personal experience I shall try to set down a record of such thinking. Perhaps it will be interesting to psychologists. At any rate, my fellow repairmenshould be interested, amused, even compensated for their somewhat tonguetied characteristic – unable to convey to an outsider that which we of the trade undergo.

Since we are dealing with a torrent of thoughts – the only organization possible is movement. It will start at one point, and finish at another.

. . . .

"... Hmm. They never think to clear the junk off the top! Where's the light? Living rooms are certainly dark nowadays since television ... ah, at least this floor lamp still has a bright bulb. What is it? A console. Drag it out. Careful, watch out for that rug ... remember, put something on the top ... this paper will do. Never forget the time I accidentally burned a tiny spot on a top. So small it rubbed out easy ... looked like they'd kill me ... refused to take pay for the job ... told 'em to apply it to re-



send you your TELL-A-FAULT binder, subject separators and all the installments that have been released to date. For full information on the most unique SERVICE ever made available to TV and radio service technicians — write to Dept. TF 8.



Here are more data that will keep your RIDER'S DEPENDABLE REPLACEMENT PARTS LISTING published in TV Volume 10 up to date. This is also to be included in TEK-FILE Packs 58, 59, 60, 61, 63, 64, 67, 68, 70, 71, 75, and 76.

ADDITIONS:

	Set Mfg.'s	Replacement	Dependable	
Set Mfg.	Original	Part Mfg.	Replacement	Remarks
	Part No.	Name	Part No.	
Belmont	80-17845	C D	C031	
11	80-18487	C D	0078*	*Omit 125mf contion
	80 19546	C. D.	DD1015A	·Omit 125mi Section
	80 10584	C.D.	DR2013A	
Hallianaftana	460172	C.D.	BRIDIS	*Descillet en etterne
Motorolo	10D110	C. D.	0.000	*Parallel sections
Dhiloo	200 0417 7	Stancor	A-38//	
Philico	30-2417-7	C. D.	BBR2-50T	
	20.0570.57	Mallory	TC 302	
	30-2570-57	C. D.	D 111	
		Mallory	FP 476	
** **)	30-2570-66	C. D .	XA 004	
		Mallory	FP 117	
) 1	30-2584-9	C. D.	D 111	Parallel sections
	 A second sec second second sec	Mallory	FP 344.5	
"	30-2584-10	Mallory	FP 225	
P1.	30-2584-15	C. D.	UPT 435	
		Mallory	FP 255-TC 72	
**	32-8242-11	Stancor	A-3823	
**	32-8522	Stancor	A -3825	
		Triad	F-21A	
Starrett	CO 1050-2	Aerovox	AFH-3-44	1
17	CO 1050-3	Aerovox	AFH-4-14	
Stromberg-				
Carlson	161030	Stancor	C-2326	
Westown	101000		• • • • • • • • • • • • • • • • • • • •	
Auto	190 19749	Stongor		
Auto	120-10/45	Stancor	A-3878	
		Triad	S-8X	
, , , , , , , , , , , , , , , , , , ,	12M-18241-1	Stancor	A-8125	
		Triad	A -97X	
CORRECTION	1:			
Western-				
western-	1914 19941	Change A 00V	A 07V in Triad 6	moon Trongformone column
Auto	12M-10241	Change A-99A	to A-91X In Triad 2	sweep Transformers column.
CORRECTION	S FOR VARIABLE	RESISTANCE C	ONTROLS LISTING	5:
Croslev	153348	Change P 128 t	o P1-128 in IRC On	ter Shaft column.
Emerson	390156	Transpose DS- Shaft column	36 from Mallory Sw	ritch No. column to Inner
	390181	Transpose DS-	36 from Mallory Sw	vitch No. column to Inner
		Shaft column	•	
	390183	Transpose DS- Shaft column	36 from Mallory Sw	titch No. column to Inner
Firestone	78X12	Change QJ-375	to QJ-418 in IRC S	tock No. column.

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ATTENTION AUTHORS:

We are soliciting articles concerning radio, television, and allied electronic maintenance. All aspects are of interest. Articles of 1,000 to 2,000 words are desired. Preference is given to subject matter which reflects practical work rather than theory. The presentation should be *direct*, to the point, and amply illustrated. Finished art work will be prepared by us from the roughs submitted. Photographs are welcome. The rate of payment is on a word basis — and, needless to say, good writing rates good pay!

Submit all articles and inquiries to Editor, Successful Servicing.

JOHN F. RIDER PUBLISHER, Inc. 480 CANAL STREET New York 13, N. Y. Let's forget the "glittering generalities" about quality.

Let's Check 4 specific ways CBS-HYTRON CBS-HYTRON CUTS YOUR Call-backs



1. BY MAKING CBS-HYTRON TV ORIGINALS BEST.

Longest experience with production . . . with applications . . . with improvements . . . all count. *CBS-Hytron-built* 1AX2, 1X2A, 6GQ6GT, 12A4, 12B4, 12BH7, 12BY7, 12BZ7, 25BQ6GT, 16RP4, etc. *are* more trouble-free. Prove it to yourself.



2. BY ENDLESSLY IMPROVING STANDARD TV TYPES.

Close co-operation with leading set makers alerts CBS-Hytron daily to needed betterments. Take one of endless examples: the CBS-Hytron 6CB6. You will find its clear, non-carbonized bulb eliminates undesirable loading effects at vhf.



3. BY APPLYING "RELIABLE" TUBE TECHNIQUES.

CBS-Hytron 6AL5 is typical. Experience with the military 6AL5 family (JAN 6AL5, 6097/CT, 5726) is passed on to you. You profit by a commercial CBS-Hytron 6AL5 made truly reliable.



4. BY MATCHING EACH TUBE TO THE SET.

Daily, CBS-Hytron analyzes leading TV chassis. Dynamic socket-by-socket checks, plus continuous field experience, pay off. Give you

CBS-Hytron matched-to-the-set performance... with the accent on trustworthy replacements.

Take advantage of CBS-Hytron extras like these. Keep your customers happy. Guarantee yourself against profit-slicing call-backs. Demand dependable CBS-Hytron tubes.



NOW ... TEST THE EASY TOPSIDE WAY!

Wish you could test a chassis topside? Without first pulling and wrestling with the heavy chassis? Without disturbing wiring and parts by digging underneath for buried sockets? How much

faster, easier, safer you could work! New CBS-Hytron Test Adapter does the trick. Just replace a 7-pin miniature tube with the Test Adapter. Plug tube into Test Adapter. Presto, all socket connections are topside . . . within instant reach of your test prod or clip. Just one job pays for this new CBS-Hytron Test Adapter. Get yours today! **HERE'S HOW!** With the CBS-Hytron Test Adapter, you quickly measure voltage, resistance, gain. You inject and trace signals . . . monitor intermittents. You check oscillating stages. Or the effect of adding a bypass condenser or shunt resistor.

With several CBS-Hytron Test Adapters you make stage-bystage circuit checks...fast. You do all this dynamic testing the e-a-s-y way... topside. With no ill effects at a-f frequencies. And only slight capacitance and inductance effects at much higher frequencies.

You will like: The positive contact of the low-resistance, silverplated base pins and test points. The plainly marked pin connections. The easy insertion and tight grip. CBS-Hytron Test Adapter is another designed-by-and-for-you "must" you must have. See your CBS-Hytron jobber today.





DANVERS, MASSACHUSETTS

TV Set Functions With Transitors* T. R. Kennedy Jr.

A complete portable television receiver functioned perfectly here today without radio vacuum tubes. Instead, it utilized thirty-seven bits of laboratory magic known as "transistors," which even now are said to perform nearly all the functions of the ordinary radio tube, and do some of them even better.

The video receiver, which was battery operated and about one-quarter the weight and size of an ordinary home table model set, was only one of a number of familiar electronic devices such as home and automotive radios, record players and public address systems – using only transistors – demonstrated for the first time as a "transistor application progress report" in this new field by the David Sarnoff Research Center of the Radio Corporation of America.

The only conventional type of vacuum tube in the video set was its own self-contained picture tube, on which the image was created.

And even that last conventional radio tube in the home video may in time give way to a newer device patterned after the



transistor. Dr. E. W. Engstrom, vice president of the R.C.A. Laboratories Division, expressed such views as the new transistoroperated devices were demonstrated for newspaper men and technical writers, who saw them for the first time.

"Even now we are thinking along such lines," he said. "Tomorrow's video screen may be something entirely different than we have in today's sets. We have seen more progress in four years of transistor development in the laboratory than in twenty for the radio tube."

Great Cost Production Seen

Dr. Engstrom explained that the small size of the viewing screen of the receiver demonstrated – five inches wide – had nothing to do, however, with the transistors inside the unit, which provided only the amplification of the signal and converted it to something the viewing screen could turn into a moving image. The laboratories had only tried to eliminate the thirty-seven ordinary tubes.

With transistors in use, however, the largest element of cost in the ordinary home video set except the viewing screen – the power needed to light twenty-four to thirty ordinary tube filaments – might be reduced almost to nil. It was Dr. Engstrom's estimate that tomorrow's video receivers with full complement of transistors and the usual cathode-ray viewing screen might be, when production is stepped up, "something about half of today's costs."

For those not familiar with transistor history, Dr. Engstrom explained that the original device was a product of the work of Dr. William Shockley and associates of the Bell Telephone Laboratories in 1948, and since then under intensive development in many electronic laboratories, including the R. C. A.'s.

In the various branches of the laboratories the visitors saw transistors being made from refined bars of metal called "germanium," which must be first purified, then contaminated with other elements to achieve the required end of being good amplifiers and generators of eleotric currents – "better than most radio tubes and far more versatile than many."

When the germanium bars are finished they are sliced up into minute particles, the bits, mounted in plastic holders, "cat whiskers" of fine wires applied through which small voltages are applied from batteries. The result is amplification of a radio signal, without the heated filaments in ordinary vacuum tubes.

> *Reprinted through courtesy of The New York Times.



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PACKS 1-77

HOW TO USE THIS INDEX

File number.

To locate service data instantly, all you need to know is the manufacturer's name and the model or chassis number of the set.

The index is compiled alphabetically, according to man-ufacturer. Note the column headings at the top of each page: MODEL, PACK-FILE, PAGES.

Model numbers run in numerical sequence, starting with the smallest number under a manufacturers name. This applies also to model numbers using letters. (i. e. model AR precedes model CG). Model numbers starting with hel-ters precede model numbers starting with numbers.

As an example, let's look up ADMIRAL model 36X36AS. It shows that the information is in (1-1) para No. 1, ADMIRAL. File No. 1. The data (8-23-46) starts on page 8-23 and runs through page 8-46. There is also data on the 23 and runs through page 8-46. There is also data on the TEK-FILE Pack No. 1, in ADMIRAL Record changer Fulle No. 2. The data begins on page 21-9 and ends on page 21-16.

Under the column headed PAGES, the first and second numbers indicate the page where the information starts; the last number shows where the data is concluded.

Under the column PACK-FII TEK-FILE Pack number, and	E, the first r the second n	number is the number is the	If you remove the pages from th sert them in the TEK-FILE bind PACK-FILE column and refer to	e TEK-FIL ler, you ca the PAGES	E Files and in- n disregard the S only.
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	MODEL	MOTORO	TS-53, Ch.	13-14, Ch. TS-88, Ch. TS-89, Ch.	TS-94, Ch. TS-95, Ch.	TS-101, Ch.	TS-115, Ch.	TS-118, Ch.	TS-118A, TS-118B, Ch. "S-119, TS-119A, TS-119B	TS-119C, Ch.	15-119D, Cn. TS-172, Ch.	IS-174, TS-174A, TS-175B, Ch IS-214, Ch.	rs-216, Ch. 15-221, Ch.	TS-228, Ch.	TS-307, Ch.	rs-314A, Ch.	rs-315, Ch. rs-315A, Ch.	TS-325, TS-325B, Ch. TS-326, TS-326A, TS-326B, Ch.	rs-351, ch. rs-401, ch.	2K1, 12K1B, Ch. TS-53	2K3, 12K3B, Ch. TS-53 2K3, 12K3B, Ch. TS-53	ZTI, IZTIB, Ch. TS-53 2T2, 12T3, Ch. TS-53	4K1, 14K1B, Ch. TS-88 4K1BH, 14K1H, Ch. TS-115	4T1, 14T1B, Ch. TS-68 4T3 Ch. TS-114	4T4, 14T4B, Ch. TS-216 6F1 16E1B, Ch. TS-216	6F1BH, 16F1H, Ch. 13-00	6K2, 16K2B, Ch. TS-74 6K2BH, 16K2H, Ch. TS-94	6T1, 16T1B, Ch. TS-60 6T1BH, 16T1H, Ch. TS-99	7F1, Ch. TS-118A, TS-118B 7F1, 17F1B, Ch. TS-118	7FIA, 17F1BA, Ch. TS-89 7F2W, Ch. TS-118	7F2W, Ch. TS-118A, TS-118B	7F3B; Ch. TS-118	7F3BA, Ch. TS-110A, 13-110B	7F4, Ch. TS-118 7F4, Ch. TS-118A, TS-118B	7F4A, Ch. TS-89 7F5, Ch. TS-118	7F5, Ch. TS-118A, TS-118B 7F5A, Ch. TS-89	775B, Ch. TS-118	7F6, Ch. TS-118	7F6B, Ch. TS-118A, TS-118B 7F6B, Ch. TS-118	7F6BC, 17F6C, Ch. TS-174	Record Changer	MOTOROLA RC-36A 7F7, Ch. TS-118A,	TS-118B 7F7B, Ch. TS-118	7F7B, Ch. TS-118A, TS-118B	

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		PACK -FUE	CO CORP. (C	22-3	22-3		23-RC2	22-3	22-RC2	22-3	22-3	22-3	32-3	22-3	22-3	22-3	22-3	22-3	22-3	22-3	11-8 1	71. 22-3	21-8	22-3	22-3	22-3	22-3	22-3	22-3	22-3	22-3	22-3	71-8	22-3	71-8	22 ₅ 3	71;-8	11-8	22-3	68-7 44,	22+3	52-RC2 22-3	v
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25

Replacement Parts in TV Receivers

(Continued from page 7)

mica type almost completely. It is interesting to note the rapid rise in the use of negative temperature coefficient ceramic capacitors in television receivers. In these, the capacity decreases with increase in temperature. They are very prominent in the front-ends and are used more and more in other parts of a tv receiver where it is desired to maintain constant circuit behavior under varying temperatures.

The ceramic dielectric capacitor offers high insulation resistance; therefore, it is used for d-c blocking, bypassing, and coupling, especially in those circuits that operate at frequencies above the audio range. Its behavior under varying conditions of frequency (including UHF), temperature, and humidity is excellent.

Another feature of the ceramic dielectric unit is the ease with which it can be produced in very low values of capacitance, with the result that the wide variety of low values of capacitance used in television receivers are prominently available in this kind of capacitor.



Construction of fixed mica and ceramic capacitors.

A high order of interchangeability between mica and ceramic capacitors exists, especially between certain ceramics and silver micas. Since the subject is somewhat elaborate, the discussion will be held in abeyance until the subject of substitution is treated.

Paper Dielectric Tubulars. Paper dielectric tubulars follow two patterns of construction. One utilizes alternate layers of foil (the active surface) and paper dielectric between. The foil and paper are wound concentrically; by making proper electrical connections to the active surfaces, non-inductive behavior is accomplished to a highly satisfactory degree. Also, any desired capacitance value and voltage rating within certain limits is achieved.

The usual limit on the minimum capacitance produced in this manner, and also on the maximum, is a low of about .001 μ f and a high limit of about 50 μ f. However, the upper capacitance limit of paper dielectric capacitors used in tv receivers is about .25 μ f.

A second form of construction uses metallized paper, that is, metal is sprayed on the paper dielectric. The metallized strip then is rolled concentrically and the connections made to the active surfaces.

An important part of the construction of both varieties of capacitors is the impregnation. All air is drawn out of the assembly and all spaces within are filled with an impregnant that also penetrates the paper dielectric. It may be any one of a variety of substances such as mineral oil, castor oil, wax, or a synthetic substance. The impregnant ascribes certain electrical characteristics to the capacitor. Only some of the highlights can be treated here because the subject is extremely broad.

The impregnant influences the capacitance of the capacitor – whether it is going to increase or decrease relative to the nominal value with changing temperatures, and by what amount. It determines the variation in electrical losses within the capacitor with changes in operating temperature, thereby determining the suitability of the component for use at various operating temperatures. Insulation resistance on the other hand always decreases with increase in temperature.

These details are a matter of concern to the tv receiver designer, although his problem revolves more around what happens with increasing temperatures than for the opposite temperature variation. That is why design engineers specify the operating temperature of fixed capacitors used in the equipment they conceive. Fortunately, the service technician's problem is greatly simplified, in that the vast majority of paper dielectric capacitors used in television receivers bear one of two operating temperature ratings, 65° C or 85° C. Judging by specifications, the tendency is toward the higher rating. These needs are being satisfied by replacement components, but it still behooves the responsible tv service technician to make certain that he is procuring the proper part. This is one reason why the use of surplus capacitors for replacements is a very bad practice, and suggestions for replacement must be based on the original specifications.

The casing or housing used for the capacitor has a bearing on its operation with different conditions of temperature and humidity. There was a time when all these capacitors were contained in wax impregnated cardboard tubes and wax sealed. The tendency is away from these to molded plastic casings in order to improve operation under high humidity conditions. Hermetically sealed metal cases also are available, but these seldom are used as original equipment or for replacement in tv receivers.

Electrolytic Capacitors. Although the electrolytic capacitor is in a class by itself, it still conforms with the basic requirement of a capacitor; namely two conducting surfaces between which a dielectric exists. The essential difference between the electrolytic capacitor and the ordinary fixed capacitor is that the dielectric in the form is an exceedingly thin oxide film which is deposited on the metal surfaces of the capacitor. The film displays unilateral conductivity properties, that is, when the applied voltage is of one polarity, the film displays very high resistance, and relatively little current flows through the dielectric, and when the voltage is of the opposite polarity a high current would flow through the capacitor. In spite of this, the unit is still capable of storing electricity.

In view of this behavior relative to the polarity of the applied voltage, electrolytic capacitors are polarized. By this is meant the capacitor terminals bear polarity designations which must be adhered to when the d-c or pulsating voltage is applied to the



Cutaway view of an electrolytic capacitor.

capacitor. Otherwise, the unit may be damaged.

The three types of electrolytics - etched foil, plain foil and fabricated - refer to the manner in which the basic metal surface is treated so as to afford maximum surface for contact with the oxide film. The plain foil presents a smooth surface and affords a unit surface area, hence a unit value of capacitance. When the metal is etched by a chemical process, the surface area is increased. This occurs because the etching process causes microscopic cavities in the surface, all of which tends to increase the surface area in contact with the film. Substantial increase in capacitance is obtained in this fashion, perhaps from 5 to 8 or more times the capacitance which is obtainable with the plain foil. In the fabricated plate type, the anode material is made by deposit-

(Continued on page 34)

Notice to All Purchasers of:

RIDER'S TV 10

We have always prided ourselves on the accurate information we have made available to the servicing industry. To live up to this tradition we wish to correct certain discrepancies that crept into the replacement parts listings published in TV 10. Because we are anxious to give you thoroughly accurate replacement parts listings, which include additions that arrived after the publication of TV 10, we ask you to do the following:

Please fill in the registration coupon on the first page of your Rider TV 10 Manual and send it to us. We will forward the replacements parts listing corrections direct to your address. Also, by returning this coupon to us, you will be assured of having your name on our mailing list for exclusive information that will be available to TV 10 owners. <u>Do Not</u> send us the replacement parts pages!

Look to future issues of SUCCESSFUL SERVICING for the newest additional replacement parts listings.

John J. Rider, Publisher

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Service dealers are getting powerful local advertising support from new Westinghouse RELIATRON_{TM} Tube Distributors. In cities now served by Westinghouse Distributors, dealers get local newspaper advertising, a complete kit of store display and imprinted mailing material.

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For the name of your Westinghouse Distributor, or the approximate date when Westinghouse Tubes will be available in your area, drop a postal card to Dept. M-201 or have your regular distributor contact Dept. M-201 for information on how he can better serve you.

: 4

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Westinghouse Electric Corporation Box 284, Elmira, N. Y.

ET-95013

1200

The Quick Diagnosis

(Continued from page ?)

used to this poor reception? Or am I going to be blamed? Nothing on their faces . . lucky. The times I've been blamed for *all* the ghosts and everything else after just putting in one tube . . . !

Hey! What's that noise? Picture, too? Yeh. Streaks, and flashes, once in a while. Is it aerial? Bang the cabinet! Yeh, something's loose . . . here we go again! Tap. Where's that long handled fibre screw driver? No good for alignment anymore, but swell for tapping. Watch out for that picture tube! Don't put your hand near it! Oh. This one's glass. Got so I react against any picture tube . . . got banged so hard by the metal ones without a plastic shield. Imagine, expecting a man to work on a set without that protection . . .

Boy! Like a toothache . . . this one hurts all over. Uh. Tuner? Not more sensitive than most . . . just normal oscillator response to a bang. First i.f.? No. Second . . . um . . . gee . . . everything around that tube is sensitive. Can I work without a mirror? Yeh. The flashes when I hit show through the edge of the picture tube . . . hear and see at the same time. Is it this tube? Doubt it ... but, have to try a new one ... I wonder . . . try another . . . Wow! Hotter'n the devil! What is it? Mmm. Oh, here it is . . . 6CB6. Where's that tube kit? The load I carry! Can't keep 'em in order . . . swell . . . here it is. They are really watching me now! Sure that I'm putting in more than necessary. Alright . . . she's hot now . . . no use banging till they are hot . . . same thing! Alright! Pull out the new one . . . put back the old. Darn these tiny pin tubes!

Ugh, ugh . . . got to be a contortionist . . . geez it's hot in here . . . O.K., turn her on again. Tap some more . . . that's the spot alright. Just like an unsoldered connection. Wonder if they had been bothered by this . . . ? ;

What's that? Yeh, the trouble for which you called me is fixed . . . but what I just found is another trouble which may not bother you, if you are lucky. It is apparently a loose connection under the chassis, but if the set is not jarred too much, it may hang on and you can get it fixed when the set does have to have a major repair . . .



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MERIT ADDED TO RIDER'S REPLACEMENT PARTS LISTING PROGRAM

Merit Coil and Transformer Corp. is now a participating manufacturer in the Rider Replacement Parts Program.

Merit replacement parts will make their appearance with TEK-FILE Pack No. 78 and Rider's TV Manual 11. However, it is intended that supplementary information on Merit replacement parts will be made available to the servicing industry for those TV receivers covered by Rider's TV 10 This data will appear in SUCCESSFUL SERVICING.



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Additional literature on each of the products described in these columns may be obtained from SUCCESSFUL SERVICING. See the coupon in column three.

New Tester for Mobile Radio Systems

This new general purpose test meter, RCA Model 6X-7A, will measure current, voltage, and radiated power – all the electrical measurement necessary to install and service two-way radio communications systems. Tester is designed so that several related functions can be checked with a single arrangement of test leads.



Item 1

Sturdy-Tune Detents

Telematic Industries has broadened its line of Sturdy-Tune Detents so that it now includes eleven different detents to handle the replacement needs of nearly every brand TV receiver on the market.



Item 2

The detents are available with or without a back plate. The availability of the Sturdy-Tune Detents without a back plate, if so desired by the serviceman, serves to cut the replacement cost.

Rack Mounting Adapter for Cathode-Ray Oscillographs

Allen B. DuMont Laboratories announces the availability of a new Rack Mounting Adapter, Type 2598, for use with DuMont Types 303, 303-A, 303-AH and 322 cathoderay oscillographs.

Shipped dis-assembled, the Adapter provides a rigid mount for the instrument in standard 19 inch relay racks; the front opening is large enough to permit all but the front panel of the oscillograph to pass through. The Adapter has been designed so that the entire relay rack may be moved with the instrument in place.



Item 3

Standard Voltage Rated Power Supplies

Kepco Laboratories has released a new group of voltage regulated power supplies, the Model 700 series. Model 700 feature one regulated d-c voltage supply, a high voltage supply continuously variable from 0 to 350 volts and a delivery of from 0 to 750 milliamperes; Model 710 delivers 1.5 amperes, 720 delivers 2.25 and Model 730 delivers 3 amperes. In the range of 30-350 volts, output voltage variation is less than ½% for line fluctuations from 105-125 volts and load variation from minimum to maximum current. Ripple voltage is less than 10 millivolts P-P.

The gray cabinet is 22% inches high, 21% inches wide and 15% inches deep.



Item 4

Video Output Tube

General Electric has added a new power pentode, type 6CL6, for use in the video output stage of tv receivers.

The tube provides a high plate current at low plate voltage, giving a 40 to 45 voltage gain in wide band video circuits and being capable of supplying 132 volts peak-to-peak output across a load resistor of 3,900 ohms. This new nine-pin miniature may also be used as a wide-band amplifier in industrial and laboratory equipment.



Item 5

Low Résistance—High Accuracy Instrument Resistor

Type 245S, a new 1-watt precision wirewound resistor for decades and other applications requiring low resistance values with close tolerances, low temperature rise, and low inductance, has been announced by the Shallcross Mfg. Co. The new resistor can be calibrated to a tolerance of $\pm 0.1\%$ or better and is available in values from 0.1 ohm to 1000 ohms. A single layer bifilar winding protected by a moisture resistant lacquer coating is used for all values. The Steatite bobbin and axial wire leads are at the same end for ease in mounting the resistor directly on decade switch decks or other similar equipment. Size is 11% inches long by % inch diameter.



Item 6

To obtain additional literature on any of the items described in this section encircle the number of the product (number appears under picture) on the coupon below, cut the coupon out and mail it to SUCCESSFUL SERV-ICING, 480 Canal Street, New York 13, N. Y.

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A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: With more manufacturers reporting changes for this period, a continued emphasis is being placed on the in-troduction of new products, especially by manufacturers of antennas, ca-pacitors and controls. Also evident is the continued tendency toward in-creased prices by the leading TV tube manufacturers.

New Items

- New Items
 AEROVOX—Added 3 new values to their series CP 2, 2 watt carbofilm resistors.
 ASSEMBLY PRODUCTS Added No. 2056-1, thermocouple at \$2.90 net and Model C, portable pyrometer case at \$1.75 net.
 BAKER MFG. Added No. 2 FM at \$2.37 net to their line of TV antenna towers.
 BLILEY FELECTRIC Added TV service crystal MC9, 13,627.5 kc. at \$5.50 net.
 BOGEN CO. Introduced Model R701, high fidelity FM-AM receiver at \$145.20 net . . Model DO10, high fidelity power amplifier at \$78.85 net.
 CLAROSTAT Added TV replacement controls RTV 356 to 383 inclusive.
 EITEL-MCCULLOUGH Added No. HR-10 at \$1.60 net to their series of heat dissipating connectors.
 ELECTRONIC MEASUREMENT—Added Model 600, oscilloscope at \$99.50 net, to their test converses and their series of heat first test converses files.

- 600, oscilloscope at \$99,50 net, to their test equipment line. FEDERAL TEL. & RADIO Added kit No. 3, all purpose selenium rectifier assembly at \$19.95
- net. GENERAL ELECTRIC Added No. RPX-052 at \$38.95 list and No. RPX-053 at \$57.90 list to their triple play variable reluctance cartridge series. Also added 20DP4A, rectangular all-glass picture tube for TV receiver applications at
- picture tube for TV receiver applications at \$39.35 net. GON-SET Introduced FM radarray No. 1517 at \$28.50 net . . No. 1529, rhombic UHF an-tenna with 8 foot mast at \$7.77 net . . No. 1531, parabolic with 9 foot mast at \$5.18 net and 5 other UHF antennas. GREAT EASTERN MFG. Added Model CRT, Iuxor emission booster at \$1.95 net. HYTRON Introduced No. SH27, test adapter at \$1.45 net. Also added special purpose tubes OA2WA at \$4.50 list and OB2WA at \$4.90 list.

- OA2WA at \$4.50 list and OB2111 at the list. JENSEN INDUSTRIES Introduced a number of diamond replacement needles for the following manufacturers: Astatic, Audak, Columbia, Cros-ley, Electro-Voice, General Electric, Magnavox, Philco, RCA, Seeburg, Shure, Sonotone, Web-ster Electric and Webster-Chicago. MALLORY & CO. Added No. PS54010, motor starting capacitor at \$4.89 net. . . No. FF45052, photoflash capacitor at \$13.50 net. . . No. U-67, 5 meg, carbon control at \$.75 net and WF252-T23, 2500 chm wire wound control at \$1.50 net.

67. 5 meg. carbon control at \$.75 net and WF252-T23, 2500 ohm wire wound control at \$1.50 net.
MERIT TRANSFORMER — Added No. A-3100, high fidelity output transformer at \$10.80 net.
MINNESSOTA MINING & MFG.—Added sound recording tape No. 111AP, plastic prof. reel, 14" x 1200 feet.
PACIFIC TRANSDUCER — Added Model 201D at \$33.00 net This model is the same as Model 201, a wide range variable reluctance cartridge with a frequency response to above 12,000 cps. with an output of 60 millivolts, with a diamond stylus instead of a standard sapphire stylus.
PERMOFLUX — Added No DHS-31B at \$50.00 net to their line of monaural dynamic headsets and No. PHA-6 at \$8.00 net and No. PHA-8 at \$13.00 net to their line of headbands.
PREMAX PRODUCTS—Added mobile mounting CA at \$6.00 net.
REMAX PRODUCTS — Introduced new series ARP, aluminum rack panels.
R.C.A. — Added 12BF6 at \$1.70 list, a multi-unit minature tube of the heater-cathole type containing from a 12-volt storage battery. Also added 12V6-GT at \$2.00 list, a beam power tube of the (Continued on page 35)

Use either one...



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Replacement Parts, etc. (Continued from page 26)

ing small particles of molten metal (aluminum) on a suitable carrier. This construction also provides increased surface area over that of plain foil, hence greater capacitance per unit size. This type is said to have as much as 10 times the capacitance as the plain foil type.

The varieties of foils also affect the operating capabilities of the electrolytic capacitor. Since a certain amount of current leakage is permitted in an electrolytic unit (although definite limits are set on it), and since each electrolytic capacitor is associated with a value of equivalent series resistance, power loss occurs inside the unit. This raises the operating temperature of the device, which in turn, is a limiting agency on the proper functioning of the unit and on its operating life. The plain foil type of electrolytic is capable of withstanding higher operating temperatures than the etched variety. Also, the plain foil electolytic is capable of withstanding much higher a-c ripple components than is the etched foil type.

As a general rule, electrolytic capacitors used in television receivers for a variety of



tubular capacitor.

filtering and bypassing duties are of the etched foil kind. This derives from the fact that it affords the maximum capacity per unit size and per unit price, and also because the temperatures prevailing in a tv receiver are within its ratings. On occasion the tv receiver makes use of plain foil units.

The references to tubular and can electrolytics apply to the physicial types. Both are contained in metal housings, except that the tubular variety has an insulating cardboard sleeve around the metal container. These are mounted in place by means of the connecting wires, or a mounting bracket. The can type is intended for above chassis mounting, to be screwed into a socket, or to be locked in place by means of twist lugs.

Like the paper dielectric capacitor, the electrolytic variety also is affected in its operation by temperature. This is especially true of the leakage current. This leakage increases with operating temperature inasmuch as heat tends to deteriorate the oxide film. Any action which tends to destroy the effectiveness of the film naturally displays an adverse effect on the capacitance of the unit. Also, high operating temperatures tend to dry out the electrolyte and so effect the capacitance and performance of the device.



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(Continued from page 33)

heater-cathode type intended primarily for use in the output amplifier of auto radio receivers operating from a 12-volt storage battery. RADIO MFG. ENGINEERS—Added mobile con-verters No. MC-55 at \$69.50 net and MC-57 at \$64.50 net. REGENCY — Added UHF converter, Model RC-600 rt \$37.46 ref.

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- NRB, rigid mounting base with haldwate at \$3.50 net.
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- AUDIO DEVELOPMENT Discontinued Model 50, 6192-tal pickup arm.
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 BOGEN CO. Discontinued Model DB10, high fidelity 10 watt amplifier . . Model PH10, 10 watt multi-range photo-amplifier and Model PX15, 15 watt phono-amplifier.
 CHICAGO INDUSTRIAL INSTR.—Discontinued Model 453, featherweight miniature volt-ohm-mil-liammeter.
 HUBBELL, HARVEY—No, 408B32, straight plug and No. 412B42, connector are discontinued.
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 SARKES TARZIAN—Advises that their line of TV picture tubes is discontinued.
 SUPERIOR INSTR. Discontinued Model 660, ac signal generator and CA-12, signal tracer.
 SYLVANIA Discontinued subminature tubes 6BF7 and 6BG7.
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 UNIVERSAL METAL PRODUCTS—Model EM-2 in their series of universal mounts is discon-tinued.

2 in their series of universal mounts is discon-tinued.

Price Increases

- ARGOS PRODUCTS Increased price on Model TC-2, tube caddy "junior"/to \$7.75 net. BOGEN CO.—Increased price on Model CH18P-1 to \$92.50 net and Model CH30P-1 to \$108.80 net in their challenger sound equipment series, BURLINGTON INSTR.—Increased price of No. A70x32 to \$11.50 net in their current transformer

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- \$1.80 net. PENN BOILER & BURNER—Increased price of the universal adaptor in their tenna-mast hard-ware series to \$.50 net. RADIO MERCHANDISE SALES Increased price on the TYLS series of 8 element Yagi
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(Continued on next page)





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(Continued from page 35)

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- LAROSTAT—Decreased prices on their series of 160 watt adjustable wire-wound resistors, series K-160-WA. CLAROSTAT-
- GENERAL ELECTRIC Decreased prices on a number of items in their Alnico 5 loudspeaker line.
- NATIONAL UNION RADIO—Decreased prices on videotron TV picture tubes NU-16DP4 to \$30.00 net . . . NU-10BP4 to \$21.00 net and NU-10BP4A to \$21.00 net.
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TV Filament Circuits

(Continued from page 1)

These examples, which are representative, show the serviceman that, in troubleshooting a receiver, filament circuits cannot be taken for granted but must be checked with the wiring diagram. The fact that chokes are used in the r-f tuning and video i-f units must not be forgotten. Suppose, for instance, in Fig. 3, that the choke between the first and second i-f amplifiers should burn out, or there should be a bad connection. This means that the second, third, and fourth amplifiers would fail to function. Or, if a filament bypass capacitor should short, the heating current would no longer pass through the filament. More important than this is the fact that the transformer winding is shorted and will be damaged. An understanding, therefore, of why and how chokes and capacitors are used in the filament circuits is necessary for successful servicing.



After Capehart-Farnsworth

Fig. 3. The schematic diagram of Capehart-Farnsworth Model 300-1B filament circuits showing the use of r-f blocking chokes, bypass capacitors, series and parallel combinations, and several transformer windings.

contain many chokes and capacitors. The r-f amplifier and the mixer-oscillator have 500-µµf capacitors in parallel with their filaments. These bypass any high-frequency signals. There is also an r-f choke directly in series with each filament to block the r-f signals. In addition, there is a $5,000-\mu\mu f$ capacitor which is across the two-tube parallel network. This, of course, further and more completely bypasses the r-f voltage. And finally there is another r-f choke in series with the circuit across the supply which even further removes any r-f signal.

Again, this is done to prevent these signals from reaching the video stages of the receiver and causing interference in the picture.

The video i-f amplifiers are also across this filament winding to ground. Each has a 1,500-µµf capacitor across it to bypass signals. These elements are three times the size of those across the r-f tuning unit tubes. This is so since the frequencies in the video i-f stages are reduced from the incoming carrier frequency which the r-f stages use. The r-f chokes are again used to block the r-f signals. Note also the use the filament choke used to isolate the audio amplifier and the 2nd audio i-f tube as well as the use of the 5,000- $\mu\mu$ f capacitor for video and audio bypassing.

Arnold J. Unger

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winding. The cross section of the winding is not uniform as in the case of older yokes (see part A of Fig. 1). The turns near the inside of the winding are in a thin layer, and pile up to successively increasing thickness as the winding progresses away from the window (see part B of the figure). As a result of this type of winding arrangement, the distribution of magnetic flux threading through the neck of the tube is more uniform than with the old-style yokes. Because of this more uniform field, the focus of the spot toward the edges and the corners of the picture-tube raster is considerably improved.

As the electron beam, which has a definite thickness, passed through the nonuniform field produced by the conventional yoke, different portions of that beam experienced differing amounts of deflection force. As a result, an elongated spot was produced at the raster edges that resulted in an out-offocus condition. By causing the beam to travel through the more uniform field produced by the cosine yoke, uniform deflection of all parts of the electron beam occur, and a 500 minimum amount of defocusing takes place.

The arrangement of the conventional windings around the picture-tube neck can be seen in part A of Fig. 2. The deflection coils are shown in cross section here. The horizontal windings produce a magnetic field with vertical lines of force. This magnetic field produces horizontal deflection. The vertical windings produce a magnetic field

(Continued on page 10)

the cosine yoke

In physical appearance deflection yokes for tv receivers have changed but little since the early models. However, electrically and magnetically the changes have been considerable.

In size, for instance, the first yokes were about three inches long and were designed to be used with small picture tubes having deflection angles of about 50 degrees. Present-day yokes run a maximum of two and one half inches long and are used for 66-degree and 70-degree tubes.

Electrically the old-style yokes used lower inductance horizontal coils (8 mh) while modern coils have inductances which run from 13 to 30 mh. At the same time, vertical windings have grown somewhat smaller, with inductances of about 30 to 40 mh, against the early 50 mh windings.

Magnetically, modern design employs ferrite cores in a yoke known as the *cosine yoke*. This yoke gives a notable improvement in focusing at the edges of the picture. This deficiency in performance of earlier yokes was generally ignored because of the use of smaller picture tubes. The design of these early yokes was primarily concerned with sensitivity of deflection and toward obtaining a perfectly rectangular raster with no sagging inward or bulging outward of the sides. The sagging inward is called "pincushioning" while the bulging outward is known as "barrelling."

The means employed to construct a cosine yoke involves the correct distribution of the



Successful Servicing, February, 1953



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PRINTED CIRCUIT

- FIG. 2

THE reproduction of electrical circuits on L insulated surfaces by various printing techniques has become a standard method of fabricating small, lightweight, economical electronic devices. The increased emphasis placed by the Armed Services and industry on miniaturization and ruggedness of electrical components has caused this innovation to assume vital importance. Printed circuitry is no longer confined to a few military devices and hearing aids, but may now be encountered in a large number of everyday equipments. These include speech amplifiers, portable receivers, citizens two-way radios, television receiver front-ends, f-m receivers, and many others. For this reason, a working knowledge of the design, production, and maintenance of such circuits will be a valuable asset to any worker in the electronics field. This article is concerned with a discussion of the general types of printed circuits, the relative advantages of each, and methods of effecting servicing repairs.

The use of printed circuitry has been revolutionary not only because it permits the fabrication of extremely small and rugged electronic components, but also because it reduces the production of such components to a simple, rapid operation which is almost completely devoid of the possibility of human error. By this method, a relatively unskilled operator can reproduce literally hundreds of complex units in the time formerly required to make one unit by old-fashioned "wire-by-wire" soldering techniques. In addition to electrical conductors, critical circuit components such as resistors, capacitors, and inductors can be "printed" into the circuit in the same operation and held to close, reproduceable tolerances. Fig. 1 shows a typical printed circuit and its schematic diagram.

Printed circuits are classified according to the method used to reproduce them. There are, at present, six general types. These processes are: painting, spraying, vacuum evaporation, chemical processing, metal stamping, and powdered metal dusting. Each of these general categories will now be discussed in some detail.

Printing Techniques

Probably the most widely used process for producing printed circuits is the *painting* technique. In this method, the conductors and other components of the circuit being fabricated are painted on the insulating surface which acts as the base for the circuit. The paint may be applied by hand with a brush, although in production operations the silk-screen stenciling process is more frequently used. Thin ceramic or plastic sheets may be employed for the base, or a metallic surface covered with an insulating lacquer may be used. In special instances, the glass envelope of a vacuum

or silver in suspension in a liquid binder. This conducting paint is applied to the surface of the insulating base to form the "wires" of the circuit. Other paint, made up of a resistive material such as carbon, may be applied in specific amounts to form resistors. Capacitors may be made by printing the plates on opposite sides of the base plate, if the required capacitance is small. Otherwise, small capacitors (such as the Aerovox Hi-Q BPD type disc ceramic) are connected to the printed circuit as in Fig. 3. It is interesting to note that these capacitors are manufacured by processes which are essentially printed circuit techniques. Inductances are produced by painting spirals of conducting paint on the surface of the ceramic or other base material. "Crossovers" in the wiring are made by planting one conductor directly over the other with a layer of insulating material such as lacquer between, or by "detouring" one conductor to the other side of the plate for a short distance by means of metal rivets or eyelets through the insulator, as is illustrated in Fig. 4.

3

When all printed components have been painted in place, the entire assembly is "fired" at an elevated temperature to fuse the metal particles together and bond the circuit to the base plate. Temperatures ranging from room temperature for plastic bases to as high as 800 degrees C. for ceramics are used.

Vacuum tubes, external leads, and other components not printed are soldered to eyelets in the base plate as in Figs. 1 and 3. To take maximum advantage of the spacesaving properties of printed circuits, tubes of the subminiature type are usually employed.

(Continued on page 17)

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Curtain Time

Transistors and Replacement Parts

The last few months have witnessed increased activity in the publicity given to transistors and other semi-conductors. In fact, almost the entire November, 1952 issue of the *Proceedings of the IRE* was devoted to this fabulous device. One manufacturer already is offering one type of transistor for sale to experimenters.

No one has any doubt about the impact of the transistor on the entire electronic industry. This will occur when there are no uncertainties about its reproducibility in large quantities and with consistent performance characteristics – application to all present uses of vacuum tubes over the full gamut of frequencies. When all of this comes to pass, the effect will be the equivalent of a revolution in electronic components and design.

The miniaturization of all equipment will be one manifestation, although this program involving subminiature vacuum tubes and transistors, has been going on for years under the impetus of the Armed Forces equipment requirements. The trend to transistors or some other devices made of materials showing similar behavior will, without question, shrink the physical dimensions of electronic equipment to a small fraction of even the smallest vacuum tube device made today.

Forgetting vacuum tubes for the moment, a tremendous effect seems likely on companion units presently being used to supply operating power to the vacuum tubes. A great portion of the energy supplied to vacuum tubes is wasted in heat. This is not so in transistors; hence those devices which supply operating power to the vacuum tubes in equipment are subject to change to a great degree — if not elimination in their present form.

All of this will not happen overnight. Engineers involved in the research of transistor and similarly behaving materials are very reluctant to forecast when the change from vacuum tubes to some semi-conductor type of device will take place; estimates range from 4 years to 8 years. But who can tell? In the meantime, present-day designed equipments are still being sold in great quantities to the public. It is not a wild guess to say that before any major engineering change takes place in electronic equipments - television receivers especially - the nation's houses will contain from 40 to 50 million units, if not more. These receivers will require replacement parts for a long time, regardless of what radical engineering change may take place at the end of four or five years.

It is said that color television is on its way. It is highly doubtful if it will be a transistor-equipped receiver when it arrives, despite the fact that such a black and white receiver equivalent to 34 tubes has been shown already. All sound evaluations contend that the arrival of color television in a year or two, will still make use of vacuum tubes and present types of complementary equipments.

All in all, a tremendous market for replacement parts exists – and is destined to increase substantially in the immediate future. The concern which need be felt by those who are producing and selling these parts is a matter of the nature of their planning. How far in the future do they look? The receivers in the field – all kinds of receivers – must be serviced, and they require replacement parts. The table model radio displaced the console radio – but those consoles which were in people's homes were not discarded. They were serviced until television came along to grab the public's interest. The birth of a "hot" war may change some of this. If past

The birth of a "hot" war may change some of this. If past performance is any sort of a barometer, an acceleration of technological development is a certainty. A part of this will be the transistor or its equivalent because of the unbounded interest in miniaturization of electronic devices for military uses. If this occurs, semi-conductor devices will emerge full fledged much sooner than would be the case with just a cold war in progress. But even then, public holding in electronic equipment will not be thrown away; they will require service and so, replacement part production, selling, and installation.

Summarizing the whole thing, there is every reason why all individuals affiliated with the electronic industry should take note of the progress being made in the semi-conductor phase of the art. The tube manufacturers have been doing this for a long time. But we can't see any reason for concern about inventories in parts manufacturing establishments, parts jobbers stocks, or service technician's parts stocks. Everyone will sell what they have, and what they will make and buy, for years to come.

TV Service

Questions asked here and there among those who are in a position to know indicate a definite improvement in the level of competency being demonstrated by TV service technicians. Taking into account the television receiver sales during 1952, and the total number in use across the nation, the proportion of complaints has decreased. This is especially true in the largely populated areas, where greatest density of receivers prevails.

Chassis Coding

The matter of chassis coding is still a problem in the field. In view of the practice by many television receiver manufacturers to show different schematics representative of different production runs, especially when changes have been made, it is of the utmost importance that the service technician be able to correlate correctly, with the appropriate schematic, the chassis in for service.

We don't know what the answer is, but isn't it possible to establish some common method of coding and also a common location for the coding symbol on the chassis? The former may be difficult because of the different systems firmly rooted in the factories, but the latter is not faced with the same problems. Even if the entire issue is not settled for some time, taking care of one detail at a time would help.

John F, Rider

reater than Quere



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Replacement Parts in TV Receivers Part I-Capacitors (cont'd)

This is the fourth in a series of articles on "Replacement Parts in TV Receivers." "Capacitors" will be continued next month.

Preceding paragraphs dealt with the identification of capacitors according to their physical construction. This base gives rise to the major type categories. But in the final analysis the suitability of a capacitor for a particular use is only in part determined by its physical construction. Every capacitor within a major type group is not necessarily suitable for every application even if the function indicates the general category of type from which the selection should be made. Still another basis of selection must be applied in order to establish suitability.

For instance a mica capacitor is generally considered to be a suitable type of capacitor for use in tuned circuits. The same may be said for the ceramic dielectric unit. Yet every version of these two general types of units is not suitable for use in every resonant circuit. The same applies to the paper dielectric and the electrolytic capacitors relative to portions of the TV receiver which contain these types. The final indicator in the suitability of use are the constants of the capacitor.

Constants of Capacitors

The suitability of a capacitor for a particular application is determined by many factors. Among these are

- a. physical size
- b. capacitance
- c. operating voltage rating
- d. allowable variation in capacitance from rated value
- e. required change in capacitance with temperature
- f. allowable change in capacitance with temperature
- g. maximum temperature for normal operation
- h. permissible electrical losses
- i. insulation resistance
- . resonant frequency
- k. test voltage rating
- l. leakage current (if applicable)

and several others.

With the exception of the physical dimensions, the other factors express the electrical qualifications of the component, and when stated in particular standardized terms, are the constants of the capacitor. Some of the terminology already listed are examples of terms which are constants, as for instance, items a,b,c,i,j,k and k. Item d is expressed by the constant "capacitance tolerance"; item e is "temperature coefficient" and item

by John F. Rider

f is "tolerance in temperature coefficient". Item g is expressed by "operating temperature", and item h by "power factor" and several others.

Because of the limitations in capabilities imposed by physical construction, or because of the capabilities given to a capacitor by its physical construction, each main type of capacitor has its own set of constants. Some of the constants are common to all types of capacitors because of the very nature of the device. A few examples of these are the physical size, the capacitance, the operating voltage and the electrical losses. When expressed numerically, they may differ widely – again because of the constructional features – but each set of constants does include them.

The selection of a particular capacitor for a particular use is a matter of comparison of the constants of the contemplated capacitor with the requirements of the circuit where it is to be used. At first thought this may seem to be a major problem to the service technician. Actually it is not so, because it already has been done by the individual who designed the circuit. In fact the entire problem is simplified because the receiver manufacturer's service literature contains the electrical specifications for the capacitors required at every point. All of the constants are not given, but a familiarity with the general order of constants applicable to that particular type of capacitor, will,

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these Pa	cks, refer to the TEK-FILE INDEX
in the Jo	inuary, 1953 issue. If you do not
have the	issue, consult your Rider distribu-

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when added to the details already known, lead to the correct replacement.

In the Rider Replacement Parts Program all the electrical requirements surrounding the original capacitor used in the television receiver are known, and these are compared with the electrical constants of the replacement items; then the suitable replacement is listed, that is, if there is one. A number of different types of capacitors can satisfy some of the original design requirements, but only after consideration of all of the constants is it possible to select which particular type of capacitor is suitable, or in some instances, which types are the equivalent of each other for a particular use. Examples of these will be given in a later article.

Physical Size

The physical size requirement is listed as one of the constants. Perhaps this is taking some license with the stricter meaning of constants but it does no harm. It is one of those descriptive terms which offers substantial leeway in the selection. At the factory end the physical size relates to most. convenient production, satisfying space limitations inside or around other components, electrical performance when operation is at very high or ultra-high frequencies, and finally, to some extent the matter of economy. From the service technician's viewpoint, the physical size requirement is the one with the least problem, providing that when a limitation exists, it is realized.

We have illustrated the range of physical dimensions within which capacitors of different types are generally available. It was seen that each type comes in different sizes. In some categories of units the full range of sizes is available on the replacement market; in others it is not. But fortunately the manner of use of a capacitor in a television receiver does not always demand complete conformance with the physical size specification, assuming that the electrical requirements can be satisfied.

For example, when a capacitor is located inside of some other component with fixed boundaries, such as an i-f or similar transformer can, or a deflection yoke, it is necessary that the replacement be of similar physical dimensions, or smaller, in order to fit within the same space. At the moment we are neglecting the possibility that the technician may not be interested in replacing a capacitor in an i-f transformer; he would rather replace the entire unit, which after all, does make sense when all factors are considered. Another example is the capa-

(Continued on next page)

citor which is used in a critical circuit where space is at a premium and the distributed capacitance must be kept to a minimum, or when the lead length is important. The larger the unit in these cases, the lesser is the possibility of keeping the lead length to the dimension used for the original component.

It is not beyond the realm of the imagination that a service technician may feel that the replacement of a fixed tuning capacitor inside of a transformer can be accomplished by locating the component outside the can. This is bad practice, and should not be done. The performance of the transformer can be affected adversely and feedback problems may arise.

Finally there is the case of the can type of electrolytic capacitor for which a mounting plate already exists in the receiver. It is conceivable that a new mounting plate suitable for a larger or smaller sized replacement can be used insead of the old one, but this involves the unwarranted expenditure of time and is justified only when the proper replacement is not procurable. Or, it is conceivable that a completely new mounting arrangement will be used, such as locating the replacement beneath the chassis. Of course it can be done, but we feel that in the latter cases, which are not too numerous to begin with, the physical features of the chassis should be retained by procuring the part that fits the chassis properly.

As to capacitors which are located on the underside of the chassis, the physical dimensional requirements are not of major import, providing, as we have said before, that the electrical requirements are satisfied. However, it always is best to duplicate the original size, but if there is to be a difference, it is best and most convenient to work with the smallest physical sizes rather than the reverse.

Capacitance and Capacitance Tolerance

In the list of electrical qualifications and in any list of constants of capacitors, these two items are shown individually. In reality they are closely related; hence are treated together here. Moreover, they are associated with all basic categories of capacitors being treated in this replacement parts series.

All capacitors bear some identification which states the capacitance rating of the unit. Sometimes the value is simply stated on the box which contains the unit, as usually is the case with variable capacitors. In the case of fixed units of all kinds, the value is marked on a label attached to the capacitor, or it appears as some form of coding impressed on the unit. Whether the label or coding expresses the capacitance in microfarads or micromicrofarads is unimportant because one is convertible into the other. A more important thing is the realization that the value of capacitance so shown is an approximate value. Frequently it is referred to as the nominal value.

By approximate or nominal we mean a value corresponding to the standard value within a certain leeway or tolerance. As a matter of convenience, lowest cost, and other production factors, the radio and television industry has agreed upon certain values of capacitance for each type of capacitor as being "standard" values. Design engineers try to build their equipments around these values. Capacitor manufacturers in turn build capacitors to approximate these standard values within a certain tolerance (expressed as a percentage of the rated value) and label them accordingly.

Although the standard values of capacitance are not the same for all basic categories of capacitors, at least do not begin at the same low limit and end at the same high limit, there is a range of capacitance in which the paper dielectric, mica dielectric, and ceramic dielectric afford more or less the same standard values, but not exactly the same. Such a list would begin at about 0.0001 µf and end at about 0.01 µf. It must be understood however that operating voltage ratings will tend to modify the range of standard values in all three types. As an illustration we might point out that the usual lowest standard value of capacitance in paper dielectric capacitors rated below 2000 volts working, is 0.001 µf, and even this is increased to perhaps several times that value when the working voltage is below 600 volts.

Mica dielectric and ceramic dielectric capacitors are available in like standard values from about 1 $\mu\mu f$ to about 0.01 μf , but even in this group, especially between a fraction of 1 $\mu\mu f$ and about 70 $\mu\mu f$, the preponderant selection of ceramic capacitors for many uses by design engineers has lead to the creation of standard values which differ from each other in very small steps, perhaps 2 or 3 $\mu\mu f$.

The electrolytic capacitor is in a class by itself as far as standard values are concerned. They begin at about 4 μ f and extend up into the thousands of microfarads. But here too the particular type and the working voltage rating sets limits, as for example about 50 μ f is the limit at 450 volts, whereas 5000 μ f units are available at 6 volts.

Capacitance Tolerance. Concerning the association between standard values and tolerance, by definition, tolerance is the acceptable departure from a rated value. In the television industry, for that matter in the entire electronic industry, capacitance tolerance is expressed in two ways. One is in terms of percentage of the rated value, the other is in terms of a certain amount of capacitance. For instance when the capacitance is less than 10 $\mu\mu f$, and the unit is a ceramic dielectric capacitor, the + and - tolerance ratings may be $0.1\mu\mu f$, 0.25 µµf, 0.5 µµf, 1.0 µµf or 2.0 µµf, depending entirely on the degree of accuracy required by the circuit involved. As a rule, capacitors of this kind used in television

receivers bear either + or - 0.25 $\mu\mu$ f or 0.5 $\mu\mu$ f tolerance ratings.

In the case of mica capacitors up to and including 10 $\mu\mu f$, two minimum tolerance ratings exist. For the plain foil mica, the minimum tolerance is 1.0 $\mu\mu f$, whereas for the silver mica it is 0.5 $\mu\mu f$.

When the capacitance exceeds 10 $\mu\mu f$, the capacitance tolerance is expressed in

(Continued on page 20)

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The Cosine Yoke

(Continued from page 1)

with horizontal lines of force. This magnetic field produces vertical deflection. Part B of the figure shows a cross section of the windings of the cosine yoke. Windings which produce horizontal and vertical deflections are labeled. Part C is an enlarged view of one of the horizontal windings with the window and butting edge of the winding shown.

Note that the cosine distribution must be designed into both vertical and horizontal windings, but in different amounts. This is true because the deflection components of both magnetic fields are not the same due to the raster being wider than it is high. The size of the window in both horizontal and vertical coil assemblies affects the over-all distribution and hence the spot focusing in the corners of the picture.

The cosine distribution curve is a design detail and has no direct significance to the serivce man. Suffice it to say that the winding thickness varies in a cosinusoidal manner. Some windings claim to be cosine squared in character, which means that the winding thickness increases faster than in a normal cosine yoke.

In general a cosine yoke can be distinguished from a conventional-style yoke by inspecting the size of the winding window. Cosine yokes have narrow windows. This is natural, since the winding starts nearer to the center line of the assembly, and thus has farther to spread while increasing its thickness. The horizontal winding window can be readily seen, since this winding is on the inside of the yoke and lies along the neck of the tube.

Finally, in checking an old yoke when considering replacement with a cosine yoke, note that the cosine yokes probably have higher horizontal-winding inductance than conventional designs and replacement might result in poor performance and probably give ringing in the picture. Also, another condition to watch out for is whether the shape of the raster has been changed, since better corner focus may have been obtained at the expense of pincushioning of the raster. Some cosine yokes produce pincushioning that must be removed by placing small permanent magnets (held on brackets) around the neck of the tube. These antipincushioning magnets must be readjusted in making a replacement. A cosine yoke with such magnets cannot be used with metal picture tubes since the cone may become permanently magnetized and thus distort the raster.

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In compliance with the many requests we have received from our readers, this and future issues of SUCCESSFUL SERVICING will again contain the feature, TV PRODUCTION CHANGES.

The Rider Manual pages and TEK-FILE pack which include the original data and shematics to which the following production changes apply, appear in the index on page 24 of this issue.

ANDREA

MODEL T-VL12 **CHASSIS VL12**

Service Data Addenda (Coil and Transformer Resistances)

Low-Voltage Transformer, T12, Part. No. ST-3033

Primary: .8 ohm

- High-voltage secondary: 38 ohms, (center tap)
- 5v secondary (yellow leads): .1 ohm
- 6v secondary (green leads): .1 ohm
- 6v secondary (blue leads): .3 ohm High-Voltage Transformer, T8, Part No. ST-3018-1
 - Terminals 1-2: 90 ohms
 - Terminals 2-3: 180 ohms
 - Terminals 4-5: 9 ohms
 - Terminals 5-6: .3 ohm
- Vertical-Output Transformer, T7, Part No. ST-3030

Blue-red leads: 600 ohms

Green-yellow leads: 10 ohms

Vertical-Blocking Transformer, T6, Part No. ST-3029

Blue-red leads: 150 ohms

Green-yellow leads: 900 ohms

Horizontal-Oscillator Transformer, L18, Part No. SA-335

Terminals A-F: 75 ohms

- Terminals C-D: 43 ohms
- Deflection Yoke, L17, Part No. ST-3034 Horizontal winding: 13.5 ohms

Vertical winding: 70 ohms

Focus Coil, L14, Part No. ST-3032 1300 ohms

Horizontal-Linearity Control, L20, Part No. SA-315-1

35 ohms

Width Coil, L19, Part No. SA-336 .5 ohm

Speaker Output Transformer, T11, Part No. **SL-4009**

Primary: 400 ohms

Secondary: .5 ohm

Filter Choke, L22, Part No. 3031 100 ohms

MAGNAVOX

CHASSIS CT-270, 271, 272, 273, 274

R-F Unit

These chassis use r-f tuner unit No. 700349.

GAMBLE-SKOGMO (CORONADO)

15RA2-43-9105A **CHASSIS 16AY210**

MODELS 05TV1-43-9014A,

Circuit Changes, Video Amplifier

The following component changes were made in the video amplifier circuit:

Old Part Number	New Part Number	Description
C-9B1-70	C-9B1-66	2,200 ohms, ½ watt, 10%
C-9B2-64	C-9B-62	1,000 ohms, ½ watt, 10%
C-9B4-21	C-9B2-70	4,700 ohms, 1 watt, 10%
new part added	C-9B4-82	47K ohms, 2 watts, 10%
new part added	C-8G-11892	22 $\mu\mu f$, ceramic
A-16Ā-18685	A-16A-19486	240 µh peaking coil
A-16A-18685	A-16A-19485	380 μ h peaking coil
	01d Part Number C-9B1-70 C-9B2-64 C-9B4-21 new part added new part added A-16A-18685 A-16A-18685	Old Part Number New Part Number C-9B1-70 C-9B1-66 C-9B2-64 C-9B-62 C-9B4-21 C-9B2-70 new part added C-9B4-82 new part added C-8G-11892 A-16A-18685 A-16A-19486 A-16A-18685 A-16A-19485

NOTE: Chassis code numbered 124023 or higher incorporate this change.

MITCHELL

MODELS T16-2KB, T16-2KM, T16-B, T16-M

Production Change (Tube Substitution) In some receivers, a 6SN7 is used in place of a 12AU7 for the d-c restorer and sync separator stage. This is done by making the following wiring changes:

- 1. Filaments: Connect pins 5 and 9 of the 12AU7 to pins 7 and 8 of the 6SN7, respectively. Disconnect pin 4 of the 12AU7.
- 2. Cathodes: Connect pins 3 and 8 of the 12AU7 to pins 6 and 3 of the 6SN7, respectively.
- 3. Grids: Connect pins 2 and 7 of the 12AU7 to pins 4 and 1 of the 6SN7, respectively.
- 4. Plates: Connect pins 1 and 6 of the 12AU7 to pins 5 and 2 of the 6SN7, respectively.



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HOFFMAN

MODEL 612 CHASSIS 142

Hoffman Model 612 is a 24 tube table model with a 6 inch speaker and an audio power output of 3.0 watts. A 12 inch picture tube is used. Its major components are: Chassis - 142

- Speaker 6" PM (Part No. 9062 voice coil, 3.2 ohms at 400 cps.)

Cabinet - Part No. 7533

Escutcheon Frame - Part No. 2277

Filter Plate Glass - Part No. 734

Picture tube - 12KP4, 12LP4, L2QP4

SYLVANIA

MODEL 74M CHASSIS 1-356(C05)

Sound I-F Limiter (Circuit Change)

- 1. Resistor R-104 (120 ohm) is removed from the cathode (pin 7) of the Sound I-F Limiter (V-10, 6AU6) and the cathode is connected directly to ground.
- 2. Capacitor C-104 (.2µf, 400v), connected from the bottom of T-52 (sound discriminator transformer primary) to ground, is removed from the circuit.
- 3. Resistors R-105 (33K, ½w) and R-106 (10K, ½w), connected to the screen grid of the Sound I-F Limiter (pin 6 of V-10, 6AU6), are removed from the circuit.
- 4. Pin 6 of V-10 is connected to the bottom of T-52.
- 5. Resistor R-107 (33K, ½w), connected between the bottom of T-52 and the +125v supply, is changed to 22K, 1/2w (Service Part 181-0223).
- NOTE: Chassis coded C06 (Serial Nos. beginning 5606-) incorporate this change.

SYLVANIA

MODELS 22M-1, 23B, 23M, 24M-1 **CHASSIS 1-387-1**

3rd Video I-F Stage (Resistor Change)

Resistor R-140, in the grid circuit (pin 1) of the 3rd video i-f tube (V-5, 6BA6), is changed from 27K, ½w to 22K, ½w (Service Part 181-02235).

NOTE: Chassis coded C01 (Serial Nos. beginning 87101-) incorporate this change.

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To All Purchasers of: RIDER'S TV

Please do not forget to fill in the registration coupon on the first page of your Rider TV 10 Manual and send it to us if you have not done so already. We will forward the replacements parts listing corrections direct to your address. Also, by returning this coupon to us, you will be assured of having your name on our mailing list for exclusive, replacement parts information that will be available to TV 10 owners. Do Not send us the replacement parts pages!

Here are more data that will keep your RIDER'S DEPENDABLE REPLACEMENT PARTS LIST-ING published in TV Volume 10 up to date.

ADDITIONS TO PHILCO VARIABLE RESISTANCE CONTROLS SECTION:

						REF	LACEMEN	NTS										
PHILCO	CLAROSTAT			IRC					MALLORY									
Part No.	Cat. No.	Kit No.	Inner Shaft	Switch No.	Stock No.	Kit. No.	Panel Elem,	Rear Elem.	Outer Shaft	Inner Shaft	Switch No.	Stock No.	Kit. No.	Panel Elem.	Rear Elem.	Outer Shaft	Inner Shaft	Switch No.
33-5546-41 33-5563-42 33-5563-42 33-5563-43 33-5563-43 33-5563-50 33-5563-51 33-5564-14 33-5565-17 33-5565-31 33-5565-32	A43-10K A10-10K RTV-345 RTV-241 RTV-360 RTV-358 RTV-359 AT-116 AG-55-S AG-44-S AG-85-S AG-84-S		FKS 1/4 FKS 1/4 FKS 1/4 FKS 1/4 FKS 1/4 FKS 1/4 FKS 1/4	SWA	WK-10000 4WK-10000 QJ-391 QJ-302 QJ-356 QJ-356 QJ-357 Q18-139X Q11-140 Q11-123 Q11-14 Q11-239	K-2 K-2 K-2 K-3	W17-111 B11-125 B12-141 B11-123 W17-111	WR11-116 B11-130 B18-139X B11-130 B11-128	P3-129 P1-200 P1-200 P1-200 P3-131	R8-213 R1-216 R1-216 R1-216 R1-216	76-1	M10MP UT451 SU46 SU35 SU67 SU565		UF54L WF252	UR25AL UR15L			US26

ADDITIONS AND CORRECTIONS TO FIXED CAPACITORS SECTION:

Part No.

Set Mfr.

Set Mfr. 's Original

Belmont	8C-18487	Add AFH4-82 to Aerovox column
Packard-Bell	23936	Change BPD-, 0015 mf to SI-2-1500 mmf in Aerovox column.
0		Change K071 to G071 in Cornell-Dubilier column.
a .	3.4	Change DC-5215 to UC-5212 in Mallory column.
	ir -	Change 5HK-D15 to 5GA-D15 in Sprague column.
та –	23955	Change K078 to KD077 in Cornell-Dubilier column.
8 3		Change UC-5240 to DCD524 in Mallory column.
ů.		Change 5DA-D4 to 5HK-2D4 in Sprague column.
) i	23956	Change 1468L-HV 47 mmf to HVD30-47 mmf 10% in Aerovox column.
11		Delete 5P20Q47 in Cornell-Dubilier column. No replacement.
- + +	- <u>1</u>	Delete MCL-447 in Mallory column. No replacement
FT 1		Change 60GAB-047K to 20GAB-047K in Sprague column
	23967	Change 1468L-HV-100 mmf to HVD15-470 mmf in Aerovox column
n	11	Delete 5P10T47 in Cornell-Dubilier column. No replacement
1 at 1		Delete MCK-347 in Mallory column. No replacement
1	23959	Change MMA20T5 to MMC-20T5 in Cornell-Dubilier column
Philco	30-2417-3	Add PRS50-10 to Aerovox column.
	**	Add BR-105 to Cornell-Dubilier column.
		Add TC-32 to Mallory column.
	.11	Add TVA-1304 to Sprague column.
a	30-2417-7	Add BBR-2-50T to Cornell-Dubilier column.
	30-2570-57	Add D111 to Cornell-Dubilier column.
1.0	**	Add FP476 to Mallory column.
0	30-2570-66	Add XA004 to Cornell-Dubilier column.
"	and the state of the second states of the second	Add FP117 to Małlory column.
	30-2584-9	Add D111* to Cornell-Dubilier column.
		Add FP344.5 to Mallory column.
	30-2584-15	Add UPT 435 to Cornell-Dubilier column
	11	Add FP225-TC72** to Mallory column.
Stromberg-Carlson	111082	Change PRS 15/500 to PRS 12/500 in Aerovox column.
	111094	Change TVL-2764 to TVL-4840*** in Sprague column.
		Change FP238 to FP476*** in Mallory column.
	111095	Change FP476* to FP238 in Mallory column. Delete "Remarks" column.
1 S S.	"	Change TVL-4840* to TVL-2764 in Sprague column. Delete "Remarks" column.

*Parallel 20 mf and one 20mf/3000VDC section to replace original 30 mf section. **TC72 tubular electrolytic used in place of 10mf/450V section of original unit.

***Omit one 10 mf section.

0



THE INSTRUMENT THAT DEMANDS FROM THE TUBE UNDER TEST!

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PRINTED ELECTRONIC CIRCUITS

(Continued from page 3)

The painting technique has the advantage of requiring a minimum of auxiliary equipment and so has been the most popular type for experimentation and design work with printed circuits. It is also the best method to use in making repairs on printed circuits, as will be discussed later.

The spraying method of reproducing printed circuits differs from the painting technique in that the conductors are sprayed onto the surface of the base. Both molten metals and metallic conducting paints may be applied in this manner. In some processes, stencils are used to define the circuit conductors. In others, grooves are machined or molded in the base material where a conductor or other circuit component is desired. Grooves may also be formed by sand-blasting through a stencil. Metal is then sprayed over the entire base plate, filling the grooves and covering the spaces between. The surface is then milled off, removing the excess metal and leaving only that in the grooves. High conductivity is obtained by this method since relatively large conductors are formed in the grooves. Standard

the work. Metal evaporated from a heated filament, or other source of metal vapor, is distilled on the printed circuit plate placed over it. In either type of vacuum processing, it is unnecessary to further heat treat br fire the deposited metal. Only thin films are usually deposited in this manner. If greater conductivity is required, conductors may be built up by electroplating.

In the chemical-deposition methods of making printed circuits, the techniques employed are similar to those used in silvering mirrors. A silvering solution, consisting of ammonia and silver nitrate mixed with a reducing agent, is poured on the chemically clean surface to be coated. The confines of the solution are controlled by an adhesive stencil. The metal films obtained are usually too thin to permit direct soldering, but may be built up by repeated coatings or by plating. The chemical processes have not been applied as extensively as those discussed above.

The metal stamping technique has been used principally to print loop antennas on the back covers of radio receivers. However,



tube sockets and other components are sometimes connected to sprayed circuits by mounting them on the opposite side of the base plate so that the terminals protrude through holes into the grooves. Then, when the circuit is sprayed, connections are automatically made to the conductors. Circuit cross-overs are made in a manner similar to that employed in the painting process. Resistors, capacitors, and inductances may also be formed by spraying.

The vacuum evaporation process of circuit printing consists of evaporating a metal such as silver, copper, or nickel onto the surface of the dielectric material by melting the metal in a vacuum. A mask or stencil on the surface of the insulator is used to outline the circuit desired. In one such process, called "cathode sputtering", a high voltage is applied between the source of metal vapor (the cathode) and the work upon which it is to be deposited (the anode). The metal vapor is thus drawn to the work by electrostatic forces. Only a "rough" vacuum, such as can be produced by a good mechanical vacuum pump, is required for this process.

Another vacuum process used is very similar to cathode sputtering except that no voltage is applied between the cathode and other types of circuit wiring have been produced by this method. A die, bearing the outline of the desired circuit, is used to press a thin metal foil into the surface of a plastic or other insulator. In the same operation the sharp edges of the die cut the metal sheet to the desired shape. The metal sheet may be backed by an adhesive to insure a good bond. Circuits made in this manner have good conductivity.

The last general type of printed circuit is produced by a process known as "dusting". In this method, a powdered metal is dusted onto the insulating base plate and fired in place. The cricuit outline is defined either by coating the entire insulator with a sticky substance and applying the metal powder through a stencil, or by applying the bonding substance through the stencil and then dusting on the powder so that it is held in place by the adhesive until fired.

Servicing Printed Circuits

As was mentioned above, the most convenient method of making repairs and replacements in printed circuits is the brushapplied painting technique. Kits of such paints, including both conductor and resistor mixtures, are commercially available.



First in a brand new series of practical books that will give you the exact directions for correcting TV receiver performance "bugs." Each remedy is the one developed by the receiver's own manufacturer. It is positive! Each cure is official, factoryauthorized. It will help correct some of the most difficult faults—picture jitter, hum, instability, buzz, tearing, etc.

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PRINTED ELECTRONIC CIRCUITS

(Continued from page 17)

Most of these paints require no heat for drying, so that they may be used for repairing circuits having parts which cannot be subjected to high temperatures. This is an important precaution when working with circuits printed on certain types of plastic.

Although subminiature tube sockets are sometimes used with printed circuits, tubes are frequently connected directly to metal eyelets in the base plate, as in Fig. 1. When replacing tubes connected in this manner, care must be exercised to avoid the use of excessive heat during soldering operations. Soldered connections may also be made directly to printed conductors if the base material will stand the heat involved.

A solder containing a small percentage of silver should be used for best results. Where soldering is inadvisable, connections to tube leads and other wires should be made with metallic paint.

Printed resistors which have become defective may be repaired or replaced by the painting technique. Defective resistors are located in the usual manner with an ohmmeter. If it becomes necessary to "disconnect" a printed resistor from the circuit for a resistance check, this may be accomplished by scratching through the printed conductor lead with a sharp instrument. If defective, the resistor may be repaired with resistive paint. It will usually be found to be open or high in value. In such cases, additional resistive paint should be applied over the old resistor to reduce its resistance to the

proper value. Some commercial printed circuits have a protective layer of lacquer over the conductors and particularly over resistors to prevent moisture absorption. This coating must be completely removed before repairing resistors. If attempts to repair defective resistors are unsuccessful, the old coating should be removed completely and a new resistor painted in its place. The proper dimensions may be determined by trial and error, keeping in mind that the resistance is directly proportional to the length, and inversely proportional to width and thickness. The resistance material must make good contact with the printed conductors at the ends. Breaks introduced in the conductors to isolate resistors may be repaired with a bridge of conducting paint.



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New Horizontal Output Transformer May Be Replaced Easily

One component with a high mortality rate is the horizontal-output transformer. Not much was done to alleviate the replacement problem. To those who have undertaken such replacement, the tedious and delicate procedure can be well appreciated.

In the new Stewart-Warner 9300 television chassis, a realistic approach has been taken to the problem. The horizontal-output transformer (shown here) is simply mounted



New Horizontal Output Transformer.

and connectors are employed rather than soldered leads. With this transformer, it is not necessary to remove the high-voltage rectifier tube socket from the chassis merely to replace the filament leads, nor is it necessary to postpone replacement of the transformer as a last resort because of the work involved.

To replace the horizontal-output transformer, it is only necessary to remove two sheet metal screws and unplug the leads. The entire replacement procedure does not require much more than five minutes, and can be done in the customer's home without removing the chassis and without the use of a soldering iron.

TV SUPPLEMENTARY SHEET NO. 1

MODEL &	PART F	CATALOG #	FUNCTION	DESCRIPTION	UST	MODEL &	PART !	CATALOG !	FUNCTION	DESCRIPTION	LIST
ADMIRAL						AMBASSADOR		F.	1		
22A2,A 22M1	7581-50	AG-83-5 KSS-3	Tone	2 Meg.Ω carbon	\$1.25		VC-12121C	AG-84-5 FKS-1/4	Height	2.5 Meg. Ω carbon	\$1.2
2211	75811-20	RTV-327	Contrast/ Vol./Sw.	1500/1 Meg. Tap 500K Ω Canc. Dual carbonSPST	\$4.30		VC-12127B	RTV-297	Contr ast/ Vol./Sw.	750 Tap 500/250K Ω Conc. Dual carbon SPST	\$4.3
	75B13-3	AG-84-5 FKS-1/4	Height	2.5 Meg, Ω carbon	\$1.25		VC-12131C	AG-44-5 KSS-3	Hor. Hold	50K Ω carbon	\$1.2
	75813-7	AG-15-5 FKS-1/4	Vert. Lin.	-3000 Ω carbon	\$ 1.25		VC-12132C	AG-83-5 KSS-3	Vert, Hold	1.3 Meg. Ω carbon	\$1.2
	75B13-12	AG-49-5 K\$\$-3	Bright.	100K Ω carbon	\$1.25		VC-12135	AG-49-5 FKS-1/4	Bright	100K Ω carbon	\$1.2
	75B13-13	AG-40-5 KSS-3	Hor. Hold	25K Ω carbon	\$1.25	ANDREA 2C-VL20	GRV-812-1	AG-83-5	Height	2 Meg. Ω carbon	\$1.2
	75B13-14	AG-61-5 KSS-3	Vert. Hold	l Meg. Ω carbon	\$1.25		GRV-824	A43-2000	Vert.	2000 Q 2w-w.w.	\$1.2
	75B13-16	A43-750 KSS-3	Focus	750 Ω 2W-W.W.	\$1.25	CHASSIS	GRV-830	AG-50-Z	Vol./Sw.	500K Ω carbonSPST	\$1.2
AMBASSADO	R					VL-20	0.001	13-0/5118	. A.	SOK D Mar Care	
C 1720 C2020	131-0001	AG-19-5 FKS-1/4	Vert. Lin.	5000 Ω carbon	\$1.25		GRV-831	RTV-75	Hor./Vert Hald	Dual carbon	33.10
C2420 CD2020	131-0002	AG-84-5	Height	2.5 Meg. Ω carbon	\$1.25		GRV-834	KTV-300	Contrast	carbon Conc. Dual	1 4.0.
r2020	131-0003	FKS-1/4 RTV-1	Contrast	10K/IMeg. Top	\$3.70	AR14L AR17L	P-2	AG-19-5 FKS-1/4	Vert. Lin.	5000 Ω carbon	\$1.2
			Vol ./ Sw.	carbonSPST	\$1.25	17CRR 17ROG	P-5	AG-84-5 FKS-1/4	Height	2.5 Mey. Ω carbon	\$1.2
	131-0012	KSS-3	Hold	50K O carbon	\$1.25	203D 1000	P-7	AG-60-Z FS-3/SWB	Vol./Sw.	500K Ω carbon SPST	\$1.25
	131-0012	KSS-3	bright.	JOR SECOND		2nd Run	P-12	AG-8-5	AM-Rejection	1000 Ω carbon.	\$1.2
	131-0013	AG-61-5 K\$\$-3	Vert. Hold	1 Meg. Ω carbon	\$1.25		PD-5	RTV-146	Vert./Hor.	Meg./50K Ω	\$3.1
	131-0014	RTV-10	Focus	5090 Ω 4W-W,W,	\$1.85		PD 6	PTV 252		Conc. Dual corbon	
HAMT, MTS	VC-12120B	AG- 19-5 FKS-1/4	Vert. Lin.	5000 Ω carbon	\$1.25	MST_12	P 2	KIV-233	Bright.	Conc. Dual carbon	\$3.1
MT, MTS	VC-12121C	AG-84-5 FKS-1/4	Height	2.5 Meg. Ω carbon	\$1.25	MST 14 14TR 16TP	P_5	FKS-1/4	Lin.	Duou Ω carbon	\$1.2
	VC-121278	RTV-297	Contrast . Vol . / Sw .	750 Tap 500/250K Ω Conc. DualSPST	\$4.30	17CD 17CRR	P_4	FKS-1/4	Fear	2.5 Meg. Q carbon	\$1.25
	VC-12130	AG-49-5	Bright.	100K Ω carbon	\$1.25	20CD 20TR		FKS-1/4	rocus	1300 12 W-W.W.	\$1.85
	VC-12131	AG-44-5	Hor.	50K Ω carbon	\$1.25	112X 203D 312	P-7	AG-60-Z FS-3/SWB	Vol./Sw.	500K Ω carbon SPST	\$1.25
	VC-12132B	AG-83-5 KSS-3	Vert. Hold	1.3 Meg. Ω carbon	\$1.25	819 3163CR 8163CR	PD-4	RTV-145	Contrast/ Bright.	750 Ταρ 250/100 ΚΩ 2W-W.W./carbon Conc. Dual	\$3.70
M-17C, CB,C1M	PT-1002	RTV-252	Contrast Vol./Sw.	750 Tap 250/250K 2W-W.W./carbon Conc. DualSPST	\$4.30	8193CM 1st Run /	PD-5	RTV-146	Vert./Hor. Hold	l Meg./50ΚΩ Conc. Dual carbon	\$3.10
M-20C, T PL-17CB, CG,	PT-1004	AG-19-5 FKS-1/4	Vert. Lin.	5000 Ω carbon	\$1.25	ARVIN 5175 5176	E22464-17	RTV-258	Contrast/ Vol./S w .	25K/3 Meg. Tap 1 Meg. Conc. Duol	\$4.30
20C 13P	PT-1005	AG-84-5 FKS-1/4	Height	2.5 Meg. Ω carbon	\$1.25		E22464-20	RTV-259	Vert. Lin./	carbonSPST 3000/2.5 Meg.	\$3.10
	PT-1007	AG-49-5 KSS-3	Bright	100K Ω carbon	\$1.25	CRASSIS	522464 34			2W-W.W./carbon Conc. Dual	
	PT-1008	AG-61-5 KSS-3	Vert. Hold	1 Meg. Ω corbon	\$1.25	1,020	E22464 35	KSS-3	Dright,	IVUK Ω corbon	\$1.25
	PT-1009	AG-44-5 KSS-3	Har. Hold	50K Q carbon	\$1.25		E22464 34	MFR.	Phono Sw.		
OPC OPCS	VC-12120B	AG-19-5 FKS-1/4	Vert. Lin.	5000 Ω carbon	\$1.25		E22444 07	KSS-3	Hold	1.5 Meg. Ω carbon	\$1.25



This supplementary sheet is for use as an up-to-theminute addition to your Clarostat RTV Manual. Manuals are available through your distributor or directly from Clarostat. Price \$1.00.

CLAROSTAT MFG. CO., INC. DOVER, NEW HAMPSHIRE

Form No. 751835010-5M-11/52

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A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: Since the last reported period, fewer manufacturers were engaged in "change activity". TV and radio receiving tube manufacturers are continuing their tendency toward in-creasing prices, while other product group price changes remain spotty with no apparent trend.

New Items

- AEROVOX -EROVOX — Introduced a number of new items including AFH triple and quad electrolytic capa-
- citors. AMERICAN ELECTRONICS Added No. 4-01, (1-10 Rocklet at \$ 50 dealer net . . . No. 103-01,

- including AFH triple and quad electrolytic capacitors.
 AMERICAN ELECTRONICS Added No. 4-01, Code Booklet at \$.50 dealer net . . No. 103-01, Advanced Course at \$6.95 dealer net and Individual Records at \$1.40 dealer net.
 AMERICAN PHENOLIC Added Model 114-053, UHF bo-ty antenna at \$3.00 dealer net . . . Model 114-560, UHF bo-ty reflector at \$1.65 dealer net and Model 114-558, UHF bo-ty stacking harness at \$.36 pr/dealer net.
 BELL SOUND SYSTEM Added Model 372MB, 30 watt mobile amplifier at \$165.00 dealer net.
 BRIDGEPORT BRASS Added Model 372MB, 30 watt mobile amplifier at \$165.00 dealer net.
 BRIDGEPORT BRASS Added Model V-8, VHF antenna at \$25.50 dealer net, . . . Model U-4, UHF antenna at \$5.97 dealer net . . . Model U-4, UHF antenna at \$5.97 dealer net and Model 110T22, vibrator converter at \$47.31 dealer net.
 CREST LABS. Added laminated miniature sockets No. 49-6H at \$1.35 dealer net and No. 49-7H at \$1.80 dealer net.
 GENERAL ELECTRIC Added germanium transistors 4JAIA1 at \$1.95 dealer net . . . Model RPX-042, variable ret. Also added Model UPX-009, pickup and transcription arm at \$9.33 dealer net . . . Model RPX-042, variable reluctance cartridge at \$5.28 dealer net and Model RPX-042, variable reluctance cartridge at \$5.28 dealer net and No. 3027, cascade pre-amplifier at \$9.95 dealer net. . . Model RPX-051, triple play variable reluctance cartridge at \$5.28 dealer net and No. 3028, signal slicer at \$29.95 dealer net and No. 3028, signal slicer at \$29.95 dealer net and No. 3028, signal slicer at \$29.95 dealer net. Added Slieneer in quart size at \$6.50 dealer net. Added Model LWF line at \$7.08/100 ft. dealer net. . . No. 3027, cascade pre-amplifier at \$29.95 dealer net. . . Model Slieneer in quart size at \$6.50 dealer net. Added Model LWF line at \$7.08/100 ft. dealer net. . . No. 3027, cascade pre-amplifier at \$29.95 dealer net. . . Model Slieneer in quart size at \$6.50 dealer net. Added Slieneer in quart size at \$6.50 dealer n

- T2W, 12 Wall Bracket and Model 7W, 7 Wall bracket.
 MERIT TRANSFORMER Added Model HVO-11, transformer at \$5.40 dealer net.
 MINNESOTA MINING Added 7" (1200') professional reel and box (plastic) at \$1.25 list.
 RADIO CITY PRODUCTS Added 7" (1200') professional reel and box (plastic) at \$1.25 list.
 RADIO CITY PRODUCTS Added a number of new items including Model 345, super vacuum tube voltmeter at \$47.50 dealer net and Model 8873, TV servishop at \$139.95 dealer net.
 R.C.A. Added radio receiving tubes 6AR5 at \$1.65 list ... 6AX4GT at \$2.40 list and 6K8G at \$3.30 list. Also added electron tubes 3C45 at \$17.80 list ... 91 at \$30.00 list ... 5718 at \$8.65 list and 6211 at \$2.95 list.
 RAYTHEON Added 6AH6V, radio receiving tube at \$3.90 list, a miniature sharp cut-off pentode having high transconductance and low input and output capacitances, and is designed specifically for television amplifier applications.
 REEVES SOUNDCRAFT Added soundcraft 45 rpm recording disc at \$6.66 dealer net.
 STANDARD TRANSFORMER CORP. Added deflection yokes Model DY-11A at \$6.00 dealer net.
 STROMBERG-CARLSON Added radio receiving tubes 6T4 at \$3.50 list. ... 1NRB at \$2.65 list ... 40B2 at \$3.50 list. ... 6N76TA at \$2.20 list and sub-miniature tubes 1T6 at \$2.05 list ... 6BF7 at \$1.85 dealer net.

(Continued on page 24)

Replacement Parts

(Continued from page 8)

percentages, and sometimes in a value of capacitance, whichever is the greater of the two. As to minimum tolerances, they vary with the type of component. For example the minimum tolerance generally considered in ceramic dielectric capacitors and in silver mica capacitors is ± 1 percent. In the plain foil mica dielectric unit it is ± 2 percent, whereas in paper dielectric capacitors it is \pm 5 percent. In electrolytic capacitors the minimum tolerance is 10 percent.

While on the subject of tolerances it is necessary to comment that the minimum tolerances quoted here are not necessarily the standard tolerances which are used for components in television (and radio) receivers. The high order of accuracy indicated by these minimum tolerances are seldom applied to household electronic equipments. The figures used are much more liberal, but none the less important as far as accomplishing a desired result, hence demanding recognition by the service technician who is making a replacement. It is because of this that television receiver manufacturers frequently list the capacitance tolerance in their service literature, and why the Rider Replacement Parts Program listings of capacitors always state the capacitance tolerance.

Each type of capacitor bears a standard tolerance figure plus and minus. The list shown below indicates the range of tolerances associated with capacitors used in household electronic appliances such as television and radio receivers. Attention is called to the fact that we have omitted the full gamut of capacitance tolerances which are available on request from capacitor manufacturers; instead we show only those values which appear in the capacitor specifications set by the receiver manufacturers for capacitors used in their television and radio receivers, and whatever other electronic products they make for public consumption. The list which follows applies to capacitors in excess of 10 µµf. Lower values of capacitance have already been dealt with.

It is understandable that every single capacitance tolerance figure which is used in the industry is not listed here. But it can be said that those which represent the vast majority are included.

It also is important to state that the letter code shown on this listing corresponds to the coding in capacitor specifications contained in capacitor manufacturers' catalogs and in RTMA as well as JAN specifications. We have however omitted the letter coding indicative of 1, 2 and 3 percent capacitance tolerances. These are F, G and H respectively, although the letter H when applied to ceramic units indicates 2.5 percent.

Finally, attention is called to the possibility of confusion between the capacitance tolerance code letters and the Temperature Coefficient as well as the Temperature Coefficient Tolerance code letters. While similar code letters apply to all of these, their meanings are completely different.

Type of Capacitor Mica	Standard Industry Capacitance Tolerance in Percent	Capacitan Toleranc Values Us in Percer	ice re sed at	Letter Code
(Plain)	± 20	<u>+</u>	20	м
(1	101	· +	10	K
(Silver)	+ 5	.+	10	K
(BIIVEI)	- 0		. 10 . 5	T
Ceramic		-		J
(GP)#	± 20	<u>-+-</u>	20	М
		+	10	K
e "		<u>+</u>	5	T
(GMV)*	+ 100			2
, ,	and -0	+100 -	- 0	
		+100 -	- 20	
(TC)**	± 10	+	10	K
(10)	10	-+-	5	Ţ
Paper				J
Dielectrie	+ 20	• • •	90	м
Dielectric	- 40	+	10	v
		<u>بن</u> نور.	10	Γ. Ť
			0	Ţ
		+ 60 -	- 25	
		+ 40 -	20	
		+ 40 -	- 15	
		+ 40 -	10	
		+ 20 -	· 10	
Electrolytic				
(Tubular)		+100 -	10	
		+150 -	10	
		+250 -	10	
(Can)		+ 40 -	10	
` ·		+ 50 -	10	
		+100 -	10	
		+150 -	10	
# Concert Due		1 200	~~	

General Purpose * Guaranteed Minimum Value ** Temperature Compensating

Applications of Capacitance and Capacitance Tolerance. How are these two constants used? . . . To begin with, the capacitance required in a circuit is a function of the design of the system which uses it. Among the constants of the circuit is the amount of capacitance required. But seldom, if ever, is this value an absolutely precise one; invariably it is an approximation, although it is stated as a definite amount as that value which most closely approximates the nearest standard value. We refer to it as an approximation because the capacitance value indicated is \pm a certain amount of capacitance. For instance the capacitance specified by a receiver manufacturer for a circuit may be 0.0022 μ f ± 10 percent. Assuming all other conditions satisfied, any value of capacitance between 0.00198 μ f and 0.00242 μ f seems suitable.

The conclusions accompanying the example are correct except for one additional consideration. Suppose we deal with the 0.0022 µf unit. In order to be a suitable replacement within the stated 10 percent capacitance limits, the value must be a measured value for the replacement unit. If this is not so, but instead a capacitor labelled (Continued on page 23)



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22

Replacement Parts

(Continued from page 20)

with the standard value of say $0.002 \ \mu f$ (which is within tolerance of the original) is contemplated, what must be its tolerance? If it conforms with standard industry practice, namely ± 20 percent, then it could have any value between $0.0016 \ \mu f$ and $0.0024 \ \mu f$. Obviously it would be within tolerance on the high side but not on the low side.

Suppose that the contemplated replacement rated at 0.002 μ f was within a \pm tolerance of 10 percent, what then? On the low side it would have a value of 0.0018 μ f and on the high side it would be 0.0022 μ f. Again it is within tolerance on the high side but outside the tolerance on the low side.

Suppose we consider the next higher standard value, say $0.0025 \ \mu f$ for the replacement. Would any normal tolerance satisfy? With a rating of ± 10 percent, the low limit would be $0.00225 \ \mu f$ and the high limit would be $0.00275 \ \mu f$. Now the contemplated replacement is within tolerance on the low side but beyond tolerance on the high side . . . Is there any answer?

Of course there is! But before we describe it, we might present another practical question - how important is the capacitance tolerance? . . . A simple reply is to say that it all depends on the circuit where the capacitor is used. But this is a very indefinite answer. We know that bypassing capacitance values are not as important as capacitance values related to time constant circuits, or resonant circuits or coupling circuits. But does it make sense to set up a tolerance on the tolerance in each and every particular application of a capacitor? To do this involves something else – namely complete knowledge concerning the conditions established by the design engineer in every section of a television receiver which he designed . . . This is very difficult to determine. It is much easier to recognize the requirements established in the design of the receiver as indicated by the constants of the capacitor, and to satisfy these requirements of capacitance and capacitance tolerance.

To do this is simple. It means nothing more than the procurement of a capacitor rated at the same nominal capacitance and capacitance tolerance as the original. This is no problem because design engineers are using standard values, and capacitor manufacturers, are making them. We admit that procurement practice of this kind for replacement purposes is somewhat of a departure from past tactics, but to adopt it makes most sense, because it enhances the possibility of making the proper repair and attaining best performance from the receiver.

The above suggestion to follow the capacitance tolerance stipulated for the original is subject to some qualifications, especially in the case of paper dielectric and electrolytic capacitors. Some of the tolerance percentages are different for the + side than for the - side, as for example + 60 percent and - 20 percent. In that event a variety of selections is available. Assuming the same nominal value of capacitance, say 0.005 μ f for the original and the contemplated replacement component, a replacement rated at any value of + tolerance between 0 and 60 percent and - tolerance between 0 and 20 percent obviously is suitable.

But the leeway for selection is even greater than described. With a 60 percent tolerance on the + side, the upper limit is 0.008 μ f. On the - side, it is 0.004 μ f. Under the circumstances, any standard value of capacitance which, with its rated tolerance limits falls within these two extremes of capacitance, is suitable as a replacement as far as capacitance is concerned. Naturally, any capacitor whose *measured* values fall within these limits is satisfactory capacitance-wise.

The use of + 60 percent and - 20 percent as capacitance tolerances are purely illustrative. It could just as soon be + 100 percent and - 10 percent, as in some electrolytic capacitors. The same reasoning applies to any other set of capacitance values established by the tolerance limits for any type of capacitor. The more liberal the capacitance tolerance figures, the easier is it to find a suitable replacement in terms of capacitance. It is only when the capacitance is relatively small, say between 10 $\mu\mu f$ and 100 $\mu\mu f$ and the tolerance is severe, say 5 percent or even 10 percent in both directions - that it becomes difficult to find a replacement other than one which parallels the original in nominal capacitance and tolerance. Occasionally this happens with higher values of capacitance.

Two other items warrant comment, even if not complete at this time. One of these pertains to possible misinterpretation of these references to satisfying the capacitance requirement. This should not be construed as implying that as long as this constant and the tolerance constant requirements are met, free interchangeability exists between capacitor types. This is not so, for reasons which will become evident when the other constants are discussed.

The second item is a slight elaboration of a point already raised concerning capacitors rated at 10 $\mu\mu$ f and less. There isn't too much margin in these values for the selection of one standard value for another, based on the capacitance tolerance. One or two micromicrofarads do not seem like too much capacitance but when dealing with very small values to begin with, they represent high percentages. Moreover the selection of these small values is based on engineering requirement, and it is best servicing practice to comply with these needs, even if the reasons for their existence are not immediately apparent.



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Radio's Master Reports

(Continued from page 20)

- TRICRAFT PRODUCTS Added Model U-1, UHF antenna at \$7.50 dealer net. TRIPLETT ELECTRICAL INSTR. Added No. 9989, signal tracing probe at \$9.50 dealer net, for use with Model 3441 TV-FM oscilloscope and BV adaptor for TV picture tube tests at \$7.90 dealer net.
- BV adapton to dealer net. TV WIRE PRODUCTS Added new series, formvar covered copperweld, at \$4.72 dealer net, per 100 feet and at \$47.21 dealer net, per
- 1000 feet. VACO PRODUCTS Added No. RT-14, handy service kit, complete with 7 nut drivers, 2 Philips and 3 regular drivers plus extension piece at \$7.34 dealer net. WEBSTER-ELECTRIC Added No. 90-25, sepa-rate teletalk amplifier for paging at \$120.00 list and 15 pair plastic interstation cable and junction box at \$.34 list (on reel).

Discontinued Items

- DISCONTINUED ITEMS ADVANCE ELECTRIC & RELAY -- Discon-tinued Model 400M, transmitter relay. AMERICAN PHENOLIC -- Discontinued Model 14-358, twin lead transmission wire . . . Model 187-072 and Model 187-079, molded polethylene rims and Model 509, rotator. Model 14-298, 100, 500, 1000 feet, remote control wire, temporarily discontinued

discontinued. CLAROSTAT -- Discontinued wire wound control

- 43-7000. ELECTRONIC TECHNICAL INSTITUTE Discontinued Model 5207, Novice 80-M transmitter kit. GENERAL ELECTRIC — Discontinued Model
- RPX-046, broadcast type variable reluctance cartridge. Also discontinued G-10 series of transistors. GON-SET
- ON-SET Discontinued Model 3005, tri-band amateur converter and their Gonset radarray

KENWOOD ENGINEERING-Discontinued Model

- 140, 7" wall bracket.
 POTTER & BRUMFIELD Discontinued LC and LP series of plate circuit relays.
 SHURE BROS. Discontinued Model 55 and Model 556, multi-impedance, super-cardiod micro-reburget.
- SIMPSON ELECTRIC Discontinued Model 340,
- signal generator. STROMBERG-CARLSON -- Model RD-22, driver

unit, discontinued. SUPREME, INC. — Discontinued Model 675,

Signal generator.
 WEBSTER-ELECTRIC — Discontinued Model 53D50, teletalk amplifier for paging and Model 5C45, speaker microphone.
 WIRT PRODUCTS — Discontinued auto radio ignition suppressors S-915 and S-918.

Price Increases

- ASTATIC CORP. Increased price on "scanafar" booster, Model CT-1 to \$21.00 dealer net. BLONDER-TONGUE Increased price on Model MT-1, matching transformer to \$3.90 dealer net. CORNELL-DUBILIER Increased price on Model 8BD, "hi-ball" auto aerial to \$3.03 dealer
- DUMONT LABS.
- LABS. Increased price on two 12". four 17", four 20", and three 21" TV one 16", fou picture tubes
- picture tubes. FISHER RADIO CORP. Master audio control, Model 50-C, increased to \$97.50 dealer net. GENERAL ELECTRIC Radio receiving tube 6BA7 increased to \$2.50 list. Also increased one 12", three 17", one 20" and one 21" TV picture tubes ubes
- GON-SET ON-SET — Increased price on Model 1531, rhombic UHF antenna, with 9' mast to \$7.77 dealer net
- HICKOK ELECTRICAL INSTR. -- Increased price on Model 605, portable all-purpose tube and set tester to \$184.50 dealer net.

COMING IN APRIL RIDER'S TV11

R.C.A. — Increased price on Model WO-88A, 5" oscilloscope to \$169.50 user price. Also increased power tube fittings 202F1 to \$23.85 user price ...211F1 to \$28.20 user price and 228F1 to \$67.60 user price. STROMBERG-CARLSON — Increased price on combas of items inclusion No. 2012

- \$67.60 user price.
 \$17.60 user price.</l

Price Decreases

- Price Decreases
 CREST LABS. Decreased price on cathode ray tube rejuvenators Model B to \$3.15 dealer net ... Model C to \$2.20 dealer net and Model D to \$2.60 dealer net.
 ELECTRONS, INC. Decreased price on grid control rectifier EL C6M to \$31.00 dealer net.
 GENERAL ELECTRIC Decreased price on TV picture tubes 16KP4 and 16KP4A.
 GON-SET Decreased price on Gonset line to \$6.24 dealer net/100 feet.
 R.C.A. Decreased price on radio receiving tube 6L6G to \$3.00 list and electron tube 5654+t to \$4.90 list.
 WIRT PRODUCTS Decreased price on slide switches SW 723 to SW 726.

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In physical appearance deflection yokes for tv receivers have changed but little since the early models. However, electrically and magnetically the changes have been considerable.

In size, for instance, the first yokes were about three inches long and were designed to be used with small picture tubes having deflection angles of about 50 degrees. Present-day yokes run a maximum of two and one half inches long and are used for 66-degree and 70-degree tubes.

Electrically the old-style yokes used lower inductance horizontal coils (8 mh) while modern coils have inductances which run from 13 to 30 mh. At the same time, vertical windings have grown somewhat smaller, with inductances of about 30 to 40 mh, against the early 50 mh windings.

Magnetically, modern design employs ferrite cores in a yoke known as the *cosine yoke*. This yoke gives a notable improvement in focusing at the edges of the picture. This deficiency in performance of earlier yokes was generally ignored because of the use of smaller picture tubes. The design of these early yokes was primarily concerned with sensitivity of deflection and toward obtaining a perfectly rectangular raster with no sagging inward or bulging outward of the sides. The sagging inward is called "pincushioning" while the bulging outward is known as "barrelling."

The means employed to construct a cosine voke involves the correct distribution of the

winding. The cross section of the winding is not uniform as in the case of older yokes (see part A of Fig. 1). The turns near the inside of the winding are in a thin layer, and pile up to successively increasing thickness as the winding progresses away from the window (see part B of the figure). As a result of this type of winding arrangement, the distribution of magnetic flux threading through the neck of the tube is more uniform than with the old-style yokes. Because of this more uniform field, the focus of the spot toward the edges and the corners of the picture-tube raster is considerably improved.

As the electron beam, which has a definite thickness, passed through the nonuniform field produced by the conventional yoke, different portions of that beam experienced differing amounts of deflection force. As a result, an elongated spot was produced at the raster edges that resulted in an out-offocus condition. By causing the beam to travel through the more uniform field produced by the cosine yoke, uniform deflection of all parts of the electron beam occur, and a 500 minimum amount of defocusing takes place.

The arrangement of the conventional windings around the picture-tube neck can be seen in part A of Fig. 2. The deflection coils are shown in cross section here. The horizontal windings produce a magnetic field with vertical lines of force. This magnetic field produces horizontal deflection. The vertical windings produce a magnetic field

(Continued on page 10)

the cosine yoke



Successful Servicing, February, 1953

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3



*This material appeared originally in "The Aerovox Research Worker".

THE reproduction of electrical circuits on L insulated surfaces by various printing techniques has become a standard method of fabricating small, lightweight, economical electronic devices. The increased emphasis placed by the Armed Services and industry on miniaturization and ruggedness of electrical components has caused this innovation to assume vital importance. Printed circuitry is no longer confined to a few military devices and hearing aids, but may now be encountered in a large number of everyday equipments. These include speech amplifiers, portable receivers, citizens two-way radios, television receiver front-ends, f-m receivers, and many others. For this reason, a working knowledge of the design, production, and maintenance of such circuits will be a valuable asset to any worker in the electronics field. This article is concerned with a discussion of the general types of printed circuits, the relative advantages of each, and methods of effecting servicing repairs.

The use of printed circuitry has been revolutionary not only because it permits the fabrication of extremely small and rugged electronic components, but also because it reduces the production of such components to a simple, rapid operation which is almost completely devoid of the possibility of human error. By this method, a relatively unskilled operator can reproduce literally hundreds of complex units in the time formerly required to make one unit by old-fashioned "wire-by-wire" soldering techniques. In addition to electrical conductors, critical circuit components such as resistors, capacitors, and inductors can be "printed" into the circuit in the same operation and held to close, reproduceable tolerances. Fig. 1 shows a typical printed circuit and its schematic diagram.

Printed circuits are classified according to the method used to reproduce them. There are, at present, six general types. These processes are: painting, spraying, vacuum evaporation, chemical processing, metal stamping, and powdered metal dusting. Each of these general categories will now be discussed in some detail.

Printing Techniques

Probably the most widely used process for producing printed circuits is the *painting* technique. In this method, the conductors and other components of the circuit being fabricated are painted on the insulating surface which acts as the base for the circuit. The paint may be applied by hand with a brush, although in production operations the silk-screen stenciling process is more frequently used. Thin ceramic or plastic sheets may be employed for the base, or a metallic surface covered with an insulating lacquer may be used. In special instances, the glass envelope of a vacuum be applied in specific amounts to form resistors. Capacitors may be made by printing the plates on opposite sides of the base plate, if the required capacitance is small. Otherwise, small capacitors (such as the Aerovox Hi-Q BPD type disc ceramic) are connected to the printed circuit as in Fig. 3. It is interesting to note that these capacitors are manufacured by processes which are essentially printed circuit techniques. Inductances are produced by painting spirals of conducting paint on the surface of the ceramic or other base material. "Crossovers" in the wiring are made by planting one conductor directly over the other with a layer of insulating material such as lacquer between, or by "detouring" one conductor to the other side of the plate for a short distance by means of metal rivets or evelets through the insulator, as is illustrated in Fig. 4.

When all printed components have been painted in place, the entire assembly is "fired" at an elevated temperature to fuse the metal particles together and bond the circuit to the base plate. Temperatures ranging from room temperature for plastic bases to as high as 800 degrees C. for ceramics are used.

Vacuum tubes, external leads, and other components not printed are soldered to eyelets in the base plate as in Figs. 1 and 3. To take maximum advantage of the spacesaving properties of printed circuits, tubes of the subminiature type are usually employed.

(Continued on page 17)

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Curtain Time

Transistors and Replacement Parts

The last few months have witnessed increased activity in the publicity given to transistors and other semi-conductors. In fact, almost the entire November, 1952 issue of the *Proceedings of the IRE* was devoted to this fabulous device. One manufacturer already is offering one type of transistor for sale to experimenters.

No one has any doubt about the impact of the transistor on the entire electronic industry. This will occur when there are no uncertainties about its reproducibility in large quantities and with consistent performance characteristics – application to all present uses of vacuum tubes over the full gamut of frequencies. When all of this comes to pass, the effect will be the equivalent of a revolution in electronic components and design.

The miniaturization of all equipment will be one manifestation, although this program involving subminiature vacuum tubes and transistors, has been going on for years under the impetus of the Armed Forces equipment requirements. The trend to transistors or some other devices made of materials showing similar behavior will, without question, shrink the physical dimensions of electronic equipment to a small fraction of even the smallest vacuum tube device made today.

Forgetting vacuum tubes for the moment, a tremendous effect seems likely on companion units presently being used to supply operating power to the vacuum tubes. A great portion of the energy supplied to vacuum tubes is wasted in heat. This is not so in transistors; hence those devices which supply operating power to the vacuum tubes in equipment are subject to change to a great degree — if not elimination in their present form.

All of this will not happen overnight. Engineers involved in the research of transistor and similarly behaving materials are very reluctant to forecast when the change from vacuum tubes to some semi-conductor type of device will take place; estimates range from 4 years to 8 years. But who can tell? In the meantime, present-day designed equipments are still being sold in great quantities to the public. It is not a wild guess to say that before any major engineering change takes place in electronic equipments – television receivers especially – the nation's houses will contain from 40 to 50 million units, if not more. These receivers will require replacement parts for a long time, regardless of what radical engineering change may take place at the end of four or five years.

It is said that color television is on its way. It is highly doubtful if it will be a transistor-equipped receiver when it arrives, despite the fact that such a black and white receiver equivalent to 34 tubes has been shown already. All sound evaluations contend that the arrival of color television in a year or two, will still make use of vacuum tubes and present types of complementary equipments.

All in all, a tremendous market for replacement parts exists – and is destined to increase substantially in the immediate future. The concern which need be felt by those who are producing and selling these parts is a matter of the nature of their planning. How far in the future do they look? The receivers in the field – all kinds of receivers – must be serviced, and they require replacement parts. The table model radio displaced the console radio – but those consoles which were in people's homes were not discarded. They were serviced until television came along to grab the public's interest.

to grab the public's interest. The birth of a "hot" war may change some of this. If past performance is any sort of a barometer, an acceleration of technological development is a certainty. A part of this will be the transistor or its equivalent because of the unbounded interest in miniaturization of electronic devices for military uses. If this occurs, semi-conductor devices will emerge full fledged much sooner than would be the case with just a cold war in progress. But even then, public holding in electronic equipment will not be thrown away; they will require service and so, replacement part production, selling, and installation.

Summarizing the whole thing, there is every reason why all individuals affiliated with the electronic industry should take note of the progress being made in the semi-conductor phase of the art. The tube manufacturers have been doing this for a long time. But we can't see any reason for concern about inventories in parts manufacturing establishments, parts jobbers stocks, or service technician's parts stocks. Everyone will sell what they have, and what they will make and buy, for years to come.

TV Service

Questions asked here and there among those who are in a position to know indicate a definite improvement in the level of competency being demonstrated by TV service technicians. Taking into account the television receiver sales during 1952, and the total number in use across the nation, the proportion of complaints has decreased. This is especially true in the largely populated areas, where greatest density of receivers prevails.

Chassis Coding

The matter of chassis coding is still a problem in the field. In view of the practice by many television receiver manufacturers to show different schematics representative of different production runs, especially when changes have been made, it is of the utmost importance that the service technician be able to correlate correctly, with the appropriate schematic, the chassis in for service.

We don't know what the answer is, but isn't it possible to establish some common method of coding and also a common location for the coding symbol on the chassis? The former may be difficult because of the different systems firmly rooted in the factories, but the latter is not faced with the same problems. Even if the entire issue is not settled for some time, taking care of one detail at a time would help.

John F. Rider

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Replacement Parts in TV Receivers Part I-Capacitors (cont'd)

This is the fourth in a series of articles on "Replacement Parts in TV Receivers." "Capacitors" will be continued next month.

Preceding paragraphs dealt with the identification of capacitors according to their physical construction. This base gives rise to the major type categories. But in the final analysis the suitability of a capacitor for a particular use is only in part determined by its physical construction. Every capacitor within a major type group is not necessarily suitable for every application even if the function indicates the general category of type from which the selection should be made. Still another basis of selection must be applied in order to establish suitability.

For instance a mica capacitor is generally considered to be a suitable type of capacitor for use in tuned circuits. The same may be said for the ceramic dielectric unit. Yet every version of these two general types of units is not suitable for use in every resonant circuit. The same applies to the paper dielectric and the electrolytic capacitors relative to portions of the TV receiver which contain these types. The final indicator in the suitability of use are the constants of the capacitor.

Constants of Capacitors

The suitability of a capacitor for a particular application is determined by many factors. Among these are

- a. physical size
- b. capacitance
- c. operating voltage rating
- d. allowable variation in capacitance from rated value
- e. required change in capacitance with temperature
- f. allowable change in capacitance with temperature
- g. maximum temperature for normal operation
- h. permissible electrical losses
- i. insulation resistance
- i. resonant frequency
- k. test voltage rating
- l. leakage current (if applicable)

and several others.

With the exception of the physical dimensions, the other factors express the electrical qualifications of the component, and when stated in particular standardized terms, are the constants of the capacitor. Some of the terminology already listed are examples of terms which are constants, as for instance, items a,b,c,i,j,k and k. Item d is expressed by the constant "capacitance tolerance"; item e is "temperature coefficient" and item

by John F. Rider

f is "tolerance in temperature coefficient". Item g is expressed by "operating temperature", and item h by "power factor" and several others.

Because of the limitations in capabilities imposed by physical construction, or because of the capabilities given to a capacitor by its physical construction, each main type of capacitor has its own set of constants. Some of the constants are common to all types of capacitors because of the very nature of the device. A few examples of these are the physical size, the capacitance, the operating voltage and the electrical losses. When expressed numerically, they may differ widely — again because of the constructional features — but each set of constants does include them.

The selection of a particular capacitor for a particular use is a matter of comparison of the constants of the contemplated capacitor with the requirements of the circuit where it is to be used. At first thought this may seem to be a major problem to the service technician. Actually it is not so, because it already has been done by the individual who designed the circuit. In fact the entire problem is simplified because the receiver manufacturer's service literature contains the electrical specifications for the capacitors required at every point. All of the constants are not given, but a familiarity with the general order of constants applicable to that particular type of capacitor, will,

E	
	New RIDER TEK-FILE Packs
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	Replacement Parts Listings
	available this month!
ļ	Pack 70. Motorola
İ	Pack 71. Packard-Bell, Philco
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ł	Pack 73. Western Auto, Westinghouse
000	Pack 74. Radio Craftsmen, RCA, Sears Roebuck
	Pack 75. Sentinel, Sparton, Spiegel, Starrett, Stewart-Warner
ļ	Pack 76. Stromberg-Carlson, Sylvania
	Pack 77. Westinghouse, Zenith
1	For the individual models included in
let	these Packs, refer to the TEK-FILE INDEX
-	in the January, 1953 issue. If you do not
-	have the issue, consult your Rider distribu-
	tor or write to us directly.

when added to the details already known, lead to the correct replacement.

In the Rider Replacement Parts Program all the electrical requirements surrounding the original capacitor used in the television receiver are known, and these are compared with the electrical constants of the replacement items; then the suitable replacement is listed, that is, if there is one. A number of different types of capacitors can satisfy some of the original design requirements, but only after consideration of all of the constants is it possible to select which particular type of capacitor is suitable, or in some instances, which types are the equivalent of each other for a particular use. Examples of these will be given in a later article.

Physical Size

The physical size requirement is listed as one of the constants. Perhaps this is taking some license with the stricter meaning of constants but it does no harm. It is one of those descriptive terms which offers substantial leeway in the selection. At the factory end the physical size relates to most convenient production, satisfying space limitations inside or around other components, electrical performance when operation is at very high or ultra-high frequencies, and finally, to some extent the matter of economy. From the service technician's viewpoint, the physical size requirement is the one with the least problem, providing that when a limitation exists, it is realized.

We have illustrated the range of physical dimensions within which capacitors of different types are generally available. It was seen that each type comes in different sizes. In some categories of units the full range of sizes is available on the replacement market; in others it is not. But fortunately the manner of use of a capacitor in a television receiver does not always demand complete conformance with the physical size specification, assuming that the electrical requirements can be satisfied.

For example, when a capacitor is located inside of some other component with fixed boundaries, such as an i-f or similar transformer can, or a deflection yoke, it is necessary that the replacement be of similar physical dimensions, or smaller, in order to fit within the same space. At the moment we are neglecting the possibility that the technician may not be interested in replacing a capacitor in an i-f transformer; he would rather replace the entire unit, which after all, does make sense when all factors are considered. Another example is the capa-

(Continued on next page)

citor which is used in a critical circuit where space is at a premium and the distributed capacitance must be kept to a minimum, or when the lead length is important. The larger the unit in these cases, the lesser is the possibility of keeping the lead length to the dimension used for the original component.

It is not beyond the realm of the imagination that a service technician may feel that the replacement of a fixed tuning capacitor inside of a transformer can be accomplished by locating the component outside the can. This is bad practice, and should not be done. The performance of the transformer can be affected adversely and feedback problems may arise.

Finally there is the case of the can type of electrolytic capacitor for which a mounting plate already exists in the receiver. It is conceivable that a new mounting plate suitable for a larger or smaller sized replacement can be used insead of the old one, but this involves the unwarranted expenditure of time and is justified only when the proper replacement is not procurable. Or, it is conceivable that a completely new mounting arrangement will be used, such as locating the replacement beneath the chassis. Of course it can be done, but we feel that in the latter cases, which are not too numerous to begin with, the physical features of the chassis should be retained by procuring the part that fits the chassis properly.

As to capacitors which are located on the underside of the chassis, the physical dimensional requirements are not of major import, providing, as we have said before, that the electrical requirements are satisfied. However, it always is best to duplicate the original size, but if there is to be a difference, it is best and most convenient to work with the smallest physical sizes rather than the reverse.

Capacitance and Capacitance Tolerance

In the list of electrical qualifications and in any list of constants of capacitors, these two items are shown individually. In reality they are closely related; hence are treated together here. Moreover, they are associated with all basic categories of capacitors being treated in this replacement parts series.

All capacitors bear some identification which states the capacitance rating of the unit. Sometimes the value is simply stated on the box which contains the unit, as usually is the case with variable capacitors. In the case of fixed units of all kinds, the value is marked on a label attached to the capacitor, or it appears as some form of coding impressed on the unit. Whether the label or coding expresses the capacitance in microfarads or micromicrofarads is unimportant because one is convertible into the other. A more important thing is the realization that the value of capacitance so shown is an approximate value. Frequently it is referred to as the nominal value.

By approximate or nominal we mean a value corresponding to the standard value within a certain leeway or tolerance. As a matter of convenience, lowest cost, and other production factors, the radio and television industry has agreed upon certain values of capacitance for each type of capacitor as being "standard" values. Design engineers try to build their equipments around these values. Capacitor manufacturers in turn build capacitors to approximate these standard values within a certain tolerance (expressed as a percentage of the rated value) and label them accordingly.

Although the standard values of capacitance are not the same for all basic categories of capacitors, at least do not begin at the same low limit and end at the same high limit, there is a range of capacitance in which the paper dielectric, mica dielectric, and ceramic dielectric afford more or less the same standard values, but not exactly the same. Such a list would begin at about 0.0001 μ f and end at about 0.01 μ f. It must be understood however that operating voltage ratings will tend to modify the range of standard values in all three types. As an illustration we might point out that the usual lowest standard value of capacitance in paper dielectric capacitors rated below 2000 volts working, is 0.001 µf, and even this is increased to perhaps several times that value when the working voltage is below 600 volts.

Mica dielectric and ceramic dielectric capacitors are available in like standard values from about 1 $\mu\mu$ f to about 0.01 μ f, but even in this group, especially between a fraction of 1 $\mu\mu$ f and about 70 $\mu\mu$ f, the preponderant selection of ceramic capacitors for many uses by design engineers has lead to the creation of standard values which differ from each other in very small steps, perhaps 2 or 3 $\mu\mu$ f.

The electrolytic capacitor is in a class by itself as far as standard values are concerned. They begin at about 4 μ f and extend up into the thousands of microfarads. But here too the particular type and the working voltage rating sets limits, as for example about 50 μ f is the limit at 450 volts, whereas 5000 μ f units are available at 6 volts.

Capacitance Tolerance. Concerning the association between standard values and tolerance, by definition, tolerance is the acceptable departure from a rated value. In the television industry, for that matter in the entire electronic industry, capacitance tolerance is expressed in two ways. One is in terms of percentage of the rated value, the other is in terms of a certain amount of capacitance. For instance when the capacitance is less than 10 $\mu\mu$ f, and the unit is a ceramic dielectric capacitor, the + and - tolerance ratings may be $0.1\mu\mu f$, $0.25 \ \mu\mu f$, $0.5 \ \mu\mu f$, $1.0 \ \mu\mu f$ or $2.0 \ \mu\mu f$, depending entirely on the degree of accuracy required by the circuit involved. As a rule, capacitors of this kind used in television

receivers bear either + or - 0.25 $\mu\mu$ f or 0.5 $\mu\mu$ f tolerance ratings.

In the case of mica capacitors up to and including 10 $\mu\mu f$, two minimum tolerance ratings exist. For the plain foil mica, the minimum tolerance is 1.0 $\mu\mu f$, whereas for the silver mica it is 0.5 $\mu\mu f$.

When the capacitance exceeds 10 $\mu\mu f$, the capacitance tolerance is expressed in

(Continued on page 20)

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Successful Servicing, February, 1953

The Cosine Yoke

(Continued from page 1)

with horizontal lines of force. This magnetic field produces vertical deflection. Part B of the figure shows a cross section of the windings of the cosine yoke. Windings which produce horizontal and vertical deflections are labeled. Part C is an enlarged view of one of the horizontal windings with the window and butting edge of the winding shown.

Note that the cosine distribution must be designed into both vertical and horizontal windings, but in different amounts. This is true because the deflection components of both magnetic fields are not the same due to the raster being wider than it is high. The size of the window in both horizontal and vertical coil assemblies affects the over-all distribution and hence the spot focusing in the corners of the picture.

The cosine distribution curve is a design detail and has no direct significance to the serivce man. Suffice it to say that the winding thickness varies in a cosinusoidal manner. Some windings claim to be cosine squared in character, which means that the winding thickness increases faster than in a normal cosine yoke.

In general a cosine yoke can be distinguished from a conventional-style yoke by inspecting the size of the winding window. Cosine yokes have narrow windows. This is natural, since the winding starts nearer to the center line of the assembly, and thus has farther to spread while increasing its thickness. The horizontal winding window can be readily seen, since this winding is on the inside of the yoke and lies along the neck of the tube.

Finally, in checking an old yoke when considering replacement with a cosine yoke, note that the cosine yokes probably have higher horizontal-winding inductance than conventional designs and replacement might result in poor performance and probably give ringing in the picture. Also, another condition to watch out for is whether the shape of the raster has been changed, since better corner focus may have been obtained at the expense of pincushioning of the raster. Some cosine yokes produce pincushioning that must be removed by placing small permanent magnets (held on brackets) around the neck of the tube. These antipincushioning magnets must be readjusted in making a replacement. A cosine yoke with such magnets cannot be used with metal picture tubes since the cone may become permanently magnetized and thus distort the raster.

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In compliance with the many requests we have received from our readers, this and future issues of SUCCESSFUL SERVICING will again contain the feature, TV PRODUCTION CHANGES.

The Rider Manual pages and TEK-FILE pack which include the original data and shematics to which the following production changes apply, appear in the index on page 24 of this issue.

ANDREA MODEL T-VL12 CHASSIS VL12

Service Data Addenda (Coil and Transformer Resistances)

Low-Voltage Transformer, T12, Part. No. ST-3033

Primary: .8 ohm

- High-voltage secondary: 38 ohms, (center tap)
- 5v secondary (yellow leads): .1 ohm
- 6v secondary (green leads): .1 ohm
- 6v secondary (blue leads): .3 ohm
- High-Voltage Transformer, T8, Part No. ST-3018-1
 - Terminals 1-2: 90 ohms
 - Terminals 2-3: 180 ohms
 - Terminals 4-5: 9 ohms
 - Terminals 5-6: .3 ohm
- Vertical-Output Transformer, T7, Part No. ST-3030

Blue-red leads: 600 ohms

- Green-vellow leads: 10 ohms
- Vertical-Blocking Transformer, T6, Part No. ST-3029
- Blue-red leads: 150 ohms

Green-yellow leads: 900 ohms

- Horizontal-Oscillator Transformer, L18, Part No. SA-335
- NO. 5A-000

Terminals A-F: 75 ohms

- Terminals C-D: 43 ohms
- Deflection Yoke, L17, Part No. ST-3034 Horizontal winding: 13.5 ohms Vertical winding: 70 ohms

Focus Coil, L14, Part No. ST-3032 1300 ohms

Horizontal-Linearity Control, L20, Part No. SA-315-1

35 ohms

Width Coil, L19, Part No. SA-336 .5 ohm

Speaker Output Transformer, T11, Part No. SL-4009

Primary: 400 ohms

Secondary: .5 ohm

Filter Choke, L22, Part No. 3031 100 ohms

MAGNAVOX

CHASSIS CT-270, 271, 272, 273, 274

R-F Unit

These chassis use r-f tuner unit No. 700349.

GAMBLE-SKOGMO (CORONADO)

MODELS 05TV1-43-9014A, 15RA2-43-9105A CHASSIS 16AY210

Circuit Changes, Video Amplifier

The following component changes were made in the video amplifier circuit:

Ref. No.	Old Part Number	New Part Number	Description
R35	C-9B1-70	C-9B1-66	2,200 ohms, ½ watt, 10%
R38	C-9B2-64	C-9B-62	1,000 ohms, ½ watt, 10%
R123	C-9B4-21	C-9B2-70	4,700 ohms, 1 watt, 10%
R127	new part added	C-9B4-82	47K ohms, 2 watts, 10%
C122	new part added	C-8G-11892	22 $\mu\mu$ f, ceramic
L20	A-16A-18685	A-16A-19486	240 µh peaking coil
L21	A-16A-18685	A-16A-19485	380 µh peaking coil

NOTE: Chassis code numbered 124023 or higher incorporate this change.

MITCHELL

MODELS T16-2KB, T16-2KM, T16-B, T16-M

Production Change (Tube Substitution)

In some receivers, a 6SN7 is used in place of a 12AU7 for the d-c restorer and sync separator stage. This is done by making the following wiring changes:

- 1. Filaments: Connect pins 5 and 9 of the 12AU7 to pins 7 and 8 of the 6SN7, respectively. Disconnect pin 4 of the 12AU7.
- 2. Cathodes: Connect pins 3 and 8 of the 12AU7 to pins 6 and 3 of the 6SN7, respectively.
- 3. Grids: Connect pins 2 and 7 of the 12AU7 to pins 4 and 1 of the 6SN7, respectively.
- 4. Plates: Connect pins 1 and 6 of the 12AU7 to pins 5 and 2 of the 6SN7, respectively.



HOFFMAN

MODEL 612

CHASSIS 142

Hoffman Model 612 is a 24 tube table model with a 6 inch speaker and an audio power output of 3.0 watts. A 12 inch picture tube is used. Its major components are: Chassis -142

Speaker – 6" PM (Part No. 9062 voice coil, 3.2 ohms at 400 cps.)

Cabinet – Part No. 7533

Escutcheon Frame - Part No. 2277

Filter Plate Glass – Part No. 734

Picture tube - 12KP4, 12LP4, L2QP4

SYLVANIA

MODEL 74M CHASSIS 1-356(C05)

Sound I-F Limiter (Circuit Change)

- Resistor R-104 (120 ohm) is removed from the cathode (pin 7) of the Sound I-F Limiter (V-10, 6AU6) and the cathode is connected directly to ground.
- Capacitor C-104 (.2μf, 400v), connected from the bottom of T-52 (sound discriminator transformer primary) to ground, is removed from the circuit.
- Resistors R-105 (33K, ½w) and R-106 (10K, ½w), connected to the screen grid of the Sound I-F Limiter (pin 6 of V-10, 6AU6), are removed from the circuit.
- 4. Pin 6 of V-10 is connected to the bottom of T-52.
- Resistor R-107 (33K, ½w), connected between the bottom of T-52 and the +125v supply, is changed to 22K, ½w (Service Part 181-0223).
- NOTE: Chassis coded C06 (Serial Nos. beginning 5606-) incorporate this change.

SYLVANIA MODELS 22M-1, 23B, 23M, 24M-1

MODELS 22M-1, 25B, 25M, 24M-1 CHASSIS 1-387-1

3rd Video I-F Stage (Resistor Change)

Resistor R-140, in the grid circuit (pin 1) of the 3rd video i-f tube (V-5, 6BA6), is changed from 27K, ½w to 22K, ½w (Service Part 181-02235).

NOTE: Chassis coded C01 (Serial Nos. beginning 87101-) incorporate this change.

MODEL

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To All Purchasers of: RIDER'S TV

Please do not forget to fill in the registration coupon on the first page of your Rider TV 10 Manual and send it to us if you have not done so already. We will forward the replacements parts listing corrections direct to your address. Also, by returning this coupon to us, you will be assured of having your name on our mailing list for exclusive, replacement parts information that will be available to TV 10 owners. <u>Do Not</u> send us the replacement parts pages!

Here are more data that will keep your RIDER'S DEPENDABLE REPLACEMENT PARTS LIST-ING published in TV Volume 10 up to date.

ADDITIONS TO PHILCO VARIABLE RESISTANCE CONTROLS SECTION:

						REP	LACEMEN	TS										
	<u> </u>	T AROS						IRC							MALLORY			
PHILCO Part No.	Cat. No.	Kit No.	Inner Shaft	Switch No.	Stock No.	Kit. No.	Panel Elem.	Rear Elem.	Outer Shaft	Inner Shaft	Switch No.	Stock No.	Kit. No.	Panel Elem.	Rear Elem.	Outer Shaft	Inner Shaft	Switch No.
33-5546-41 33-5546-49 33-5563-42 33-5563-43 33-5563-43 33-5563-50 33-5563-50 33-5563-51 33-5565-17 33-5565-17 33-5565-30 33-5565-31	A43-10K A10-10K RTV-345 RTV-241 RTV-360 RTV-359 AT-116 AG-55-S AG-44-S AG-85-S AG-84-S		FKS 1/4 FKS 1/4 FKS 1/4 FKS 1/4 FKS 1/4 FKS 1/4 FKS 1/4	SWA	WK-10000 4WK-10000 QJ-391 QJ-302 QJ-356 QJ-356 QJ-357 Q18-139X Q11-130 Q11-123 Q11-14 Q11-239	K-2 K-2 K-2 K-3	W17-111 B11-125 B12-141 B11-123 W17-111	WR11-110 B11-130 B18-139X B11-130 B11-128	P3-129 P1-200 P1-200 P1-200 P3-131	R8-213 R1-216 R1-216 R1-216 R1-216 R1-216	76-1	M10MP UT451 SU46 SU35 SU67 SU565		UF54L WF252	UR25AL UR15L			US28

ADDITIONS AND CORRECTIONS TO FIXED CAPACITORS SECTION:

Set Mfr.

K

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Set Mfr. 's Original Part No.

Bernolit23936ChangeBPD 0015 mf to SI-2-1500 mmf in Aerovox column.Packard-BellChange K071 to G071 in Cornell-Dubilier columnChange DC-5215 to UC-5212 in Mallory columnChange SHK-D15 to 5GA-D15 in Sprague columnChange K078 to KD077 in Cornell-Dubilier columnChange bD 0015 mf to 5HX-2D4 in Sprague columnChange SDA-D4 to 5HK-2D4 in Sprague columnChange SDA-D4 to 5HK-2D4 in Sprague columnChange 1468L-HV 47 mmf to HVD30-47 mmf 10% in Aerovox columnDelete 5P20Q47 in Cornell-Dubilier column. No replacementDelete 5P20Q47 in Cornell-Dubilier columnChange 1468L-HV 47 mmf to HVD30-47 mmf in Aerovox columnDelete 5P20Q47 in Cornell-Dubilier column. No replacementDelete 5P20Q47 in Cornell-Dubilier columnDelete 5P20Q47 in Cornell-Dubilier columnDelete 5P20Q47 in Cornell-Dubilier columnDelete MCL-447 in Mallory columnDelete 5P10T47 in Cornell-Dubilier columnDelete 5P10T47 in Cornell-Dubilier columnDelete MCK-347 in Mallory column
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Inda Dit in a
add TC-32 to Mallory column.
Add TVA-1304 to Sprague column.
Add BBR-2-50T to Cornell-Dubilier column.
20 2570 57 Add Dill to Cornell-Dubilier column.
Add FP476 to Mallory column.
20.2570 66 Add XA004 to Cornell-Dubilier column.
Add FP117 to Mallory column.
Add D111* to Cornell-Dubilier column.
Add FP344.5 to Mallory column.
20 2594 15 Add IJPT 435 to Cornell-Dubilier column.
Add FP225-TC72** to Mallory column.
Change PRS 15/500 to PRS 12/500 in Aerovox column.
Stromberg-Carlson 111002 Change TVL-2764 to TVL-4840*** in Sprague column.
Change FP238 to FP476*** in Mallory column.
111095 Change FP476* to FP238 in Mallory column. Delete "Remarks" column.
Change TVL-4840* to TVL-2764 in Sprague column. Delete "Remarks" column.

*Parallel 20 mf and one 20mf/3000VDC section to replace original 30 mf section.

***Omit one 10 mf section,

10

^{**}TC72 tubular electrolytic used in place of 10mf/450V section of original unit.



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*REG. U.S. PAT. OFF. T.M. 438.006

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PRINTED ELECTRONIC CIRCUITS

(Continued from page 3)

The painting technique has the advantage of requiring a minimum of auxiliary equipment and so has been the most popular type for experimentation and design work with printed circuits. It is also the best method to use in making repairs on printed circuits, as will be discussed later.

The spraying method of reproducing printed circuits differs from the painting technique in that the conductors are sprayed onto the surface of the base. Both molten metals and metallic conducting paints may be applied in this manner. In some processes, stencils are used to define the circuit conductors. In others, grooves are machined or molded in the base material where a conductor or other circuit component is desired. Grooves may also be formed by sand-blasting through a stencil. Metal is then sprayed over the entire base plate, filling the grooves and covering the spaces between. The surface is then milled off, removing the excess metal and leaving only that in the grooves. High conductivity is obtained by this method since relatively large conductors are formed in the grooves. Standard the work. Metal evaporated from a heated filament, or other source of metal vapor, is distilled on the printed circuit plate placed over it. In either type of vacuum processing, it is unnecessary to further heat treat or fire the deposited metal. Only thin films are usually deposited in this manner. If greater conductivity is required, conductors may be built up by electroplating.

In the *chemical-deposition* methods of making printed circuits, the techniques employed are similar to those used in silvering mirrors. A silvering solution, consisting of ammonia and silver nitrate mixed with a reducing agent, is poured on the chemically clean surface to be coated. The confines of the solution are controlled by an adhesive stencil. The metal films obtained are usually too thin to permit direct soldering, but may be built up by repeated coatings or by plating. The chemical processes have not been applied as extensively as those discussed above.

The *metal stamping* technique has been used principally to print loop antennas on the back covers of radio receivers. However,



tube sockets and other components are sometimes connected to sprayed circuits by mounting them on the opposite side of the base plate so that the terminals protrude through holes into the grooves. Then, when the circuit is sprayed, connections are automatically made to the conductors. Circuit cross-overs are made in a manner similar to that employed in the painting process. Resistors, capacitors, and inductances may also be formed by spraying.

The vacuum evaporation process of circuit printing consists of evaporating a metal such as silver, copper, or nickel onto the surface of the dielectric material by melting the metal in a vacuum. A mask or stencil on the surface of the insulator is used to outline the circuit desired. In one such process, called "cathode sputtering", a high voltage is applied between the source of metal vapor (the cathode) and the work upon which it is to be deposited (the anode). The metal vapor is thus drawn to the work by electrostatic forces. Only a "rough" vacuum, such as can be produced by a good mechanical vacuum pump, is required for this process.

Another vacuum process used is very similar to cathode sputtering except that no voltage is applied between the cathode and other types of circuit wiring have been produced by this method. A die, bearing the outline of the desired circuit, is used to press a thin metal foil into the surface of a plastic or other insulator. In the same operation the sharp edges of the die cut the metal sheet to the desired shape. The metal sheet may be backed by an adhesive to insure a good bond. Circuits made in this manner have good conductivity.

The last general type of printed circuit is produced by a process known as "dusting". In this method, a powdered metal is dusted onto the insulating base plate and fired in place. The cricuit outline is defined either by coating the entire insulator with a sticky substance and applying the metal powder through a stencil, or by applying the bonding substance through the stencil and then dusting on the powder so that it is held in place by the adhesive until fired.

Servicing Printed Circuits

As was mentioned above, the most convenient method of making repairs and replacements in printed circuits is the brushapplied painting technique. Kits of such paints, including both conductor and resistor mixtures, are commercially available.

(Continued on page 18)



First in a brand new series of practical backs that will give you the exact directions for correcting TV receiver performance "bugs." Each remedy is the one developed by the receiver's awn monufacturer. It is positive! Each cure is official, factoryauthorized. It will help correct some of the most difficult faults-picture jitter, hum, instability, buzz, tearing, etc.

If you work in a strong-signal area, a fringe area, an area of high humidity, etc., you have special problems in servicing. The manufacturers' trouble cures given in this book will relieve these troubles when properly applied to the receiver in question. These tried and tested cures will speed up your work, make it easier and more profitable. For instant reference, a complete index in which trouble cures are listed by brand and chassis or model number, is included.

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Successful Servicing, February, 1953

PRINTED ELECTRONIC CIRCUITS

(Continued from page 17)

Most of these paints require no heat for drying, so that they may be used for repairing circuits having parts which cannot be subjected to high temperatures. This is an important precaution when working with circuits printed on certain types of plastic.

Although subminiature tube sockets are sometimes used with printed circuits, tubes are frequently connected directly to metal evelets in the base plate, as in Fig. 1. When replacing tubes connected in this manner, care must be exercised to avoid the use of excessive heat during soldering operations. Soldered connections may also be made directly to printed conductors if the base material will stand the heat involved.

A solder containing a small percentage of silver should be used for best results. Where soldering is inadvisable, connections to tube leads and other wires should be made with metallic paint.

Printed resistors which have become defective may be repaired or replaced by the painting technique. Defective resistors are located in the usual manner with an ohmmeter. If it becomes necessary to "disconnect" a printed resistor from the circuit for a resistance check, this may be accomplished by scratching through the printed conductor lead with a sharp instrument. If defective, the resistor may be repaired with resistive paint. It will usually be found to be open or high in value. In such cases, additional resistive paint should be applied over the old resistor to reduce its resistance to the

proper value. Some commercial printed circuits have a protective layer of lacquer over the conductors and particularly over resistors to prevent moisture absorption. This coating must be completely removed before repairing resistors. If attempts to repair defective resistors are unsuccessful, the old coating should be removed completely and a new resistor painted in its place. The proper dimensions may be determined by trial and error, keeping in mind that the resistance is directly proportional to the length, and inversely proportional to width and thickness. The resistance material must make good contact with the printed conductors at the ends. Breaks introduced in the conductors to isolate resistors may be repaired with a bridge of conducting paint.



New Horizontal Output Transformer May Be Replaced Easily

One component with a high mortality rate is the horizontal-output transformer. Not much was done to alleviate the replacement problem. To those who have undertaken such replacement, the tedious and delicate procedure can be well appreciated.

In the new Stewart-Warner 9300 television chassis, a realistic approach has been taken to the problem. The horizontal-output transformer (shown here) is simply mounted



New Horizontal Output Transformer.

and connectors are employed rather than soldered leads. With this transformer, it is not necessary to remove the high-voltage rectifier tube socket from the chassis merely to replace the filament leads, nor is it necessary to postpone replacement of the transformer as a last resort because of the work involved.

To replace the horizontal-output transformer, it is only necessary to remove two sheet metal screws and unplug the leads. The entire replacement procedure does not require much more than five minutes, and can be done in the customer's home without removing the chassis and without the use of a soldering iron.

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TV SUPPLEMENTARY SHEET NO. 1

MODEL & CHASSIS	PART /	CATALOG !	FUNICTION	DESCRIPTION	LIST PRICE	MODEL & CHASSIS	PART #	CATALOG /	FUNCTION	DESCRIPTION	LÌST PRICE
A D MIRAL 22A2 A	7581-50	AG-83-5	Tone	2 Meg.Ω carbon	\$1.25	AMERICA	VC-12121C	AG-84-5 FKS-1/4	Height	2.5 Meg. Ω carbon	\$1.24
22¥1	75811-20	RTV-327	Contrast/ Vol./Sw.	1500/1 Meg. Tap 500K Ω Conc. Dual carbonSPST	\$ 4.30		VC-12127B	RTV-297	Contrast/ Vol./Sw.	750 Tap 500/250K Ω Canc. Dual carbon SPST	\$4 .30
	75B13-3	AG-84-5 FKS-1/4	Height	2.5 Meg. Ω carbon	\$1.25		VC-12131C	AG-44-5 KSS-3	Hor. Hold	50 KΩ carbon	\$1.25
	75813-7	AG-15-5 FKS-1/4	Vert. Lin.	3000 Ω carbon	\$1.25		VC-12132C	AG-83-5 KSS-3	Vert. Hold	1.3 Meg. Ω carbon	\$1.25
	75813-12	AG-49-5 KSS-3	Bright.	100K Ω carbon	\$1.25		VC-12135	AG - 49 - S FKS - 1/4	Bright	100K Ω carbon	\$1.25
	75813-13	AG-40-5 KSS-3	Hor. Hold	25K Ω carbon	\$1.25	A NDREA 2C-VL20	GRV-812-1	AG -83-5 FKS-1/4	Height	2 Meg. Ω carbon	\$1.25
	75B13-14	AG-61-5 KSS-3	Vert. Hold	l Meg. Ω carbon	\$1.25		GRV-824	A43-2000 FKS-1/4	Vert. Lin.	2000 Ω 2W-W.W.	\$ 1.25
	75813-16	A43-750 KSS-3	Focus	750 Ω 2W-W.W.	\$1.25	CHASSIS	GRV-830	AG-60-Z FS-3/SWB	Vol./Sw.	500K Ω carbonSPST	\$1.25 .60
A MBASSADO	IR 131-0001	AG-19-5	Vert.	5000 Ω carbon	\$1.25	VL-20	GRV-831	RTV-75	Hor ./Vert Hold	50K/2 Meg. Conc. Dual carbon	\$3.10
C2020 C2420 CD2020	131-0002	FKS-1/4 AG-84-5	Lin. Height	2.5 Meg.Ω carbon	\$1.25		GRV-834	RTV-300	Bright./ Contrast	20K/5000Ω 4W-W.W./ carbon Conc. Dual	\$ 4.05
т 1720 т2020	131-0003	FKS-1/4 RTV-1	Contrast	10K/IMeg. Top	\$3.70	AR14L AR17L	P-2	AG-19-5 FKS-1/4	Vert. Lin.	5000 Ω carbon	\$1.25
			Vol.∕Sw.	200K Ω Conc - Dual carbonSPST	\$1.25	17CD 17CRR 17ROG	P-5	AG-84-5 FKS-1/4	Height	2.5 Mey. Ω carbon	\$1.25
	131-0012	AG-44-S KSS-3	Hor . Hold		\$1.25	203D 1000	P-7	AG-60-Z FS-3/SWB	∨ol./Sw.	500K Ω carbon SPST	\$1.25 .60
	131-0012	AG-44-5 KSS-3	Bright.			2nd Run	P-12	AG-8-5 FKS-1/4	AM-Rejection	1000 Ω carbon	\$1.25
	131-0013	KSS-3	Hold	I Meg. Ω carbon	\$1.25		PD-5	RT∨-146	Vert./Hor. Hold	l Meg./50K Ω Conc. Dual corbon	\$3.10
14MT, MTS	VC-12120B	AG-19-5	Vert.	5000 Ω 4w-w, w. 5000 Ω carbon	\$1.25		PD-6	RTV-253	Controst/ Bright.	2000/100K Ω Conc . Dual carbon	\$3.10
17MC, MCS, MT, MTS	VC-12121C	AG-84-5	Height	2.5 Meg. Ω carbon	\$1.25	MST-12 MST-14 14TR	P-2	AG-19-5 FKS-1/4	Vert. Lin.	5000 Ω carbon	\$1.25
MTS	VC-12127B	RTV-297	Contrast . Vol . /Sw .	750 Tap 500/250K Ω Conc. DualSPST	\$4.30	16TR 17CD 17CRR	P-5	AG-84-5 FKS-1/4	Height	2,5 Meg. Ω carbon	\$1.25
	VC-12130	AG - 49 - 5 KSS - 3	Bright.	100K Ω carbon	\$1.25	17ROG 20CD 20TR	P-6	A10-1500 FKS-1/4	Focus	1500 Ω 4₩-₩.₩.	\$1.85
	VC-12131	AG -44-5 KSS-3	Hor. Hold	50K Ω carbon	\$ 1.25	112X 203D 312	P-7	FS-3/SWB	Vol./Sw.	500K Ω carbon SPST	\$1.25 .60
	VC-12132B	AG -83-5 KSS-3	Vert. Hold	1.3 Meg. Ω carbon	\$1.25	3163CR 8163CR	PD-4	KIV-140	Bright.	2W-W.W./carbon Conc. Dual	35.70
AM-17C, CB,C1M	PT-1002	RTV -252	Contrast Vol./Sw.	750 Tap 250/250K 2W-W.W./carbon	\$4.30	lst Run	PD-5	RTV-146	Vert./Hor. Hold	l Meg./50K Ω Conc. Dual carbon	\$3.10
ET,T1M AM-20C,T PL-17CB,CG,	PT - 1004	AG-19-5 FKS-1/4	Vert. Lin.	5000 Ω carbon	\$1.25	ARVIN 5175 5176	E22464-17	RTV-258	Contrast/ Vol./Sw.	25K/3 Meg. Tap 1 Meg. Conc. Dual carbonSPST	\$4.30
20C 23P	PT-1005	AG-84-5 FKS-1/4	Height	2.5 Meg. Ω carbon	1.25		E22464-20	RTV-259	Vert. Lin./ Height	3000/2.5 Meg. 2W-W.W./carbon	\$3.10
	PT - 1007	AG-49-S KSS-3	Bright	100K Ω carbon	\$1.25	CRASSIS TE 320	E22464-34	AG-49-5	Bright.	Conc. Dual 100K Ω carbon	\$1.25
	PT-1008	AG-61-5 KSS-3	Vert. Hold	I Meg. Ω carbon	5H.25		E22464-35	Order from MFR.	Tone/ Phone Sw.		
	PT-1009	AG-44-5 KSS-3	Hor. Hold	50K Ω carbon	1.25		E22464-36	AG-83-5 KSS-3	Vert. Hold	1.5 Meg. Ω carbon	\$1.25
20PC 20PC 5 20PC 52	VC-12120B	AG-19-S FKS-1/4	Vert. Lin.	2000 71 calpou	1.23		E22464-37	AG-44-5 K55-3	Hor. Hold	50KΩcarbon	\$1.25



This supplementary sheet is for use as an up-to-theminute addition to your Clarostat RTV Manual. Manuals are available through your distributor or directly from Clarostat. Price \$1.00.

Form No. 751835010-5M-11/52

CLAROSTAT MFG. CO., INC. DOVER, NEW HAMPSHIRE

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(Continued from page 8)

percentages, and sometimes in a value of capacitance, whichever is the greater of the two. As to minimum tolerances, they vary with the type of component. For example the minimum tolerance generally considered in ceramic dielectric capacitors and in silver mica capacitors is ± 1 percent. In the plain foil mica dielectric unit it is ± 2 percent, whereas in paper dielectric capacitors it is \pm 5 percent. In electrolytic capacitors the minimum tolerance is 10 percent.

While on the subject of tolerances it is necessary to comment that the minimum tolerances quoted here are not necessarily the standard tolerances which are used for components in television (and radio) receivers. The high order of accuracy indicated by these minimum tolerances are seldom applied to household electronic equipments. The figures used are much more liberal, but none the less important as far as accomplishing a desired result, hence demanding recognition by the service technician who is making a replacement. It is because of this that television receiver manufacturers frequently list the capacitance tolerance in their service literature, and why the Rider Replacement Parts Program listings of capacitors always state the capacitance tolerance.

Each type of capacitor bears a standard tolerance figure plus and minus. The list shown below indicates the range of tolerances associated with capacitors used in household electronic appliances such as television and radio receivers. Attention is called to the fact that we have omitted the full gamut of capacitance tolerances which are available on request from capacitor manufacturers; instead we show only those values which appear in the capacitor specifications set by the receiver manufacturers for capacitors used in their television and radio receivers, and whatever other electronic products they make for public consumption. The list which follows applies to capacitors in excess of 10 $\mu\mu f$. Lower values of capacitance have already been dealt with.

It is understandable that every single capacitance tolerance figure which is used in the industry is not listed here. But it can be said that those which represent the vast majority are included.

It also is important to state that the letter code shown on this listing corresponds to the coding in capacitor specifications contained in capacitor manufacturers' catalogs and in RTMA as well as JAN specifications. We have however omitted the letter coding indicative of 1, 2 and 3 percent capacitance tolerances. These are F, G and H respectively, although the letter H when applied to ceramic units indicates 2.5 percent.

Finally, attention is called to the possibility of confusion between the capacitance tolerance code letters and the Temperature Coefficient as well as the Temperature Coofficient Tolerance code letters. While similar code letters apply to all of these, their meanings are completely different.

Type of Capacitor Mice	Standard Industry Capacitance Tolerance in Percent	Capacitanc Tolerance Values Use in Percent	e d Letter Code
(Dl.t.)	+ 20	+ (1 0 1 6
(Plain)	± 20	± 1	20 M
(±.	10 K
(Silver)	± 5	±.	10 K
		±	5 J
Ceramic			
(GP)#	± 20	± 9	20 M
		± :	10 K
		±	5 I
(GMV)*	± 100		-)
(0)	and = 0	$\pm 100 -$	0
	and – 0	+100 - 4	20
	+ 10	+ 100 = 4	10 17
(10)	± 10	ر بر بر	
D		1	5 J
Paper			
Dielectric	± 20	± 2	20 M
		±]	10 K
		±	5]
		+ 60 - 2	25
		+ 40 - 2	20
		+ 40 - 1	5
		+40-1	0
		+ 20 - 1	0
Electrolytic		,	
(Tubular)		$\pm 100 - 1$	0
(Tubulai)		+150 1	0
		+250 - 1	0
$\langle C_{mn} \rangle$		+200 - 1	0
(Can)		+ 40 - 1	0
		+ 50 - 1	.0
		+100 - 1	.0
		+150 - 1	.0
# General Pur * Guaranteed	pose Minimum V	alue	

** Temperature Compensating

Applications of Capacitance and Capacitance Tolerance. How are these two constants used? . . . To begin with, the capacitance required in a circuit is a function of the design of the system which uses it. Among the constants of the circuit is the amount of capacitance required. But seldom, if ever, is this value an absolutely precise one; invariably it is an approximation, although it is stated as a definite amount as that value which most closely approximates the nearest standard value. We refer to it as an approximation because the capacitance value indicated is \pm a certain amount of capacitance. For instance the capacitance specified by a receiver manufacturer for a circuit may be 0.0022 $\mu f~\pm$ 10 percent. Assuming all other conditions satisfied, any value of capacitance between 0.00198 μ f and 0.00242 μ f seems suitable.

The conclusions accompanying the example are correct except for one additional consideration. Suppose we deal with the $0.0022 \ \mu f$ unit. In order to be a suitable replacement within the stated 10 percent capacitance limits, the value must be a measured value for the replacement unit. If this is not so, but instead a capacitor labelled

(Continued on page 23)



A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: Since the last reported period, fewer manufacturers were engaged in "change activity". TV and radio receiving tube manufacturers are continuing their tendency toward in-creasing prices, while other product group price changes remain spotty with no apparent trend.

New Items

- AEROVOX Introduced a number of new items including AFH triple and quad electrolytic capa-
- including AFH triple and quad electrolytic capacitors.
 AMERICAN ELECTRONICS Added No. 4-01, Code Booklet at \$.50 dealer net . . . No. 103-01, Advanced Course at \$6.95 dealer net and Individual Records at \$1.40 dealer net.
 AMERICAN PHENOLIC Added Model 114-053, UHF bo-ty antenna at \$3.00 dealer net . . . Model 114-560, UHF bo-ty reflector at \$1.65 dealer net and Model 114-558, UHF bo-ty stacking harness at \$.36 pr/dealer net.
 BELL SOUND SYSTEM Added Model 372MB, 30 watt mobile amplifier at \$165.00 dealer net.
 BELL SOUND SYSTEM Added Model 372MB, 30 watt mobile amplifier at \$165.00 dealer net.
 CLAROSTAT Added TV replacement controls RTV 384 to 390 inclusive.
 CORNELL-DUBLLIER Added Model V-8, VHF antenna at \$25.50 dealer net and Model 110T22, vibrator converter at \$47.31 dealer net.
 CREST LABS. Added Model LVB-117, line voltage booster at \$10.08 dealer net.
 EBY SALES Added laminated miniature sockets No. 49-6H at \$1.35 dealer net and No. 49-7H at \$1.80 dealer net.

- - - (Continued on page 24)



president: Jensen Manufacturing Company, Chicago, Illinois says: "In every field there's one-leader ---- in boosters it's Kegency" the largest selling booster at any price







TESTS PICTURE TUBES, TOO! With this BV Adapter, Model 3413-A tests every tube in a TV receiver, including the Picture Tube—without even removing tube from receiver or carton! Saves time!



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Replacement Parts

(Continued from page 20)

with the standard value of say 0.002 μ f (which is within tolerance of the original) is contemplated, what must be its tolerance? If it conforms with standard industry practice, namely \pm 20 percent, then it could have any value between 0.0016 μ f and 0.0024 μ f. Obviously it would be within tolerance on the high side but not on the low side.

Suppose that the contemplated replacement rated at 0.002 μ f was within a \pm tolerance of 10 percent, what then? On the low side it would have a value of 0.0018 μ f and on the high side it would be 0.0022 μ f. Again it is within tolerance on the high side but outside the tolerance on the low side.

Suppose we consider the next higher standard value, say $0.0025 \ \mu f$ for the replacement. Would any normal tolerance satisfy? With a rating of ± 10 percent, the low limit would be $0.00225 \ \mu f$ and the high limit would be $0.00275 \ \mu f$. Now the contemplated replacement is within tolerance on the low side but beyond tolerance on the high side . . . Is there any answer?

Of course there is! But before we describe it, we might present another practical question - how important is the capacitance tolerance? . . . A simple reply is to say that it all depends on the circuit where the capacitor is used. But this is a very indefinite answer. We know that bypassing capacitance values are not as important as capacitance values related to time constant circuits, or resonant circuits or coupling circuits. But does it make sense to set up a tolerance on the tolerance in each and every particular application of a capacitor? . . . To do this involves something else - namely complete knowledge concerning the conditions established by the design engineer in every section of a television receiver which he designed . . . This is very difficult to determine. It is much easier to recognize the requirements established in the design of the receiver as indicated by the constants of the capacitor, and to satisfy these requirements of capacitance and capacitance tolerance.

To do this is simple. It means nothing more than the procurement of a capacitor rated at the same nominal capacitance and capacitance tolerance as the original. This is no problem because design engineers are using standard values, and capacitor manufacturers, are making them. We admit that procurement practice of this kind for replacement purposes is somewhat of a departure from past tactics, but to adopt it makes most sense, because it enhances the possibility of making the proper repair and attaining best performance from the receiver.

The above suggestion to follow the capacitance tolerance stipulated for the original is subject to some qualifications, especially

in the case of paper dielectric and electrolytic capacitors. Some of the tolerance percentages are different for the + side than for the - side, as for example + 60 percent and - 20 percent. In that event a variety of selections is available. Assuming the same nominal value of capacitance, say 0.005 μ f for the original and the contemplated replacement component, a replacement rated at any value of + tolerance between 0 and 60 percent and - tolerance between 0 and 20 percent obviously is suitable.

But the leeway for selection is even greater than described. With a 60 percent tolerance on the + side, the upper limit is 0.008 μ f. On the – side, it is 0.004 μ f. Under the circumstances, any standard value of capacitance which, with its rated tolerance limits falls within these two extremes of capacitance, is suitable as a replacement as far as capacitance is concerned. Naturally, any capacitor whose *measured* values fall within these limits is satisfactory capacitance-wise.

The use of + 60 percent and - 20 percent as capacitance tolerances are purely illustrative. It could just as soon be + 100 percent and -10 percent, as in some electrolvtic capacitors. The same reasoning applies to any other set of capacitance values established by the tolerance limits for any type of capacitor. The more liberal the capacitance tolerance figures, the easier is it to find a suitable replacement in terms of capacitance. It is only when the capacitance is relatively small, say between 10 $\mu\mu f$ and 100 $\mu\mu f$ and the tolerance is severe, say 5 percent or even 10 percent in both directions - that it becomes difficult to find a replacement other than one which parallels the original in nominal capacitance and tolerance. Occasionally this happens with higher values of capacitance.

Two other items warrant comment, even if not complete at this time. One of these pertains to possible misinterpretation of these references to satisfying the capacitance requirement. This should not be construed as implying that as long as this constant and the tolerance constant requirements are met, free interchangeability exists between capacitor types. This is not so, for reasons which will become evident when the other constants are discussed.

The second item is a slight elaboration of a point already raised concerning capacitors rated at 10 $\mu\mu$ f and less. There isn't too much margin in these values for the selection of one standard value for another, based on the capacitance tolerance. One or two micromicrofarads do not seem like too much capacitance but when dealing with very small values to begin with, they represent high percentages. Moreover the selection of these small values is based on engineering requirement, and it is best servicing practice to comply with these needs, even to if the reasons for their existence are not immediately apparent.



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Manual Page

Tek-File

3.0

Radio's Master Reports

(Continued from page 20)

- TRICRAFT PRODUCTS Added Model U-1, UHF antenna at \$7.50 dealer net.
 TRIPLETT ELECTRICAL INSTR. Added No. 9989, signal tracing probe at \$9.50 dealer net, for use with Model 3441 TV-FM oscilloscope and BV adaptor/ for TV picture tube tests at \$7.90 dealer net.
- BV adaptor; for TV picture tube tests at \$7.90 dealer net. TV WIRE PRODUCTS Added new series, formvar covered copperweld, at \$4.72 dealer net, per 100 feet and at \$47.21 dealer net, per 1000 feet. VACO PRODUCTS Added No. RT-14, handy service kit, complete with 7 nut drivers, 2 Philps and 3 regular drivers plus extension piece at \$7.34 dealer net. WEBSTER-ELECTRIC Added No. 90-25, sepa-rate teletalk amplifier for paging at \$120.00 hst and 15 pair plastic interstation cable and junction box at \$.34 hst (on reel).

Discontinued Items

- DISCONTINUED ITEMS ADVANCE ELECTRIC & RELAY Discon-tinued Model 400M, transmitter relay. AMERICAN PHENOLIC Discontinued Model 14-358, twin lead transmission wire . . . Model 187-072 and Model 187-079, molded poletnylene rims and Model 509, rotator. Model 14-298, 100, 500, 1000 feet, remote control wire, temporarily discontinued, CLAROSTAT Discontinued wire wound control 43-7000.
- 43-7000. ELECTRONIC TECHNICAL INSTITUTE ----Discontinued Model 5207, Novice 80-M trans-
- mitter kit. GENERAL ELECTRIC Discontinued Model RPX-046, broadcast type variable reluctance cartridge. Also discontinued G-10 series of tran-
- GON-SET -- Discontinued Model 3005, tri-band amateur converter and their Gonset radarray series. KENWOOD ENGINEERING—Discontinued Model
- KENWOOD ENGINEERING—Discontinued Model 140, 7" wall bracket.
 POTTER & BRUMFIELD Discontinued LC and LP series of plate circuit relays.
 SHURE BROS. Discontinued Model 55 and Model 556, multi-impedance, super-cardiod micro-
- phones. SIMPSON ELECTRIC Discontinued Model 340,
- signal generator. STROMBERG-CARLSON Model RD-22, driver
- STROMBERG-CARLSON Model RD-22, driver unit, discontinued.
 SUPREME, INC. Discontinued Model 675, signal generator.
 WEBSTER-ELECTRIC Discontinued Model 5D50, teletalk amplifier for paging and Model 5C45, speaker microphone.
 WIRT PRODUCTS Discontinued auto radio ignition suppressors S-915 and S-918.

Price Increases

- ASTATIC CORP. Increased price on "scanafar" booster, Model CT-1 to \$21.00 dealer net. BLONDER-TONGUE Increased price on Model MT-1, matching transformer to \$3.90 dealer net. CORNELL-DUBILIER Increased price on Model 8BD, "hi-ball" auto aerial to \$3.03 dealer net.

- net. DUMONT LABS. Increased price on two 12", one 16", four 17", four 20", and three 21" TV picture tubes. FISHER RADIO CORP. Master audio control. Model 50-C, increased to \$97.50 dealer net. GENERAL ELECTRIC Radio receiving tube 6BA7 increased to \$2.50 list. Also increased one 12", three 17", one 20" and one 21" TV picture tubes. GON-SET
- ON-SET Increased price on Model 1531, rhombic UHF antenna, with 9' mast to \$7.77
- dealer net. HICKOK ELECTRICAL INSTR. Increased price on Model 605, portable all-purpose tube and set tester to \$184.50 dealer net.

COMING IN APRIL RIDER'S TV11

- R.C.A. Increased price on Model WO-88A, 5" oscilloscope to \$169.50 user price. Also increased power tube fittings 202F1 to \$23.85 user price.
 ... 211F1 to \$28.20 user price and 228F1 to \$57.60 user price.
 STROMBERG-CARLSON Increased price on a number of items including No. MD-38S, dynamic microphone to \$70.00 list.
 SYLVANIA Increased price on three 17", two 20" and one 27" TV picture tube.
 V-M CORP. Increased price on record changers No. 150 to \$33.47 dealer net ... No. 972 to \$40.17 dealer net and No. 985 to \$53.57 dealer net. (West Coast prices slightly higher)

Price Decreases

- CREST LABS. -- Decreased price on cathode ray tube rejuvenators Model B to \$3.15 dealer net . . Model C to \$2.20 dealer net and Model D
- Model C to \$2.20 dealer net and Model D to \$2.60 dealer net.
 ELECTRONS, INC. Decreased price on grid control rectifier EL C6M to \$31.00 dealer net.
 GENERAL ELECTRIC Decreased price on TV picture tubes 16KP4 and 16KP4A.
 GON-SET Decreased price on Gonset line to \$6.24 dealer net/100 feet.
 R.C.A. Decreased price on radio receiving tube 6L6G to \$3.00 list and electron tube 5654-t to \$4.90 list.
 WIRT PRODUCTS Decreased price on slide switches SW 723 to SW 726.

No. From To Pack Andrea T-VL12 Ch. VL12 6-1 6-10 43 Gamble-Skogmu 05TV1-43-9014A 15RA2-43-9105A Ch. 15AY210 6-1 6-16 31 Hoffman 612 5-8 5-16 35 Ch. 142

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TV Interference

This material is excerpted from the John F. Rider Publication, TV INSTALLATION TECH-NIQUES, by Samuel L. Marshall.

Electrical TV Interference Picked Up in the Antenna. Electrical disturbances caused by car ignition, static, motors, appliances, power lines, etc., are inherently broadband in nature, covering the entire radio spectrum. As such, they are difficult to deal with if picked up by the antenna proper. However, if such disturbances are picked up primarily by the downlead, (which is most often the case) then the most appropriate action to take is to install a downlead of low-loss shielded twinlead or coaxial cable.

Automobile ignition interference may be reduced by twisting the downlead if twin-lead is used; by using low-loss coax or shielded two-wire line for the downlead; and by employing an antenna, such as a Lazy-H, which attenuates *vertically* polarized signals. Sometimes the installation of a very high antenna will increase the signal to noise ratio to an extent where such interference become negligible. Where overhead power and trolley lines produce TVI, it is advisable to install the antenna as far away, and as high above, these lines as possible.

TVI Pickup in the Receiver Through the Power Line. A great deal of interference may be caused by r-f disturbances entering the receiver via the line. A good test for this is to disconnect the antenna. If the noise pattern still remains, the trouble is



and Its Remedies

by Samuel L. Marshall

being introduced through the line. Line filters, which will shortly be described in detail, are generally the solution to problems of this nature.

TVI Pickup in Receiver Components. Poorly shielded receivers may pick up signals directly via their component parts in addition to the antenna. Sometimes this results in complicated service difficulties such as leading ghosts, and pickup of i-f signals in the video i-f stages. Complete shielding of the receiver is the only solution to interference problems of this nature. An effective means of shielding a receiver, which was mentioned previously, is to line the cabinet completely with copper screen.



Fig. 2. Non-resonant line filter for TV applications.

TVI Filters. TVI filters fall into three categories:

- 1. Low-pass filters, which are designed to permit signals to pass through, and attenuate high-frequency signals.
- 2. High-pass filters, which are designed to permit high-frequency filters to pass through, and attenuate lowfrequency filters.

3. Resonant filters, which are tuned to certain unwanted frequencies and may either offer a high impedance to the passage of these frequencies into the receiver, or short-circuit them to ground.

Low-pass line filters are mostly used to eliminate line TVI. A typical filter of this type is shown in Fig. 1. It consists of a balanced network of series chokes and shunt-connected capacitors designed to permit ready passage of the 60-cycle line current, and to short circuit or greatly attenutate any high-frequency currents present in the line. The entire unit can be easily constructed by the serviceman. On completion, it should be housed in a suitably grounded metal container. Many commercial line filters of this type are readily available.

L. Marshall Recent developments in low-pass line fil-

ters have resulted in a special type of



Courtesy Jerrold Electronics

Fig. 3. High-pass filter in 300-ohm line for eliminating signals lower than 45 mc.

TV and other high-frequency applications. Conventional bypass capacitors have resonant characteristics at relatively low frequencies, and are therefore ineffective for bypassing the very high TV frequencies present in the line. This new type of capacitor is constructed so that it simulates a lossy transmission line at high frequencies, resulting in an attenuation of these frequencies over a broad bandwidth.

An illustration of a typical commercial unit is shown in Fig. 2. It must be borne in mind that these devices are of the feed-thru variety; that is, they are placed in series with the line, both center terminals being opposite ends of a feed-thru conductor which is connected to one foil of the capacitor internally. If the two end terminals are connected across the line, a short circuit will occur. Excellent results have been reported with these units.

As mentioned previously, high-pass filters are designed to attenuate r-f signals below (Continued on page 28)

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Image Frequencies in Superhets

In the operation of a superheterodyne receiver, the local oscillator heterodynes, or beats with, the incoming signal and produces in the mixer a signal at the intermediate frequency which has all the characteristics of the desired incoming signal.

Since the selectivity of the mixer input stage is not sufficient to eliminate undesired signals completely, interference may result due to the fact that the local oscillator in the receiver will heterodyne not only the desired signal, but also an undesired one, so that both are fed to the i-f amplifier. One type of interference which may result from this condition is known as imagefrequency response.

To understand what is meant by image frequency, let us consider the block diagram, Fig. 1, which represents a typical superheterodyne which employs no r-f stage. It is assumed that a 10,000-kc signal is being picked up by the antenna and fed to the mixer input circuit. The receiver is tuned to 10,000 ks; the i-f is 450 kc, hence the local oscillator in the receiver is functioning at 10,450 kc. This is the normal condition of operation.



Fig. 1. Block diagram showing superhet with r-f stage.

The i-f amplifier being tuned to 450 kc, any 450-kc signal present in the mixer output circuit will be amplified. When the receiver is tuned to 10,000 kc, a 10-mc signal will be present in the mixer circuit. The local oscillator signal at 10,450 kc combines with the incoming signal to produce a new signal which represents the sum and difference of the two frequencies present in the mixer. The difference between 10,450 kc and 10,000 kc is 450 kc, and since the i-f amplifier is tuned to this frequency, the signal will be amplified. The sum frequency, which is equal to 10,450 plus 10,000 or 20,450 kc, will also be



Fig. 2. Curves showing the improvement in image ratio which results when an r-f stage precedes the mixer.

present but will not be amplified because the i-f amplifier is not tuned to this frequency.

Now let us assume, that in addition to the desired signal of 10,000 kc to which the receiver is tuned, a strong signal of 10,900 kc is present in the mixer. This could be the case, since there is but a single tuned circuit and ordinarily this is not sufficient to cut out completely a strong signal which does not differ by a large percentage in frequency from that of the desired signal.

The 10,900-kc signal, when mixed with the 10,450-kc signal supplied by the local oscillator, produces a difference frequency equal to 10,900 -10,450 or 450 kc. Since this is the frequency to which the i-f amplifier is tuned, the undesired signal will be amplified along with the desired signal, representing the difference between 10,000 and 10,450 kc, and interference will result. The frequency at which this interference results is called the *image frequency*.

Relation of Image Frequency to Desired Frequency

Now let us see what relation the image frequency bears to the desired signal frequency. If the receiver is tuned to 10,000 kc and, as we have shown, the image frequency under such conditions is at 10,900 kc, the difference between 10,000 kc and 10,900 kc is 900, which is equal to twice the assumed intermediate frequency of 450 kc. If the intermediate frequency were 465 kc, then the local oscillator would function at 10,465 kc when the receiver was tuned to 10,000 kc. Also, a signal of 10,930 kc would produce an image frequency response. The difference between the desired and undesired signal frequencies would then be 10,930 -10,000 or 930 kc. Again we see that the image frequency response occurs at a frequency which differs from that of the desired signal by twice the intermediate frequency. And we may set this up as a rule, that the image frequency will always differ from that of the desired signal frequency by twice the intermediate frequency.

In the examples above, we have seen that the image frequency is also higher in frequency than that of the incoming signal. In some receivers, particularly on shortwave bands, the oscillator functions at a frequency which is lower than that of the incoming signal. For instance, if the receiver is tuned to 10,000 kc and the set oscillator operates at 9,550 kc, an i-f signal, representing the difference between 10,000 kc and 9,550 kc, or 450 kc, is produced.

Now, if a 10,900-kc signal were also present in the mixer circuit, the beat between it and the local oscillator would result in the production of a signal frequency of 10,900 - 9,550 or 1,350 kc. Since the i-f amplifier is tuned to 450 kc and not 1,350 kc, no interference will result. Therefore, 10,900 kc, though it differs by twice the i-f from the desired signal frequency, will not produce interference when the oscillator frequency is lower than that of the signal frequency to which the receiver is tuned.

However, if a signal of 9,100 kc instead of 10,900 kc were present in the mixer circuit, when the set is tuned to 10,000 kc and the oscillator is functioning at a frequency of 9,550 kc, which is 450 kc lower than that to which the receiver is tuned, a signal representing the difference between 9,550 kc and 9,100 kc or 450 kc will be formed and will therefore pass through the 450-kc i-f amplifier and cause interference. This 9,100-kc signal, you will note, also differs from the desired signal frequency or 10,000 kc, by 900 kc, an amount which is also equal to twice the intermediate frequency. This then is the image frequency when the oscillator is lower in frequency than that of the incoming signal.

So we may see from the above illustrations that the image frequency always differs from the desired signal frequency by an amount which is equal to twice the intermediate frequency. Also, that when the set oscillator operates at a frequency which is higher than that to which the receiver is



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VOLUME 14 NUMBER 3

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RTMA Pilot School

The RTMA Service Committee comprised of the Service Managers of the RTMA members receiver manufacturers fathered an idea about two years ago - it was a long range program with a number of objectives. Among these was the upgrading of practicing television service technicians - also an increase in the number of competent personnel trained to perform duties as television technicians. The method proposed was to be the preparation of an RTMA sponsored and supervised course of instruction capable of accomplishing these objectives. The RTMA Service Committee did not propose to go into the educational field in competition with existing schools - what it did hope to do was to sponsor and initiate a comprehensive training course and program - then make samples of it available without charge to any educational institution which contemplated setting up a television technicians' training course as a part of its educational effort.

The idea went through the ringer for quite some time. It came to a head not too long ago. Being an industry-wide effort, it has for its sponsors and financiers the RTMA as a whole – especially the receiver, test euipment, parts, and tube manufacturer members.

After a great deal of deliberation the New York Trade School in New York was chosen as the place where the course would be written and tried out to prove its practicability. The reason for selecting this institution, was its existence for more than 73 years as a philanthropy — and teaching a number of trades in cooperation with various industries — was its location in the center of the greatest television receiver population; also that it was free of all political connections and finally because it had an excellent scholastic standing.

In cooperation with an RTMA advisory sub-committee on education — having as its Course Director an exceptionally competent educator long experienced in radio and television training programs — the course, the laboratory, and lecture room facilities now are in the process of organization and construction. The Course Director was selected by the RTMA Service Committee Educational Sub-Committee and is being paid for by the RTMA.

Without question the entire project is worthy of the greatest respect, recognition and best wishes for success. Its experimental nature is one of its greatest attributes. Not only will the students gain the greatest amount of benefit from the most up-to-date instruction — and the very latest equipment — but, also the course planned will be tried and proven, all the while reflecting the television industry's needs. This should be of utmost interest to those institutes, which for a long time have wished to open classes in television servicing but have encountered many obstacles in the formulation of their program.

According to reports the school will be in operation by September, 1953 and the RTMA feels that complete information on the first course to be given, for the upgrading of practicing television technicians, will be ready for distribution by the end of 1953 if not sooner. This information will be the complete course content, time schedule, and laboratory and lecture room requirements, space and equipment needed — in fact everything which will enable interested schools to initiate similar programs.

There is no reason why this entire project should not be a complete success. Understandably the RTMA cannot set up and equip schools in all parts of the nation - so it is doing the next best thing, namely creating an experimental school for preparing and trying Training Programs - and making the information, so developed, available to all who wish to use it.

All communications should be addressed to Mr. A. Coumont, RTMA Headquarters, Suite 800, Wyatt Bldg., 777 - 14th Street, N.W., Washington, D.C.

Time Is Money

It is not easy to convince television technicians that it is very important to check the contents of service manuals in order to ascertain the variations made in chassis during different production runs. This has been a matter of grave concern for years, and with the expanding television market, it is prone to become even more so. It is understandable that changes are made during the production of a receiver. Quite frequently a change in one component necessitates changes in other components. Finally variations of this kind do not necessarily give rise to different chassis numbers in all instances.

The possibility of facing such situations is a daily occurence. The only answer is to devote a few minutes to the examination of the service information in order to establish whether or not only one version of the chassis was produced, or if differences between the chassis on the bench and the schematic may be expected. Time spent this way is not wasted; just the reverse, it can save a great deal of time in the long run.

For instance vertical output tubes have been changed during production runs, and this called for a change in the vertical output transformer. In other instances the horizontal output transformer was changed, and it called for a new yoke and a new width coil. As many as four or five different speakers may be used with a series of chassis used in different cabinet models . . . These are just a few of hundreds of examples. There just is no way of getting around the necessity for having complete data about the contents of the receiver chassis, and using it to the fullest extent. And this — before the service job is tackled. Let's remember that "haste does make waste".

John F. Rider

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(Part 1-Capacitors con'td)

This is the fifth in a series of articles on "Replacement Parts in TV Receivers." "Capacitors" will be continued next month.

Operating and Test Voltage Rating

Operating and test voltage ratings of solid dielectric capacitors make a long story. A variety of details are involved. Space limitations do not allow a complete discussion. Therefore this series simply highlights those parts which have a bearing on the problem of replacement of capacitors in television and other receivers.

All mica, ceramic, and paper dielectric capacitors bear two values of voltage rating as electrical constants of the device. One of these is the operating or working voltage rating and the other is the test voltage rating. The electrolytic variety of capacitor also bears a working voltage rating, but because of its behavior, this type of capacitor requires the consideration of more than just voltage rating when determining the suitability of a unit for a certain application. So for the moment we shall hold discussion in abeyance and speak about the other kinds of dielectric units.

The working voltage rating is a d-c value which expresses the maximum d-c voltage that can be applied for continuous duty without fear of puncturing the dielectric. By the same token, it expresses the *peak* value of continuous duty a-c voltage which may be applied without fear of puncturing the dielectric. In this connection, the frequency is a factor; it being the characteristic behavior of a capacitor to heat more as the frequency is increased, and in so doing, reduce the limit of the working voltage.

The magnitude of voltages at very high and ultra-high frequencies encountered in television receivers is relatively low, hence frequency is not a concern with respect to the meaning of the working voltage ratings of solid dielectric capacitors used in such equipment. Therefore the only concern stemming from the working voltage rating is to see that the rating is high enough for the d-c operating voltages present in the circuit where the capacitor is used; also for the peak a-c voltages in those circuits where they occur at substantial levels. Examples of the latter are the capacitors used across deflecting-yoke windings, the high-voltage rectifier, linearity coils, width coils, etc. in general, in association with components found in the vertical and horizontal output systems.

Standardized Working Voltage Ratings. As to capacitor types, working voltage ratings have been somewhat standardized. The

by John F. Rider

usual run of mica and ceramic dielectric capacitors are rated at 500 volts d-c working voltage, but to suit the needs of the television receiver, the former is available in voltage ratings up to about 3,000 volts d.c., and the latter up to ratings of 20,000 volts d.c. Some micas are available in working voltage ratings as low as 300 volts d.c.

Paper dielectric capacitors likewise are available in a range of d-c working voltage ratings, beginning at 100 volts d.c. and extending up to several thousand volts. Some receivers use paper dielectric capacitors rated at 25 and 50 volts d-c working voltage. Replacement with 100 volt d-c working voltage ratings is acceptable, sometimes even higher if it is a matter of convenience. All varieties of capacitive units are manufactured with voltage ratings in excess of those mentioned herein, but we are concerned only with those which examplify original and replacement components for television receivers.

Inasmuch as the working voltage rating of a capacitor has a great bearing on its operating life, and possibly on the life of the other equipment used with it, it is imperative that strict attention be paid to the working voltage rating when replacements are made. Under all circumstances replacements should never be rated lower than the original component in working voltage; a higher rating is alright, but never lower. This is the safest line of action.

The Test Voltage Rating. The d-c test voltage rating is self explanatory in its meaning. It is a higher figure than the

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For the individual models included in

these Packs, refer to the TEK-FILE INDEX in this issue. voltage by from 70 to 150%. It is applied for a very short period, from 30 seconds to perhaps two minutes, as a part of the testing routine after manufacture. The important point to be made is that the d-c test voltage rating should not be used as an indicator of the continuous duty d-c working voltage capability. The fact that a capacitor can stand up under the short period application of a test voltage does not imply that it can be used at that figure for long periods. It is a very unsafe risk, even in an emergency. Special caution is voiced relative to the capacitors which are used in circuits where pulse voltages are prominent, and wherein an interruption of the circuit functioning, as for example when the receiver is turned off, may result in a momentary rise in voltage beyond that normally encountered, and endanger the component.

Electrolytic Capacitors. Electrolytic capacitors also bear d-c working voltage ratings. They express the maximum continuous d-c voltage which can be applied across the capacitor when it is operated within its rated temperature limits. In addition a surge voltage rating, usually about 50% higher than the working voltage in the low. values up to about 100 volts, and from 10 to 15% higher than the working voltage rating in working voltage ratings between 150 and 500 volts, also is assigned. It expresses the maximum momentary voltage which the capacitor can withstand without damage. It is a factor in the application of this kind of capacitor in power supplies. When first turned on, and before the full current drain develops across the power supply, a momentary high surge voltage appears across the filter system. Bleeders minimize this effect, but it exists nevertheless.

Still another item of interest is the a-c ripple rating. The utility of an electrolytic capacitor is influenced by the amount of a-c voltage (ripple) which is present in the composite voltage that is applied across the capacitor, especially when it is used in a power-rectifying filter system. This information in specific figures appears in capacitor manufacturers' catalogs, and is one of the many important details which must receive attention when selecting recommendations for replacements.

The a-c ripple tends to deform the electrolytic film and if the ripple present across the capacitor exceeds the figure considered in the design of the unit it can damage the unit. The peak a-c ripple voltage plus the d-c voltage rating equal the peak voltage rating of the capacitor. This is a

(Continued on page 10)



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Image Frequencies in Superhets

(Continued from page 3)

tuned, the image frequency will always be higher, by twice the intermediate frequency, than the desired signal frequency. And, on the other hand, when the set oscillator functions at a frequency which is lower than that of the desired signal, the image will likewise be lower in frequency than that of the desired signal.

One point which deserves particular attention in this analysis is that image frequency has nothing to do with harmonics. While interference can also be produced due to harmonics of the oscillator beating with undesired signals, this type of interference is not due to image frequency response.

The extent to which interference is produced because of image response will depend upon the strength of the interfering signal, the rejection of the input circuit, the intermediate frequency employed in the receiver, and the percentage difference in frequency between the image and the desired signal. Thus, when the intermediate frequency is 450 kc, the image frequency differs from the desired signal by 900 kc; when the i.f. is 175 kc, the image frequency is only 350 kc removed from the desired signal frequency. When the receiver is tuned to 550 kc, at the low frequency end of the standard broadcast band, and the i.f. is 450 kc, the image frequency occurs at 1,450 kc, the high frequency end of the band. The percentage difference in frequency in this instance is large. But, when the receiver is tuned to 20,000 kc under the same conditions, the image frequency at 20,900 kc differs but little in percentage from that of the desired signal. Accordingly, interference due to this cause will be much worse on shortwave bands than on the standard broadcast band.

Alignment Checks of Image Frequency

The fact that the local oscillator on shortwave bands can often be tuned to a frequency which differs from that of the desired signal by the i.f., but in the wrong direction, makes it desirable to check the alignment by making certain that the image response occurs at the proper point.

Thus when the receiver is to be aligned at 18 mc, the oscillator will normally be tuned to 18,450 kc, (if the intermediate frequency is 450 kc). But if the trimmer is screwed down too far, the oscillator frequency may be changed to 17,550 kc, which will likewise produce the required 450-kc i.f. when an 18-mc signal is tuned in.

To make certain the receiver oscillator is properly adjusted, after aligning at 18 mc, tune the test oscillator to 18,900 kc (or whatever frequency which is twice the i.f. higher than that frequency to which the receiver is tuned) and without changing any of the adjustments, note if a signal response is obtained. If the oscillator is adjusted to a frequency which is higher than that to which the set is tuned, the response should be obtained. If the set oscillator is adjusted to a frequency below that of the incoming signal, no response will result.

Image Ratio

When a receiver is tuned to a given frequency, the ratio of the input signal voltage at the image frequency to that required at the frequency to which the receiver is tuned is called the *image ratio*.

For example, suppose the receiver is tuned to 1,000 kc and the i.f. is 450 kc. Assume that a 10-microvolt signal at 1,000 kc produces a 50 milliwatt output at the receiver voice coil. Then, if a 10,000-microvolt signal is required at the image frequency of 1,900 kc to produce the same output while the receiver is tuned to 1,000 kc, the image ratio is 10,000/10 or 1,000. This voltage ratio can be expressed as 60 db.

Curves showing how the image ratio becomes lower as the frequency to which the receiver is tuned is increased are shown in Fig. 2. In this graph, Curve A is representative of the image ratios secured when an r-f stage is used ahead of the mixer in a high-grade receiver, while Curve B shows the lower image ratios which result when no r-f stage is employed.

In Curve A, the image ratio resulting when the receiver is tuned to 1,200 kc is 106 db, corresponding to a voltage ratio of 200,000 to 1. That is, the signal input at the image frequency must be 200,000 times that required at the frequency to which the receiver is tuned, to produce the same output. This ratio decreases on the higher frequency bands, because of the relatively small percentage difference in frequency between the image frequency and the desired signal frequency on such bands. At 12 mc, the image ratio is 43 db, or 140 to 1, while at 36 mc it is only 11db, or 3.5 to 1.

The improvement resulting from the use of an r-f stage is much more evident at frequencies in the broadcast band than at higher frequencies. As shown in Curve B, the image ratio secured with a representative receiver employing no r-f stage is 34 db, or 50 to 1, at 1,200 kc compared with 200,000 to 1 which is obtained with a receiver employing an r-f stage, over 4,000 times as great. Yet at 12 mc, where the image ratio on Curve B is 20 db, or 10 to 1, that obtained with the receiver employing the r-f stage is 140 to 1 at this frequency; only 14 times better. The improvement decreases more rapidly at still higher frequencies.

TV Service Training Course Given at Iowa State College

During the weeks of January 26-30 and February 9-13, an intensive course in basic television was given as part of the Engineering Extension Service of Iowa State College in Ames, Iowa under the direction of G. Ross Henninger. This course was designed to provide valuable up-grade technical training for the properly qualified radio or ty technician who has an eye to the future in the rapidly expanding field of television. The cooperative efforts of many interests were assembled at Iowa State College expressly for this course. These included electronics specialists of the Electrical Engineering faculty of the college, representatives of the Service Committee of the Radio-Television Manufacturer's Association, representatives of the Iowa Chapter of the National Electronic Distributors' Association, and professional TV service technicians actively engaged in business in Iowa. Actual instruction was given by representatives of member-companies of the RTMA as follows:

Peter G. Buttacavoli – Teleset Service Dept.

Allen B. DuMont Labs., Paterson, N. J.

- Carl Finzer TV Service Engineer Motorola, Inc., Chicago, Ill.
- Ray Guichard Supervisor Publications and Training

Capehart-Farnsworth Corp., Ft. Wayne, Ind.

- Richard D. Hershey TV Service Engineer. Philco Corp., Philadelphia, Pa.
- G. Walter Irvine District Service Supervisor (Electronics-TV) General Electric Co., Washington, D.C.
- P. A. Kristensen Electronics Engineer Engineering Research Associates, St. Paul, Minn.
- Wm. H. Nelson TV Service Engineer Sylvania Electric Products Co., Buffalo, N. Y.
- E. A. Shore District Service Supervisor (Electronics-TV) General Electric Co.,

Kansas City, Mo. Milton S. Snitzer – Managing Editor, Radio and TV Publications

John F. Rider Publisher, Inc., New York, N. Y. Dick Szulgit – Field Service Engineer

Motorola, Inc., Chicago, Ill. Robert Youger – Service Engineer

Crosley Corp., Cincinnati, Ohio Geo. Troller, Chief Field Service Engineer

Motorola, Inc., Chicago, Ill. In addition, the following special speakers were heard:

Albert Coumont – Service Coordinator Radio-Television Mfrs. Assn., Washington, D.C. (Continued on page 29)





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Replacement Parts in TV Receivers

(Continued from page 7)

continuous operating rating and differs from the surge voltage rating, in that it is always less. The higher the value of capacitance, the lower the permissible a-c ripple generally.

The labels on can type electrolytic capacitors state the capacitance, d-c working voltage, and the surge voltage. When recommended as a replacement in the Rider parts listings, the related operating conditions already have been taken into account. Among these factors is another characteristic of electrolytic capacitors, namely leakage current. When a d-c voltage is applied across any capacitor, an initial charging current flows through the unit. After full charge has been reached, only changes in applied voltage cause changing charging currents. In electrolytic type capacitors, a somewhat different situation prevails; the continued application of a d-c voltage results in the flow of a continuous d-c leakage current through the capacitor. The better the capacitor the less the leakage current during operation. As a rule it amounts to from .05 to perhaps .1 or .15 milliampere per microfarad depending on the voltage rating and the capacity. Information of this kind appears in capacitor manufacturers' catalogs rather than on the component labels.

When a receiver manufacturer specifies the requirements of the original electrolytics used in the receiver, he stipulates the normal leakage current per section. The replacement suggestions in the Rider listings conform with the original equipment requirements. The initial leakage current when a receiver is placed into operation usually is higher than after a period of operation. Increase in operating temperature increases the d-c leakage current.

Temperature Coefficient

One of the very prominent factors determining the stability of operation of a television receiver is constancy in frequency sensitive circuits. The resonance condition established in a circuit must be constant if the circuit is to behave properly. Some latitude exists of course, but there are many places in a television receiver where a change of either L or C with temperature can impair the performance. This comes about as the result of an increase in inductance with rising temperature. This is a characteristic of the general run of coils of all kinds. Special forms of construction can minimize these effects, but a much more economical approach to the problem of keeping an L-C circuit constant in frequency with rising temperature, is the use of a temperature compensating capacitor. This gives rise to another constant associated with mica and ceramic capacitors - namely temperature coefficient.

Temperature compensating capacitors are becoming more and more prominent in television receivers. As used, their function is to decrease in capacitance by a specific amount per degree C rise in operating temperature. When used with an inductance in a frequency sensitive circuit, the reduction in capacitance with increasing temperature offsets the increase in effective inductance. Inasmuch as the required change in capacitance often times is small relative to the total capacitance placed across the inductance, it is common practice to form the capacitive portion of the L-C circuit from two capacitors - one of conventional design, and to shunt it with a temperature compensating unit with negative temperature coefficient. This is symbolized in Fig. 1.



Figure 1.

The total of the two capacitors in shunt is the capacitance effective when the unit is cold; as the operating temperature rises, TC autimatically lowers in value, whereas L increases in value, thus one offsets the other and the frequency remains constant because the LC product is the same constant.

Another frequent application for negative temperature coefficient capacitors is as coupling element in oscillator circuits, or as a part of the tuned circuit as shown in Fig. 2. When it is used as a coupling or



feedback link the negative temperature coefficient behavior offsets any increase in the coupled energy as the rise in circuit operating temperature causes an increase in generated signal levels. Temperature compensating capacitors are sometimes used across yoke windings.

Regardless of where in a television receiver a temperature compensating capacitor is used, the important point to remember is that replacement must be in kind. Failure to do so can well lead to unnecessary repeat calls and bad public relations. More and more of the receiver manufacturer's service manuals identify these units by temperature compensating characteristics. Wherever such a capacitor is referenced in Rider replacement parts listings, particular mention is made of the temperature coefficient for identification purposes. Where replacements are listed they conform with the requirements of the original equipment.

The specific change in capacitance of a capacitor with changing temperature is expressed by the temperature cofficient of the device. By suitable design of the capacitor, its capacitance can be made to increase or decrease in specific amounts with increase in temperature. The former is described as a positive temperature coefficient unit, whereas the latter is referred to as a negative temperature coefficient capacitor. Because of the positive temperature coefficient behavior of inductances, where temperature compensation is desired in television circuits, a negative temperature coefficient capacitor is employed. These are of main interest to us.

For example a capacitor of 250 $\mu\mu f$ $(.00025 \ \mu f) \pm 10\%$, and 1,500 volt working voltage rating, is identified by print or color code as having a temperature coefficient of N750. The letter N indicates that the capacitance decreases with increase in temperature. The number 750 after the letter N states that the decrease in capacitance is 750 parts per million per degree C increase. With a million being the base figure, the amount of change per million is the equivalent of a decimal value, for instance, 750 parts per million per degree C = 750/1,000,-000 = .00075. Hence for every degree C rise in operating temperature the capacitance decreases .00075 times whatever is its actual value. If the capacitance is 250 $\mu\mu f$ and we neglect the capacitance tolerance for the moment, the decrease in capacitance per degree C rise in temperature is .00075 x 250 or .1875 µµf. If the manner of operation is such that a 30 degree C rise in temperature occurs the total decrease in capacitance is .1875 x 30 or 5.6 µµf. This amounts to 5.6/250 = .0225 or 2.25% change in capacitance. It may not seem like much, but it is important in operation in critical circuits.

It is necessary to stress that the change in capacitance due to the temperature coefficient behavior should not be confused with the capacitance tolerance rating. Neither is the former minimized in importance by whatever may be the capacitance tolerance. The capacitance tolerance reflects the limits of capacitance values suitable for use in a circuit; the temperature coefficient, on the other hand, expresses the required change in capacitance so as to offset other

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Under the column headed PAGES, the first and second numbers indicate the page where the information starts, the last number shows where the data is concluded.

As an example, jet's look up ADMIFAL model 35XJ5AS. It shows that he information is in (1-1) Park No. 1, ADMIAL, File NO. 1. The data [8-23-46) starts on page 8-23 and Turna through page 8-46. There is also data on the ADMIAL record changer model RC 550. 1. The In(1-RC2) TEX-FILE pack No. 1, in ADMIAL Record Changer Plane No. 2. The data begins on page 21-9 and ends on page 21-16.

To locate service data instantly, all you need to know is the manufacturer's name and the model or chassis number of the set.

The Index is complied alphabetically, according to man-effecturer, Node the column headings at the top of each page: MODEL, PACK-FILE, PAGES.

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			3=1-4 4=1-4	RA-113-B5, RA-113-B6, Burlingame	33-3	8=1-26	680D, 681B, Ch. 120140-B, 120140-G, 120140-H	26-3	7=45-57	STC20, STC30, Rev. 32-2 STC70, STT65 32-2	9=11-18 7=1-12
	° en	3-2 3-2	10=1-34 5=1-25	RA-113-B7, RA-113-B6, Tarrytown	33-3	6=1-26	681D, Ch. 120144-B, 120144-G, 120144-H	3-1	8=16-30	S-1015, S-1020, S-1030 32-2 S-1055 32-2	5=8-12 5=10-14
	ന	39-4	1=31-42 3=1-4 4-1-4	RA-116A, The Westminster, Series II	39 - 4	9=1-24	681F, Ch. 120143-B, 120143-H 683B, Ch. 120141-B	3-1 3-1	8=31-39 8=40-45	S-1055X 32-2	7=1-12
	3	19-4	4=5-14	WEBSTER 100	39-RC1 1	RCH21=1-10	064B, 063B, Ch. 120134-B 686B, Ch. 120144-B,	C-07	07-T=J	2-TU00, 2-TU00	7=1-12
	0 00	3-3	6=1-26	RA-117-A1, Sumter RA-117-A3, Carlton	18-1	5-1=L	120144-G, 120144-H 686D, Ch. 120140-B,	3-1	8=16-30	S20C10, S20T20 32-2 7C42, 7C52, 7T32 61-3	10=1-11
	9 -	30-5	10=1-34	RA-117-A5, Strathmore	18-1	7=1-9	120140-G, 120140-H	26-3	7=45-57	721, 775T 61-3	10=1-11
	- 61	3-2	5=26-43	RA-117-A0, Andover RA-117-A7, Park Lane	18-1	7=1-9	686L, Ch. 120143-B, 120143-H 686L, Ch. 120142-B	3-1	8=46-55	42.33, 42.04, Iuners used with 'S' Series 32-2	9=3-10
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	er 19	13 - 3 10 - 5	6=1-26 10=35-42	RA-119A, Royal Sovereign	33-2	5=1-25 8=1-12	687B, Ch. 120144-B, 120144-G. 120144-H	3-1	8=16-30	THE FIRESTONE TIRE B R	JBBER CO.
	3	13-2	5=1-25	RA-160-A1, Devon	60-5	10=1-34	*687D, Ch. 120140B,				
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	5	9-4	0=1-12 1=31-42	RA-162-B1, Wickford RA-162-B4, Banbury	60-5 60-5	10=1-34	similar to 680D, 686D 687F, Ch. 120143-B, 120143-H	3-1	y = 31 - 39	13-G-44, 13-G-45 13-G-51, 13-G-52 4-1	8 = 10 - 24 8 = 25 - 39
			3=1-4 4=1-4	RA-162-B5, Flanders	60-5 60-5	10=1-34 10=1-34	687L, Ch. 120142-B 688B, 689B, 690B.	3-1	8=46-55	13-G-53, 13-G-54, Ch. 700-90, 700-96	8=40-51
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		9-4	1=31-42	RA-162-B7, Whitehall II	60-5	10=1-34	Ch. 120129-B	26-3	7=36-44	13-G-55, Ch. 700-93 4-1	8=40-51 8-52,59
	c,	+- D	3=1-4	RA-162-B10, Flanders RA-162-B11, Newbury	60-5	10=1-34	120129-D, similar to			13-6-57	8=1-9
	9	0-5	4=1-4 10=35-42	RA-162-B12, Somerset	60-5 60-5	10=1-34 10=1-34	688B, 689B, 690B, Ch. 120129-P	26-3	7=36-44	Record Changer VM-950 4-RC 13-G-58. 13-G-59. 13-G-79.	RCH22=1-16
	000	3-2	5=1-25	RA-162-D15, Danuary RA-162-B14, Dynasty	60-5	10=1-34	696F, Ch. 120143-B, 120143-H	1-6	8=31-39	Ch. 700-96 Ch. 724 2 4-1	8=60-70
	•	8-1	7=1-9	RA-162-B21 KA-162-B26, Banbury	60-5	10=1-34	•697B, Ch. 120129-D,	1-0	0-70-07-00	13-G-115, 13-G-116, 13-G-119,	01-4-04
0.5 113-14 Reviewed 0.5 100-35, 700	er er	19-4 3-3	4=5-14 6=1-26	RA-164-A1, Clinton PA-165-R1 Milford	60-5 60-5	10=35-42 10=35-42	slmilar to 688B, 689B, 690B, Ch. 120129-B	26-3	7=36-44	13-G-120, Code 334-2- MS31C/A 61-2	10=1-10
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	6,	30-5 0 4	10=35-42	RA-165-B2, Beverly	60-5	10=35-42	699B, Ch. 120148-B	39-4	9=9-16 PCU22-1-16	700-90, 700-93, Ch. 4-1 700-96 Ch 13-C-53 13-C-54 4-1	8=40-51 8=40-51
913 Red if is is, itelations 003 100345	2		3=1-4	RA-165-B3, Wakeileld RA-165-B4, Ridgewood	90-2 90-2	10=35-42	699D, Ch. 120160-B	60-6 60 -6	10=1-8	700-96, Ch., 13-G-58, -59, -79 4-1	8=60-70
39-1 ELECTRONIC APPLANCES INC. 7000, Ch 13013-0 101, Ut, Ch 2013-0 201, Ch 2013-0 201, Ch 2014-0 201, Ch 2014-0 2014, Ch 2014-0 2014	ຕ	3-3	6=1-26	RA-165-B5, Shelburne	60-5	10=35-42	Record Changer VM-950	39-RC1	8=1-0 RCH22=1-16	FRANKLIN AIRLOOP C	ORP.
314 101, 101, 11, Series, Lincoin, Series 701, 101, 11, Series, Lincoin, Lincoin, Series, Lincoin, Lincoin, Series, Lincoin, Series, Lincoin, Series, Lincoin, Series, Lincoin, Lincoin, Lincoin, Lincoin, Lincoin, Lincoin, Lincoin, Lincoin, Lincoin, S		19-4 9-4	9=1-24 1=31-42	ELECTRONIC A	PPLIANCES IN(u	700D, Ch. 120158-B 700L, Ch. 120153-D	50-5 61-7	9=17-24 10=18-27	500-A-10, Tuner 4-1	8=1-2
0.5 0.51			3=1-4	101, 102, 103, 104, 105, 107,			701B, Ch. 120153-B	39-4	9=1-8	FREED-EISEMANI	
0.00 10-14 Electro-TECHNICAL INDUSTRIES 110, 101, 101, 101, 101, 101, 101, 101,	9	0-5	4=1-4 10=1-34	110, 111, Series, Lincoln, S VIDEO PRODUCTS 630-K3C	See 69-1	10=1-12	Record Changer VM-950 701D, Ch. 120158-B	50-5	HCH22=1-16 9=17-24	See FREED RADIO CO	RP.
300 ELECTRO-VOICE INC. 1110, 112, 112, 120, 143, 101, 121, 123, 135, 16, 16, 112, 120, 120, 151, 112, 112, 113, 112, 113, 113, 114, 113, 104, 113, 110, 111, 112, 113, 110, 113, 111, 112, 113, 110, 112, 114, 113, 110, 112, 114, 113, 110, 112, 114, 113, 110, 112, 114, 113, 114, 113, 114, 113, 114, 114	90	10-5 0 -5	10=1-34			l	709A, Ch. 120162-A	61-7	10=9-17	FREED RADIO COR	0
39.4 1=11-42 30.4 1=11-42 30.4 56.4 64.0 50.4	0 60	3-2	5=1-24 5=1-25	ELECTRO-TECHN (TEL)	EKIT)	ILES	714B, Ch. 120153-B	2-19	10=18-27	(FREED-EISEMANN	7
301 1=1-42 101, 102, 103, 103, 103, 103, 103, 103, 103, 103	en 69	9-4	1=31-42 1=31-42		-	8-1-10	714D, 715D, Ch. 120153-D 720B. Ch. 120164-B	61-7	10=18-27 10=28-39	54, 55, 56, 68, Ch. 1620C 32-1	5=1-7
914 1=01-42 ELECTRO-VOICE INC. 1200045-0, Ch. 28-2 6-1-4 101 00-10, Ch. 50-2 9-1-4 101 90-2	6	9-4	1=31-42	1aC			120084-B, Ch.	3-1	8=1-13	101, 102, 103; 104, Ch. 1900 32-1 110. 111. 112. Ch. 700-120 50-2	5=8-10 9=1-8
3:-1 300, Booster 26-1 7-1-2 2011BB, Ch. 35-2 6-11-1-9 1220C, Ch. 37-1 3:-1 EMERSON RADIO & PHONO. CORP. 120131-5, Ch. 35-3 7-11-19 1520C, Ch. 37-1 3:-1 EMERSON RADIO & PHONO. CORP. 120131-5, Ch. 35-3 7-11-19 1520C, Ch. 32-1 3:-1 600, Ch. 120061-9 3-1 120131-5, Ch. 26-3 7-2-27 5-11-19 1200, Ch. 32-1 3:-1 614), Ch. 120063-9 3-1 120131-5, Ch. 26-3 7-2-27 5-1-1 32-1 32-1 3:-1 640, Ch. 120063-9 3-1 120140-4, Ch. 26-3 7-2-27 5-1-1 32-1 32-1 3:-1 640, Ch. 120043-8 26-2 61-1-19 120140-4, Ch. 3-1 6-1-4 120140-4, Ch. 3-1 26-3 7-2-20 5-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 3-1 <td></td> <td>5-6</td> <td>1=31-42</td> <td>ELECTRO-1</td> <td>VOICE INC.</td> <td></td> <td>120095-B, Ch.</td> <td>26-2</td> <td>6=1-4</td> <td>121 50-2</td> <td>9=9-14</td>		5-6	1=31-42	ELECTRO-1	VOICE INC.		120095-B, Ch.	26-2	6=1-4	121 50-2	9=9-14
Bit Hard EMERSON RADIO & PHONO. CORP. 1011295, 1001295	•		3=1-4	3000, Booster	26-1	7=1-2	120118B, Ch. 120127-B, 120128-B, Ch.	26-2 26-3	6=11-19 7=11-19	100-120, Cn. 50-2 1620C, Ch. 32-1	9=9-14 5=1-7 5=0-10
31-4 609, Ch. 120084-B 3-1 B-1-13 120134-G, Ch. 120134-	c	V-0	1-91-49	EMERSON RADIC	D & PHONO. C	ORP.	120129B, 120129D, Ch. 120131-B, Ch.	26-3	7=36-44 7=20-27	1000 CII.	01-0-0
41-4 6140 , Ch. 120095-B $26-2$ $6-1-4$ $120135-B$ $Ch.$ $26-3$ $7-28-35$ $7-28-35$ $7-28-35$ $39-4$ $4-5-14$ 6304 , Ch. 120095-B $26-2$ $6-1-4$ $120140-4$, Ch. 2014 $21-2$ $31-2$ $66-3$ $7-45-57$ $05741-43-9013A$, Ch. 12005 $31-2$ $66-3$ $7-45-57$ $05741-43-9013A$, Ch. 12014 $31-2$ $66-3$ $7-45-57$ $05741-43-9013A$, Ch. 12014 $31-2$ $66-3$ $7-45-57$ $05741-43-9013A$, Ch. 12014 $31-2$ $66-3$ $7-45-57$ $05777-43-9010A$ $31-2$ $66-55$ $66-3$ $7-45-43-9103A$, Ch. 16AY210 $31-2$ $66-55$ $66-3$ $7-45-43-9103A$, Ch. 16AY210 $31-2$ $66-55$ $66-3$ $7-45-43-9103A$, Ch. 16AY210 $31-2$ $66-55$ $66-55$ $7-1-10$ $120144-45$, Ch. $31-1$ $8-31-35$ $65777-43-49010A$, Ch. 16AY210 $31-2$ $66-55$ $66-53$ $7-1-10$ $120144-45$, Ch. $31-2$ $96-56$ $96-75$ $96-75$ $96-75$ $96-75$ $96-75$ $96-75$ $96-75$ $96-75$ $96-75$ $96-75$ $96-75$ $96-75$ $96-75$	0		3=1-4	609, Ch. 120084-B	3-1	8=1-13	120134-B, 120134-G, Ch.	26-3	7=1-10	GAMBLE - SKOGMO,	NC
034, Ch. 120037 0.45 , Ch. 120037 0.45 , Ch. 120034 $2.6-2$ $6.5-10$ 120140 -H, Ch. $26-3$ $7-45-57$ 0.57774 - $3-30143$, Ch. 120142 $31-2$ $6-5$ $39-4$ $4-5-14$ 65005 , Ch. 120118 $26-2$ $6-11-16$ 120142 -H, Ch. $3-1$ $8-60-45$ 0.57772 - $3-30503$ $31-2$ $6-5$ $3-1-4$ 65005 , Ch. 120118 $26-2$ $6-11-16$ 120145 -H, Ch. $3-1$ $8-60-45$ 0.57772 - $3-30503$ $31-2$ $6-5$ $3-1-4$ 6105 , Ch. 120118 $26-2$ $6-11-16$ 120144 -H, Ch. $3-1$ $8-60-45$ 0.57772 - $43-30503$ $31-2$ $6-5$ $3-1-4$ 120134 -B $26-3$ $7-1-10$ 120144 -H, Ch. $3-1$ $8-9-16$ 157774 - $43-39510$ $31-2$ $6-5$ $6-5$ $5-1$ $8-9-16$ 157774 - $43-39510$ $31-2$ $5-1$ $8-5$ $5-1$ $8-57774$ - $43-39510$ $31-2$ $5-1$ $8-57774$ - $43-9505$ $5-1$ $8-57774$ - $43-9505$ $5-1$ $8-57774$ - $43-9505$ $5-1$ $8-5666666666666666666666666666666666666$	2	9-4	4=1-4 4=5-14	614D, Ch. 120095-B	26-2	6=1-4 6 1-4	120135-B, Ch. 120140-B, 120140-G.	56-3	CE-82=1		
39-4 4^{-3-1} 650B, Ch. 12011BB 26-2 6-11-19 120142-B, Ch. 3-1 6-45-55 65772-33-3650A 31-2 06 39-4 1=31-42 654B, Ch. 12011BB 26-2 6-11-19 120142-B, Ch. 3-1 6-45-55 05777-43-49010A 31-2 06 31-4 654B, Ch. 12011BB 26-3 7-1-10 120144-B, Ch. 3-1 8-31-39 057776-43-3650A 31-2 06 31-2 51 31-2 05777-43-4010A 31-2 05777-43-4010A 31-2 05 31-2 51 31-2 05134-B, Ch. 120134-B 26-3 7-1-10 120144-B, Ch. 31-1 8-31-39 057774-43-4010A 31-2 05 31-2 51-25 6123, Ch. 120134-B 26-3 7-21-10 120144-B, Ch. 31-2 9-9-16 157771-43-8956A 31-2 9-16 157771-43-8957A 31-2 9-3 9-16 157771-43-8957A 31-2 9-3 9-3 120143-B 26-3 7-20-27 120133-B 5-1 8-3 9-3 120144-B 5-1 8-3 8-3 8-2 8-3 1010				649A, Ch. 120094A	26-2	6=5-10	120140-H, Ch.	26-3	7=45-57	05TV1-43-9014A, Ch. 16AY210 31-2	0=1-0 6=7-16
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37.2 5156 $120134-G$ $20-3$ $7-1-10$ $120144+1$, Ch. $3-1$ $3-16-30$ $157771-43-9573$, ch. $10214-10$ $3-1-2$ $3-10$ 37.2 $51-25$ 6123 $61-3$ $7-1-10$ $12014+1$, Ch. $3-1$ $3-16-30$ $15771-43-9573$, ch. $10214-10$ $3-12$ <			3=1-4	661B, Ch. 120134-B,	c ç c	01-1-6	120143-B, 120143-H, Ch.	3-1	8=31-39	05TV6-43-8935A 31-2	6=1-6 6 7 40
33.2 5=1-25 0.201, 0.005 0.401 0.90-16 1577/1.47-0003 31-2 0.9 33.2 5=1-25 6668 Ch. 12013-B 26-3 7=11-19 120148-B, Ch. 39-4 9=9-16 1577/1.47-0003 5-1 0.9 33.2 5=1-25 6668 Ch. 12013-B 26-3 7=20-27 120153-B, Ch. 10-18-27 1577/1.43-0003 5-1 0.8 33.2 5=1-25 6668 Ch. 12013-B 26-3 7=20-27 120153-B, Ch. 10-18-27 1577/1.43-0016A 5-1 0.8 33.2 5=1-25 6668 Ch. 12013-B 26-3 7=10 120153-B, Ch. 50-5 9=17 1577/1.43-0016A 5-1 8 33.2 5=1-45 6689 Ch. 12013-B 26-3 7=10 120163-B, Ch. 50-5 9=17-24 1577/1.43-0016A 5-1 8 33.2 5=26-43 6789 Ch. 12013-B 26-3 7=30-5 Ch. 90-16 10-17-8 1577/1-43-0016A 5-1 8 33.2 5=26-43 6789 Ch. 12013-B 26-3 7=306-3 7=30-6 10-17-8 1577/1-43-0016A 5-1 8 33.2 5=26-43 6789 Ch. 12013-B 26-3	3	3-2	4=1-4 5=1-25	120134-G	26-3	NT-1=)	120144-H, Ch.	3-1	8=16-30	15RA2-43-9105A, Ch. 16AYZ10 31-2 15TV1-43-8957A 5-1	6=7-10 8=1-8
33-2 5=1-25 666B, Ch. 12013-B 26-3 7=20-27 7=20-27 7=20-27 5771/1-43-0068 5-1 9. 33-2 5=1-25 666B, Ch. 120135-B 26-3 7=22-37 120135-B, Ch. 1201-8-27 15771/1-43-0058 5-1 9. 33-2 5=1-25 666B, Ch. 120135-B 26-3 7=22-35 120153-B, Ch. Late 61-7 10=18-27 15771/1-43-0058 5-1 9: 33-2 5=1-25 666B, Ch. 120134-B 26-3 7=10 120163-B, Ch. 50-5 9=17-24 15771/1-43-0016A 5-1 8: 33-2 5=1-43 678B, Ch. 120130-B 26-3 7=10 120163-B, Ch. 50-5 9=17-24 15771/1-43-0015A 31-2 33-2 5=26-43 678B, Ch. 120130-B 26-3 7=36-44 120163-B, Ch. 61-7 10=19-27 15771/1-43-0015A 5-1 8: 33-2 5=26-43 678B, Ch. 120130-B 26-3 7=36-44 120162-B, Ch. 61-7 10=9-17 157772-43-9101A 33-2 5=26-43 675B, Ch. 120139-B 26-3 7=36-44 120162-A, Ch. 61-7 10=9-17 157772-43-9101A 33-2 5=26-43 675B, Ch. 120139-B 26-3 7=36-44 120162-A, Ch. 61-7<		3-2	5=1-25	120128-B	26-3	7=11-19	120148 -B, Ch.	39-4	9=9-16	15TV1-43-8958A 31-2	9=1-8
33-2 5=1-25 6604 604.1 61.7 10=18-27 1577143-9016A 5-1 61 33-2 5=1-5 160134-6 26-3 7=1.10 120135-15 750-5 9=17-24 15771-43-9016A 5-1 61 33-2 5=2-43 6180, Ch. 120130-B 26-3 7=1.10 120165-B, Ch. 60-6 9=17-24 15771-43-9016A 5-1 61 33-2 5=26-43 643B, Ch. 120134-G 26-3 7=36-44 120165-B, Ch. 60-6 10=1-74 15771-43-9012A 31-2 9 33-2 5=26-43 643B, Ch. 120134-G 26-3 7=36-44 120162-A, Ch. 61-7 10=9-17 157772-43-9101A, 31-2 9 33-2 5=26-43 675B, Ch. 120134-G 26-3 7=36-44 120162-A, Ch. 61-7 10=9-17 157772-43-9101A, 31-2 9 33-2 5=26-43 675B, Ch. 120139-B 26-3 7=36-44 26-6 10=1-7 10=9-17 15772-43-9101A, 31-2 33-2 5=26-43 675B, Ch. 120139-B 26-3 7=36-44 26-6 15772-43-9101A, 5-1 8 33-2 5=26-43 675B, Ch. 120129-B 26-3 7=36-44 26-6 16-7 16-9-17	: : :	3-2	5=1-25 5=1-25	665B, Ch. 120131-B	26-3	7=20-27	120153-B, Ch. Late	1-19	8=1-8 10=18-27	15TV1-43-9008A 15TV1-43-9015A	8=9-18
33-2 5=1-45 120134-G 26-3 7=-10 120138-B, Ch. 50-5 9=17-24 15TV1-43-902A 31-2 33-2 5=26-43 643B, Ch. 120129-B 26-3 7=36-44 120169-B, Ch. 60-6 10-1-8 15TV1-43-902A 31-2 9-9 33-2 5=26-43 643B, Ch. 120134-G 26-3 7=1-10 120162-A, Ch. 61-7 10-9-17 15TV2-43-9101A 31-2 8-3 33-2 5=26-43 675B, Ch. 120129-B 26-3 7=36-44 200162-A, Ch. 61-7 10-9-17 15TV2-43-9101A 5-1 8 33-2 5=26-43 675B, Ch. 120129-B 26-3 7=36-44 200162-A, Ch. 61-7 10-9-17 15TV2-43-9101A 5-1 8 33-2 5=26-43 675B, Ch. 120129-B 26-3 7=36-44 200162-A, Ch. 61-7 10-9-17 15TV2-43-9101A 5-1 8 33-2 5=26-43 675B, Ch. 120129-B 26-3 7=36-44 200162-A, Ch. 61-7 10-9-17 15TV2-43-9101A 5-1 8 33-2 5=26-43 675B, Ch. 120129-B 26-3 7=36-44 200162-A, Ch. 700163 7 5-1 8 20 7=36-44 200162-A, Ch. 700163 7 5-1 8 20 7=36-44 200162-A, Ch. 700163 7 5-1 8 20 7=36-44 200162-A, Ch. 700164 7 70164 7 70164	5	3-2	5=1-25	667B, 668B, Ch. 120134-B,			120153-D, Ch.	61-7	10=18-27	15TV1-43-9016A 5-1	8=1-8
3.2 5-26-43 6749, Ch. 120129-B 26-3 7-316-4 Ch. 61-7 10-9-17 15TV2-43-9101A, 5-1 8 33-2 5-26-43 6759, Ch. 120129-B 26-3 7-36-4 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22 33-2 5-26-43 6759, Ch. 120129-B 26-3 7-36-44 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22 33-2 5-26-43 6759, Ch. 120129-B 26-3 7-36-44 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22 85-3 7-36-44 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22 85-3 7-36-44 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22 85-3 7-36-44 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22 85-3 85-36 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22 85-3 85-36 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22 85-36 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22 85-36 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22 85-36 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22 85-36 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22 85-36 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22 85-36 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22 85-36 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22 85-36 * See Emerson RCH22	(n) (n)	3-2	5=1-25 5-94-43	120134-G	26-3	7=1-10	120158-B, Ch. 120160-B, Ch.	50-5	9=17-24 10=1-8	15TV1-43-9020A, 15TV1-43-9021A	8-1- 1
33-2 5=26-43 675B, Ch. 120129-B 26-3 7=36-44 5-1 8: 33-2 5=26-43 675B, Ch. 120129-B 26-3 7=36-44 * See Emerson HANDY No. 16, Pack 26 Record Changer VM-950 5-RC1 RCH22	n en	3-2	5=26-43	674B, Ch. 120134-G	26-3	7=1-10	120162-A, Ch.	61-7	10=9-17	15TV2-43-9101A,	
	00 e	3-2	5=26-43	675B, Ch. 120129-B	26-3	7=36-44	* See Emerson HANDY No. 16. F	Jack 26		15TV2-43-9102A 5-1 5-1 8-00 5-1	8=19-27 1 RCH22=1-16

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GAMBLE-SKI	DGMO. INC. ((Cont'd)	GENERAL ELL	ECTRIC CO. ((Cont'd)	THE HALLICR	AFTERS CO. (Cont ¹ d)	HOFFMAN RA	MIC CORP.	
			17C103, 17C104, 17C105	2-1 2-1	8=21-32					LUCIO CONT.	
5TV2-43-9025A 5TV2-43-9025B	5-1	8=28-35 8=28-38	17C107, 17C108, 17C109 17C110, 17C111	5-1	8=21-32 8=1-20	880 14808, Ch. R900D, Runs 1, 2	28-3 49-5	9=1-14 9=37-52	159, 160, Ch. 164, Ch.	29-2 29-3	8=5-14 7=3
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5TV4-7003U, Ch. 5TV4-43-8948A.	5-1	8=39-46	17C114 17C115	50-5 50-5	9=1-8 9=9-24	14808B, Ch. U1000D, Run 1 17804C, Ch. L800D, Runs 1-3	63-6 49-5	10=25-38 9=53-66	172, Ch. 173. Ch.	29-3 29-2	7=22-30 6=15-28
15TV4-43-8949A, Ch.			176117	50-5	9=9-24	17810C, 17810M, 17810MG, Ch.	•		174, Ch.	29 -3	7=22-30
15TV4-7003U BAY210, Ch.	31-2	8=39-40 6=7-16	17C120 17T1, 17T2, 17T3	5-1	8=21-32	17811-H, Ch. Y800D, Runs 1-3	63-6	9=01-84 10=12-24	175, Ch. 176, Ch.	29-2	8=15-28 7=22-30
5TV2-43-9022A	62-4	10=1-10	1774, 1775, 1776 1777	50-5 50-5	9=1-8 0-0-24	17812, 17813, Ch. L800D, Buns 1.3	40.5	9-63-66	180, Ch.	6-1	8=26-34
94TV2-43-8973A	32-3	5=1-8	19C101	5-1	8=33-44	17814, Ch. F900D, Run 1	63-6	10=1-11	183B, 183M, 183T, Ch.	65-6	10=25-32
4TV2-43-8987A 4TV2-43-8993A, 94TV2-	32~3	5=1-8	20C105, 20C106 20C150, 20C151	63-7 62-6	10=39-53 10=1-22	17815-H, Ch. L800D, Runs 1-3 17816, 17817, Ch. Y800D,	49-5	9=53-66	184, 185, 186, Ch. 187. 187B, 187C, Ch.	8-1 29-3	8=6-25 9=1-10
43-8984A, 84TV2-43-8985A	32-3	5=1-8	20T2, 21C200	63-7	10=39-53	Runs 1-3	63-6 40 c	10=12-24	190, 190B, 191, 191B, Ch.	64-5	10=1-24
	0-40	*T-0-0	815	19-3	7=13-22	17824, 17825, Ch. L800D,	Cier	00-00-8	600, Ch. 154	35-4	5=1-15 5=1-15
GAROD RAI	NO CORP.		CENEDAL INCTON	MENT COD		Runs 1-3 17838 Ch 1.8000 Runs 1-3	49-5	9=53-66 9-53-66	601, Ch. 155	35-4	5=1-5
2C4, 12C5; 94 Series	19-1	5=1-14	CENERAL INSTRU	MEN CORP.		17848, 17849, 17850, Ch.			610, Ch. 140, Rev.	35-4	5=8-16
2T2, 12T3, 12T6; 94 Series 4C4, 94 Series	19-1 19-1	5=1-14 5=1-14	44, Tuner 45. Electuner	35-2	5≈1-4 6=1-6	L800D, Runs 1-3 17860-H. 17861-H. Ch. Y800D.	49-5	9=53-86	612, Ch. 142, Rev. 613, Ch. 149	35-4	5=8-16 5=8-16
4CT4, 97, 98 Series	19-1	5=1-20		4	4	Runs 1-3	63-6	10=12-24	620, 621, Ch. 155	35-4	5=1-5
4T2, 14T6; 94 Series 201 1675 1678, 94 Series	18-1	5=1-14 5=1-14	THE HALLICK	AFTERS CO.		17905, Ch. L1000S, Run 1 20822 Ch. M000D, Bun 1	64-7 40 E	10=59-68	822 823 Ch 148	35-4	5=7 5-H=16
6CT4, 16CT5; 97, 98 Series	19-1	5=1-20	B919120. Ch.	49-5	8=17-24	20823B. Ch. L900D. Run 1	49-5	9=37-52	630, 631, Ch. 159	29-2	6=5-14
6T2, 16T3; 94 Series	19-1	5=1-14	C919120, Ch.	35-4	5=1-10	20823C, Ch. R1000D, Run 1	64-7	10=45-58	630, 631, Ch. 170	29-2	8=15-28
9Co, 19Cr; 97, 98 Series 042. 1042G Late	1-81	5=1-14	D1000D, Ch.	63-6	10=25-38	20872, Ch. G900S, P800S, 119005 Dur 1	40 c	0.01	632, 633, Ch. 180 632 833 834 835 Ch 171	29-2	8=5-14 6-15-28
042GU, 1042T Late	19-1	5=1-14	E800D, Ch.	49-5	9=25-36	20882, Ch. E900D, Runs 1, 2	63-6	10=1-11	636, 637, Ch. 183	6-1	8=8-25
043, 1043G Late	19-1	5=1-14 E-1 14	E900D, Ch.	63-6	10=1-11	20990, 20990S, Ch. J800D	49-5	9=25-36	636B, 637B, Ch. 183B, 183M	65-6	10=25-32
142 Late. 1143 Late	18-1	5=1-14 5=1-14	F900D, Ch.	63-6 40 E	10=1-11	Record Changer GENERAL		10-1-10	638, 639, Ch. 180 830 831 832 Ch 151	1-9	8=26-34
244, 1244G Late, 1244GU	19-1	5=1-14	1800D, Ch.	49-5	9=25-36	20994, Ch. J800D	49-5	9=25-36	836, 837, 840, Ch. 153	29-3	7=1-5
245T Late, 1244TX 245. 1245G Late. 1245GU	18-1	5=1-14 5=1-14	K800D, Ch.	49-5	9=25-36	Record Changer GENERAL			841, 842, 843, Ch. 158	35-4	5=1-7
245T Late, 1245TX	19-1	5 = 1 - 14	LEOOD, Ch.	49-5	10=45-58 8=53-66	21923. Ch. Q1000D. Run 1	64-7 PL	10=45-58	847, 848, 849, Ch. 156	29-3	7=3
344 Late, 1345 Late 348	19-1	5=1-14	L900D, Ch.	49-5	9=37-52	21928, Ch. K1000D, Run 1	64-7	10=45-58			7=6-21
546, 1546G Late, 1546GU	19-1	5=1-14	L10005, Ch. L919120. Ch.	64-7 28-2	10=59-68 6=21-28	21940, Ch. Q1000D, Kun I	1	10=45-58	850, 851, 852, Cn. 151 856, 857, 858, Ch. 153	29-3 29-3	7=1-5
546T Late 547. 1547G Late. 1547GI	19-1	5=1-14 5=1-14	M800S, Ch.	6-1	8=1-16	THE HERTNER E	LECTRIC CO.		860, 861, 862, Cn. 157	29-3	7=3
547T Late	19-1	5=1-14	MAUUD, Ch.	49-5	9=37-52 9=67-84	(PRECIS	(NOI		866. 867. 868. Ch. 171	29-2	8=15-28
548, 1548G Late, 1548GU 548T Late	19-1	5=1-14 5=1-14	Q1000D, Ch.	64-7	10=45-58	L-10	35-1	5=1-12	866A, 867A, 868A, Ch. 173	29-2	8=15-28
549, 1549G Late, 1549GU	19-1	5=1-14	R1000D. Ch.	49-5 64-7	9=37-52 10=45-58	HOFFMAN RA	DIO CORP		870, 871, 872, Ch. 170 876, 877, 878, Ch. 171	29-2 29-2	6=15-28 6=15-28
549T Late 848 1847 1848 1840: 1 212	19-1	5=1-14	U800S, Ch.	49-5	9=67-84				876A, 877A, 878A, Ch. 173	29-2	6=15-28
671, 97, 98 Series	19-1	5=15-17	VI000D, Ch.	63 - 6 63 - 6	10=25-38	Tuner PF-6 PF-7 PF-8 Thiners	29-2	6=1-4 0-11-16	880, 881, 882, 883, 884, 885, 886, 887, Ch. 183	R_1	8-8-25
672, 1673, 1674, 1675; 07 08 50-100			603, 604	64-7	10=39-44	7B104, 7B303, Ch. 190, 190B	64-5	10=1-24	886B, 887B, Ch. 183B, 183M	65-6	10=25-32
90, 97, 98 Series	1-61	5=1-20	680, 681, Ch. B919120, Run 3	49-5	9=17-24	7M103, 7M302, Ch. 190, 190B	64-5 24 r	10=1-24	890, 891, 892, Ch. 175	24-2	6=15-28
974, 1975; 97, 98 Series	19-1	5=18-20	715. 715A. Ch. B919120, Run 3	49-5	9=17-24 9-17-24	20B102, (F304, Ch. 190, 1905 20B102, Ch. 183T	65-6 65-6	10=1-24 10=25-32	693, 894, 895, Ch. 185 Record Changer VM-950	6-BC1	8=8-25 RCH22=1-16
0421 Late, 20431 Late 546T, 2547T, 2548T, 2549T	1-41	5≓1-14	716, 717, Ch. C919120	35-4	5=1-10	20B102F, Ch. 194	64-5	10=1-24	or WEBSTER 100	6-RC1	RCH21=1-10
Late	19-1	5=1-14	730, 731, Ch. C919120	35-4	5=1-10	20B501, Ch. 183T	65-6 55-6	10=25-32	896, 897, Ch. 185 2065 2075 Ch. 1837	6-1 ac a	8-8-25
CENEDAL ELL	CT DIGTO		745, Ch. D919120	28-2	6=1-8	20M101F, Ch. 194	64-5	10=1-24	914, 915, 916, Ch. 150	35-4	5=7-16
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2C107, 12C108, 12C109,			810, Ch. M800S	6-1	8=1-16	21M106, 21M300, Ch. 191, 191B	64-5 64 - 5	10=1-24	946, 947, 948, Ch. 164	29-3	7=3
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			010° 011	26-3	7=1-11	100, 011.	50-4	J-1=C	AR-ZI, AH-ZIB	50-2	9=1=16

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76-4402, 76-5411, 76-5433, Series: Tuners	37-5	6=1-8	York, Late	11-2	8=62- 2 10=35-	76 Provincial, Final 54 7T132, Ch. KCS47D		C-01	71 - CC=R	Commander The Console		58-4 27-2	10=1-10 5=1-8
91, Ch.	68-7	10=35-44	KCS31-1, Ch., S1000 KCS31-1, Ch. 9770200	20-6	5=48-	64 Winston, Final 77 7T143. Ch. KCS48A.	Rutland	16-5	9=53-72 8=31-48	Constellation		2-1	8=1-13
PHILHARMONIC RADI	O B TELEV. CO	RP.	KCS34C, Ch.	34-7	5=80-	110 Record Changer				Highland		58-4 58-4	7=1-15 10=11-20
C-6161, T-616	22-1	7=1-5	KCS38, Ch. KCS38C, Ch.	34-7 20-6	5=65- 5=1-1	79 RCA 960284 5 RCA RP-190		10-RC1	RCH21=35-50 RCH21=1-12	Linden The Marquis		58-4 48-3	10=1-10 7=1-16
1116, 5818	22-1	7=1-5	KCS40, KCS40A, Ch. KCS40B, Ch.	37-8	6=1-1 0 7-50-	5 9T105, Ch. KCS49B 64 9T105, Ch. KCS49B.	, York KCS49BF	11-2	8=62-76	The Mayfair, Th Baleteb	e Mozart	48-3	7=1-16
PILOT RAD	IO CORP.		KCS41-1, Ch. KCS45, KCS45A, Ch	20-6	5=16-	31 KCS49BF-2, York 97126. Ch. KCS49C.	, Late Hillsdale	72-12 11-2	10=35-54 8=62-76	The Rancho, The	Revere	48-3	7=1-16
TV-125	20-1	5=1-12	KCS46, Ch.	46-9	-21-2-	32 9T126, Ch. KCS49C,	KCS49CF,	C + C L	10-26-64	Roseland		58-4	01-1=01
121- A.I.	37-2	6=1-10 5=1-12	KCS47B, KCS47C, KCS47	D, Cn. 46-1	1=33-	49 ACCARCE -2, ALLES 9T128, Ch. KCS49C,	Provincial	11-2	8=62-76	The Rover The Savoy, The	Santung	27-2 48-3	5=1-8 7=1-16
TV -163	20-1	5=1-14	Ch.; Final KCS47F. Ch.	16-5	9=53-	72 9T128, Ch. KCS49C, 44 KCS49CF-2, Prov	KCS49CF,	72-12	10=35-54	Sensation)	58-4	10=11-20
TV-165	20-1	5=1-10 5=1-14	KCS47F, KCS47G, Ch.; F	rinal 16-5	8=23-	72 9T147, Ch. KCS60A	-	11-2	8=77-94	The Suburban		27-2	8=14-25 5=1-8
TV-167A *TV-167B. TV-168	37-2	6=1-10	KCS47T, Ch.	16-3	9=17- 0 7=33-	30 Record Changer 49 RCA 960284		11-RC3	RCH21=35-50	Vogue C-1104B Ch 12	4 2.07	58-4	10=11-20
TV-191	37-2	6-1-10	KCS48A, Ch.	10-1	8=31-	48 RCA RP-190		11-RC1	RCH21=1-12	The Console	(1700	27-2	5=1-8
TV-271, TV-273, TV-274	37-2 53-3	6=1-10 9=1-14	KCS49B, Ch., Late	72-1	2 10=35-	76 91200, Ch. KCS41- 54 9TW309, Ch. KCS41-	-1	20-6	5=16-31	C-1401, Ch. 14A C-1602, Ch. 16A	X21 X23,	27-2	5=9-18
TV-293, TV-294	53-3	9=1-14	KCS49BF, KCS49BF-2, C KCS49C, Ch.	Ch. 72-1.	2 10=35- 8=62-	54 9TW390, Ch. KCS31 76 16T152, Ch. KCS47E	-1 ., Talbot	20-6 16-4	5=32-47 9=31-44	16AX25, 16AX C-1602, Series C	26	27-2	5=21-29
DMYJA PLYNC	UTH THE		KCS49C, Ch., Late KCS49CF KCS49CF_2 C	-22-1: 	2 10=35-	54 17T150, Ch. KCS66C	Colby Glenside	68-11 68-11	10=1-16 10=1-16	Ch. 16AX29		27-2	5=21-29
DIG JINI CHOINI AND	JRES BUTING C	L'HO	KCS60A, Ch.	11-2		94 17T153, Ch. KCS66,	Bristol	16-5	9=73-80	The Marquis	, 1121A	48-3	7=1-16
PRECIS See THE HERTNER	ELECTRIC CO.		KCS62, Ch.	10-1	8=1-1 8=1-1	b Late	fineria	72-12	10=17-34	C-Ibi4B, Ch. 16 The Marquis	A Y 28,	48-3	7=1-16
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* See Pilot HANDY No. 1. Pack	27		KCS66A, Ch. KCS66A, Ch., Late	16-5	9=73- 2 10=17-	80 17T155, Ch. KCS66, 34 17T155, Ch. KCS66,	Preston, Preston,	16-5	9=73-80	C-1615B, Ch. 16 The Mayfair	AY28,	48-3	7=1-16
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Outcold SERVINEL RADIO CORP. SCANTINEL RADIO CORP. Outcold 101-130 YA, YB, YC, Ch. 38-1 34-1 10-1 101-130 YA, YB, YC, Ch. 38-1 34-1 10-1 101-130 YA, YB, YC, Ch. 38-1 34-1 10-1 101-130 WB, YC, Ch. 38-1 34-1 10-1 101-130 WB, YC, Ch. YB, YC, Ch. 38-1 10-1 101-130 WB, YC, Ch. YB, YC, Ch. 38-1 10-1 101-130 WB, YC, Ch. YB, YC, Ch. 38-1 10-1 101-130 WB, YC, WA, YB, YC, SH 38-1 10-1 101-130 WB, YC, YB, YC, SH 38-1 10-1 101-130 WB, YC, YB, YC, SH 38-1 10-1 921-14 U1444A 75-2 10-1 10-1 921-14 WB, YC, YB, YC, SH 38-1 10-1 10-1 921-14 WB, YC, YB, YC, SH 38-1 10-1 10-1 921-14 WB, YC, YB, YC, SH 38-1 10-1 10-1	PACK-FILE PAGES MODEL PACK-FILL
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101.00-10, 165, 100-5, 554 74-5 10-1-30 SHERATON TELEV. CORP. 546, 100-5, 554 554 9-37-46 260-5X, 260-FM 54-1 546, 100-6, 564 55-4 9-50-52 260-5X, 260-FM 54-1 546, 100-6, 564 74-5 10-1-30 260-5X, 260-FM 54-1 546, 100-6, 546, 101-2 74-5 10-1-30 519, 520 12-1 546, 100-5, 546, 101-2 11-1 8-40-25 519, 520 12-1 546, 101-2 74-5 10-1-30 519, 520 12-1 101, 000-1 74-5 10-1-30 329, 324 54-1 101, 000-50 74-5 10-1-30 329, 324 54-1 101, 000-50 74-5 10-1-30 329, 324 54-1 101, 000-50 74-5 10-1-30 329, 324 54-1 101, 000-50 74-5 10-1-30 329, 324 54-1 101, 000-50 74-5 10-1-30 329, 324 54-1 110, 000-50 74-5 10-1-30 329, 324 54-1 <td>ABS., INC. 172-16, CI</td>	ABS., INC. 172-16, CI
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8. $361 - \Lambda$, Ch. 55-3 9=9-12 Radmoor 75-3 8. $361 - \Lambda$, Ch. 55-3 9=12-08 Roxbury 75-3 Ch. 55-4 9=21-08 Roxbury 75-3 Ch. 55-4 9=30-52 The Sparcraft 75-3 561 9=30-52 The Sparcraft 75-3 561 9=30-52 The Sparcraft 24-1 561 9=30-52 The Westmoat 24-1 561 9=30-52 Whitey 56-2 561 0-31-00 56-4 9=40-52 561 0-31-40 The Westmoat 24-1 561 0-31-40 The Westmoat 24-1 563 0-31-30 255D190, Ch. 24-1 563 10-3 255D201, Ch. 24-1 563 0-17, Ch. 74-5 10=1-30 255D201, Ch. 563 1010,700-98 74-5 10=1-30 255D201, Ch. 563 563 0-13-20 255D201, Ch. 24-1 563 1010,700-98 74-5 10=1-30 255D201, Ch.	9=1-16 478.339 478.339
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	NODEL	WESTINGHOUSE ELE	7-2150-136, Ch. 7-2150-146, Ch. 7-2150-176, Ch. 7-2150-1764, V-2150-177U, Cl. -2150-186, V-2150-177U, Cl.	V-2150-186C, V-2150- 188CA, Ch. -2150-197, Ch.	/-2152-16, Ch. /-2171, Ch.	7-2172, Ch. 7-2173, Ch. -2175, Ch.	r-2175-1, V-2176-3,	7-2176, Ch.	-2178, Ch. 7-2178-1, V-2178-3, Ch. -2179, V-2179-1, Ch.	V-2192, V-2192-1, V-2192-2, V-2192-3, Ch.	/-2194, V-2194-1, V-2194-2, V-2194-3, Ch. '-2200-1, Ch.	r-2201-1, Ch.	7-2203-1, Ch.	7-2210-1, Ch.	V-2216-1, V-2216-2, Ch.	7-2218-1, Ch. 7-2220-1, Ch. 7-2220-2, Ch.	ZENITH R	Udrich	Sarrett, Barrie Jurton, Byron	Jhurchill Solerides 190615	Coleridge H2439R	Telding, J2030R	ariand	lawthorne, J2026R lawthorne, H3267	Tying, Kiimer Lipling owell	dansfield farkham	Aeredith, Moriey helley	Thackersy, J2054R	Valpole	Valton, J2044R Valton, H2326R Jatton	Vordsworth, 72043R	1-2029R, B-2030E, W-2030R F-2030E	-2041R, Ch. 20H20 -2052R, H-2053R, Ch. 20H20	12226E, Ch. 22H20 2226R, Ch. 22H20, Warton	12226RQ, Ch. 22H20 12227E. Ch. 22H20. Garland

Replacement Parts

(Continued from page 10)

related changes which develop during operation.

NPO Ratings. In contrast to the capacitor which changes in value with changes in operating temperature, some circuits require that the capacitance (whatever it may be) remain constant with changing temperature. These capacitors are in the temperature compensating group except that they have a zero temperature coefficient. They neither increase nor decrease in capacitance with changes in temperature. Another identification for these units is NPO. Because of the high order of stability of NPO units they are excellent replacements for silver micas, assuming that all other requirements are satisfied.

In summarizing the temperature compensating variety of capacitors, it might be well to comment that they are in the main ceramic dielectric capacitors. Also that television receivers make use of a variety of negative temperature coefficient ratings all the way from N030 (-.00003) to N4200 (-.0042) in many different nominal values of capacitance, and in from 500 to 1,500 volts d-c working voltage ratings, and even higher.

GP or General Purpose Types. Another interesting point in connection with ceramic capacitors and which involves the temperature coefficient, as well as having a bearing on the matter of replacement, is the meaning of the words General Purpose. The words are self explanatory relative to application, but what is not generally known is that these units embrace a variety of temperature coefficients from P100 to N750 indiscriminately. A general purpose unit may therefore have any temperature characteristic within this range because they are used in circuits where capacitance changes with changing operating temperature are not too important. Accordingly a capacitor with any specific coefficient within this range may be used as a replacement for a general purpose capacitor, provided that nominal capacitance, capacitance tolerance, and operating voltage requirements are satisfied.

The reverse however is not true; the general purpose capacitor is not a replacement for a temperature compensating capacitor with a particular temperature coefficient, unless it is known that the temperature coefficient of the particular GP component is exactly the same as the unit to be replaced.

SL Types. There is still another variety of temperature compensating capacitor in the ceramic group. These are the units which are identified as SL, or with an N330 (+ and - 500) temperature coefficient. In effect it is a general purpose unit, and any temperature compensating capacitor whose nominal temperature coefficient (Continued on page 32)

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ADDITIONS and CORRECTIONS RIDER'S TV MANUAL 10

Here are more data that will keep your RIDER'S DEPENDABLE REPLACEMENT PARTS LIST-ING published in TV Volume 10 up to date.

FIXED CAPACITORS		
Bet httr.	Set Mir 's Ortginal	
	Part No.	
Trav-Ler	TV-EC-16	Add FP238 to Mallory column
12	TV-EC-17	Add AFM2-57 to Avroves column.
		Add PRS450V/40-40 to Accover column
	TV-EC-33	Add PRS450V. 00-00 plus PRS253/100 to Apronas column.
VARIARI E DESISTANCI	CONTROLS	inter struct in subtructy contains
Contraction of the state of the	CONTROLS	
Andrea	GR V -83,9 GR -83,9	Change AG-80-2 to AG-80-2 in Ciarostat column,
v.	GRV-431	Transpose UF26L from Maliory Lot No. column to Panet Et
Betmon	10A-18441-1	Transpose UR54L from Mailory Passi Fiem, column to Real
Du Mont	01044411	Change RTV-128 to RTV-318 in Charontat Cal. No. column
Firestone	76X13	Change B13-137 to B13-137X to BRC Boart Flows, Column.
General Electric	RRC-161 RRC-166	Change R3730 to R3-230 in LHC inner Shaft column
Halligrafters	258444	Change R2-136 to R2-316 in IRC lines Shull column
Montgomery Ward	10A -18841 -1	Change RTV-239 to RTV-231 in Clarostat Cat. No. column.
Matanata		Change RTV-128 to RTV-318 in Charontat Cal, No. column.
HEOR OF DAY	18AK702864	Change B-137X to B13-137X in BbC Rear Elem. column.
RCA	76974	Change R1-126 to Rj-316 in IRC inner Shaft culumin
weatern Waro	10A-16441	Change P200 to P1-200 in H6C Outer Shalt culumn Change RTV-126 to RTV-218 to Changeli 1 Oct.
Westinghouse	V-9877-3	Change B18-133 to B18-133X in IRC News Flem, culumn
	63 / 2023	Chaoge Q1-359 to QJ-359 is LRC Stock No. column.
AUDIO TRANSFORME IS		
Motorola	25K T03066	Add A-3030 to Mertt column.
Pactard-Beil Philco	89427A 32-8242-11	Add A-3932 to Merti column.
	32-8582	Add A-3825* to Stancor column and
RCA	76156	Add "Drill new mig. hole to Remarks column.
Technosten	76982	Add A-2931 to Meril column.
I TO MALL BEET	a i ra reamint teo.)	Add A-3932 to Merit column
POWER AND PLAMENT	THANGER ME INC	
	CALCULATE CONTINUE FOR	
Packard-Bell TraveLer	89043B	Add P-3070 to Merit column
GIEFE TRANSFORMER		AND R-JEA to IFLAS COLUMN
SWEEP TRANSFORMENS		
Admiral	79A18-6	Change 2.3:1 to 1rd. 3 in Remarks column.
Packard-Bell	89031	Transpost A-8141 from Stancor column to Ram column. Add A-3003 to Merti column.
RCA Radio Craftsmen	74114	Add A-4003 to Merit column
Syivania	241-0004	Add A-3003 to Merit column. Change 1:1 to 11:1 in Remarks column.
Techmaster Trav-Ler	ST2 TV-TR-3	Add A-3000 to Mertt column
81		Add A-97Y to Triad column.
Westers Auto	TV-TR-8 C201-1999	Add A-0123 to Stancor column
		Charles Caul-1999 to Citol-19999 in Part No. column.
FILTER CHOKES		
Packard-Bell	27005	Add C-3996 to Mertt column
POL A	10498	Add C-2996* to Merit column and
Trav-Ler	TV - PC -1	Add C-3335' to Biancor column and
M.	54	Add "Drill one mig, hole to Remarks column. Add C-2016 to Meril column.
1	Jr.	Add C 31X to Triad column
SWEEP SECTION COLLS		
Majestic	C-0.234-4	and ME-1 to Marth ant
Packard-Bell	29527	Add TV-163 to Merit column
Western-Auto	201-20186	Change Lo. Bmb-, 3mb to Lo. 3mb-, 4mb in Romarks column
VOICES		Contraction of Community & Grant Street Stre
historela	34K703240	Add MDF-70* to Meril column and
Packard-Beli	29537	Add MDF-30 to Merit column.
WERIEFE ANIO	301 -1 99-07	Add YTOFUS to Ram column.
		NUMBER OF THE OF GREAT CONTRACT
OF CALL NO		
Qoueral Electric	353707	Change 852707 to 8627D7 to Part No. column.
- m	36-1646-5	And PE-U ST-116 to Jenses columns. Add 10J11* to Jenses columns and
		Add "Viking to Remarks column.

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- 5. Glass-filled plastic case and high-temperature impregnating wax assure moistureresistant, trouble-free operation

BASING AND SOCKET



Note similarity of pin layout to that of tran-sistor symbol. CBS-Hytron type T-2 tran-sistor socket features groove to guide pins into socket. Also anti-burn-out design to in-sure that base connection of transistor will always be made first.







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In compliance with the many requests we have received from our readers, this and future issues of SUCCESSFUL SERVICING will again contain the feature, TV PRODUCTION CHANGES.

The Rider Manual pages and TEK-FILE pack which include the original data and shematics to which the following production changes apply, appear in the index on page 32 of this issue.

HOFFMAN

MODEL 610 CHASSIS 140

Hoffman Model 610 is a 24 tube table model with a 6 inch speaker and an audio power output of 3.0 watts. A 10 inch picture tube is used. Its major components are: Chassis - 140

Speaker - 6" PM (Part No. 9062 voice coil, 3.2 ohms at 400 cps.) Cabinet - Part No. 7532

Escutcheon Frame – Part No. 2250 Filter Plate Glass – Part No. 733

Picture Tube - 10BP4, 10FP4

MAGNAVOX

CHASSIS CT-270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282 (the 102 series) for Chassis with A, B and C suffix

Video i-f Alignment Chart Modulated Generator Frequency 22.75 Mc 23.4 Mc 25.2 Mc 25.3 Mc Adjust for Maximum Converter coil (on r-f tuner, front end.) 1st I-F T-102

2nd I-F T-103 3rd I-F T-104

MAGNAVOX

MODELS CT-270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282 (the 102 series) For Chassis with D suffix

Video i-f Alignment Chart Modulated Generator Frequency 23.1 Mc 25.3 Mc 23.6 Mc 25.5 Mc Adjust for Maximum Converter coil (on r-f tuner) 1st I-F T-102 2nd I-F T-103 3rd I-F T-104

MODELS T100, T120, T121 CHASSIS KCS34C, KCS38

Deflection Yoke (Circuit Changes)

RCA

Two different types of deflection yokes are used on these chassis. The older type, with an iron wire-wrap core, has a cardboard outer housing. The newer type, with a powdered-iron core, has a moulded bakelite housing. The two types are not directly interchangeable.

While the iron wire-wrap yoke will work in all receivers, the powdered-iron yoke will not work in the earlier receivers unless certain circuit changes, made in production, are incorporated. These changes are noted below:

- Locate resistor R-181, in the grid circuit of the horizontal output tube (pin 5 of V-112, 6BG6). R-181 is directly connected to one end of the 47 ohm resistor, R-183, the other end of which goes directly to pin 5. R-181 was 1 meg, and must be changed to 470k to allow for the use of either yoke.
- 2. To avoid vertical non-linearity in T120 receivers when the powdered yoke replaces the wire-wrap type, it is also necessary to modify the deflection circuits in accordance with the accompanying diagram.



Fig. 1. B Filter Connections.

- 3. When installing a new wire-wrap yoke (201D3 yoke), check the schematic for the following: the $56\mu\mu$ f capacitor which appears across one portion of the horizontal winding should appear across terminals 1 and 2 in some receivers, but across terminals 2 and 3 in others. In the latter case, the capacitor must be reconnected, since the yoke is wired with the capacitor between terminals 1 and 2. Incorrect placement of the capacitor may result in excessive raster ringing.
- NOTE: Later production chassis incorporate these revisions.

SYLVANIA

MODEL 1110X CHASSIS 1-329

Horizontal Deflection (Capacitor Change) Capacitor C-211, connected to the Horizontal Size Control, is changed from .00047µf, 1kv to .00075µf, 1.6kv, paper capacitor, Service Part 162-16375.

NOTE: Chassis coded C01 and later incorporate this change.

MITCHELL

MODELS T16-2KB, T16-2KM, T16-B, T16-M

Circuit Changes (General)

- Decrease the value of C-23, located between the junction of R-3 and L-5 (i-f coil) and ground, from .005 μf to .0015 μf (minimum value).
- NOTE: C-23 is now connected to terminal #3 of the tuner instead of terminal #7.
- 2. Increase the value of C-96, located between one side of the horizontal yoke and one side of the secondary of h-v transformer (T8), from $.25\mu f$ to $.5\mu f$, 200v.
- Connect a .005µf capacitor from the cathode of the audio output stage (pin 8, 6V6) to chassis.
- NOTE: Late production chassis incorporate these changes.

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TV Interference and Its Remedies

(Continued from page 1)



C1,C2,C3,C4 - 20 MMFD. MICA L1. L3,- 23 T. No. 24 E. 3/6 I.D. CLOSE WOUND 12- 11 T. No. 24 -

Courtesy Acrovox Fig. 4. High-pass filter in 300-ohm line for eliminating signals lower than 53 mc.

the lowest TV frequency, that is below 54 mc. Design values for two typical filters are shown in Figs. 3 and 4. The filter shown in Fig. 3 is designed to attenuate signals 45 mc and below. The one shown in Fig. 4 attenuates signals below 53 mc.

resonant circuit, its impedance at that frequency is a minimum, therefore short-circuiting any signal components at this frequency. At frequencies other than resonance, its impedance becomes high, so that it does not affect these frequencies.

In Fig. 6 (B) we will illustrate a series trap, which consists of a parallel resonant circuit tuned to the unwanted frequency. A parallel resonant circuit offers a high impedance to its resonant frequency and a relatively low impedance to other frequencies. A commercial product designed to attenuate signals between 20 and 26 mc is shown in Fig. 7.

In addition to using lumped capacitance and inductance components, tuned stubs made of 300-ohm twinlead and coaxial cable may be employed. Referring to the theory of tuned stubs, a quarter-wave open

(Continued on page 30)



Courtesy R. L. Drake Co.

TV

Fig. 5. Right: High-pass filter used in TV receivers which cuts off all signals below 50 mc. Left: Low-pass filter in transmitter which cuts off all signals above 40 mc.



Typical commercial products are shown in Fig. 5. The filter illustrated at the right is a high-pass unit designed to attenuate all signals from zero to 50 mc. The filter at the left, which is a low-pass r-f filter, is used in transmitters, and is designed to attenuate all signals above 40 mc. This insures against the transmission of harmonics which fall within the TV band.

Resonant filters are used as wave traps for such offending frequencies as might be transmitted by f.m., a.m., and other services. Two types of traps are generally employed. These are illustrated diagrammatically in Fig. 6. The one shown in Fig. 6 (A) is a shunt type trap, and is designed to resonate at the undesired frequency. As a series



Courtesy Decimeter Fig. 7. Commercial tuned-resonant traps for eliminating TVI in the 20-26 mc band.
Causes and Cures of TV Interference

The following tables were excerpted from the TVI paper presented by P. S. Rand (W1DBM) at a meeting of the "Wireless Association of Ontario" in Toronto, Canada, and are supplied through the courtesy of Mr. Rand and the Laboratory of Advanced Research, Remington Rand Inc.

A. COMMON TYPES OF TV INTERFERENCE

- 1. Diathermy.
- 2. Receiver radiation.
- 3. Co-channel interference.
- 4. Spark-plug interference.
- 5. Multiple images caused by reflections off buildings.
- 6. Airplane flutter.
- 7. Germicidal lamps.
- 8. Super-regenerative receivers operating radio controlled garage doors.
- 9. Oscillator radiation from f-m receivers and other short-wave receivers.
- 10. F-m broadcast transmitters.
- 11. Image response of receivers, etc.
- 12. Amateur TVI.
- 13. Harmonics of tv i-f amplifier falling in a tv channel.
- 14. Sound bars from tv sound channel; faulty trap adjustment or tuning of tv set.

3. TV INTERFERENCE RELATED TO TV RECEIVER DESIGN

- 1. Direct i-f feedthrough.
- 2. Image interference, arising from a combination of local oscillator frequency plus i.f.
- 3. Signal image interference, resulting from local oscillator frequency plus signal frequency.
- 4. Interference occurring at twice the oscillator frequency plus or minus the i.f.
- 5. Direct reception of the oscillator signal from a nearby television receiver.
- Direct reception of the third harmonic of the tv receiver's i-f amplifier on channel 5.

C. AMATEUR INTERFERENCE RELATED TO TV RECEIVER DESIGN

- 1. Front-end overloading with generation of harmonics in tv set.
- 2. Cross-talk.
- 3. I-f feedthrough.
- 4. I-f pickup.
- 5. Video pickup.
- Spurious responses, such as various harmonics of the local oscillator beating with amateur station fundamental, etc.
- 7. Variation in line voltage, upsetting the picture when amateur transmitter is switched on and off or when keyed.
- Rectification of amateur signal by a corroded tv antenna connection.
- 9. Weak tv signal due to a painted or improperly installed 300-ohm ribbon or

an indoor antenna.

 Rectification of amateur signal in first audio stage of tv receiver and resulting audio interference.

D. TV INTERFERENCE FROM TRANSMITTER MAY BE DUE TO:

- Self-oscillation in the final amplifier or one of the buffer stages due to lack of neutralization.
- 2. Parasitics in one of the r-f stages.
- 3. Key clicks in the case of a c-w (code) transmitter.
- 4. Surging line voltage when the transmitter is turned on or off or keyed.
- 5. Harmonics generated by one or more of the stages.
- 6. Side-band splatter in case of a phone transmitter.
- 7. Parasitics in the modulator.
- Blanketing type of broadcast interference due to unbalanced feed lines.

Many or all of the above types of interference to a television picture can be radiated:

- 1. Directly from the antenna.
- 2. From the antenna feeders.
- 3. From the r-f tank circuit in question.
- From the wiring or inter-connecting cables in the transmitter.
- 5. From the house wiring.
- 6. From the supposedly shielded relay rack.

E. SUGGESTED CIRCUIT CHANGES IN TRANSMITTERS

- 1. Return all grounds with short, heavy low inductance leads directly to the cathode of the tube.
- 2. Bypass all leads directly to the cathode, preferably with some of the new "through-type" or ceramic disc type capacitors.
- 3. Use shielded wire for all inter-connections under the chassis, omitting, of course, those leads that are supposed to be hot with r-f. Shield all inter-connecting cables between chassis preferably with a cable made up of individually shielded wires.
- 4. Use adequate filtering in all leads that leave the chassis.
- 5. Use high-C circuits.
- 6. Use pentodes wherever possible in place of triodes.
- 7. Use some type of capacitors, either tubular or vacuum, directly from plate to cathode on each tube.
- 8. Use harmonic plate traps, if necessary.
- 9. Use adequate shielding.
- 10. Operate the final amplifier as a class-B rather than class-C amplifier.
- 11. Use as low grid current and grid drive as is practical.
- 12. Use link coupling between stages with coaxial cable and coaxial fittings.

- 13. Use double-tuned tank circuits in the final amplifier (antenna coupler).
- 14. Use an antenna that will not radiate harmonics.
- 15. Use a low-pass filter between the final amplifier and antenna; never couple the antenna directly to the final tank.
- 16. Do frequency multiplying in low-power stages that are well filtered and well shielded.
- 17. Use narrow-band f.m. to eliminate last traces of modulation bars in picture.
- Install RG 8-U to the transmitting antenna and adjust for a low standingwave ratio.

F. WHAT TO TRY ON RECEIVER

- 1. Install a high-pass filter or wave traps in the antenna lead-in.
- 2. Try an r-f filter in the a-c line.
- 3. Try wave traps on the i-f amplifier to trap out the fundamental interfering frequency.
- 4. Try wave traps on the r-f amplifier ahead of the television receiver.
- 5. Try a bottom pan on the chassis.
- 6. Try substituting a coaxial feeder for the 300-ohm ribbon.
- 7. Check the tv set for correct alignment.
- Try a good tv booster amplifier ahead of the tv receiver.

t the tv receiver. EDITOR'S NOTE: Since the foregoing information was originally directed to an audience of radio amateurs, most of the emphasis has been placed on causes and cures of television interference resulting from amateur transmitters. This is not to imply that this source of interference is any more or less important or widespread than the other 13 types listed under A above. As a matter of fact, radio amateurs, as a group, have done much to cooperate in the elimination of tv interference.

TV Service Training Course

(Continued from page 9)

Russ Hansen - Contracts Manager

Motorola, Inc., Chicago, Ill.

Dr. George R. Town – Assoc. Director, Engineering Experiment Station,

Iowa State College

Ames, Iowa

Students, drawn mainly from Iowa, Illinois, Missouri and Nebraska, were lodged and quartered on the campus for the course. These students were divided into two classes which ran concurrently. The classes began at eight o'clock in the morning and terminated at ten o'clock in the evening so that individual instruction and consultation could be undertaken during the evening sessions. Both students and instructors lived, ate, and slept television during the two intensive weeks of training. A large quantity of demonstration equipment and service instruments were used both during the formal daytime sessions and during the informal evening classes. All were in agreement that both students and instructors benefited greatly from the 2-week course.

RCAI Alumni News

At the RCA Institute's alumni meeting in February, Mr. Robert Hurd, Commercial Service Representative of RCA Service Company, gave a lecture-demonstration on UHF and the RCA Service Clinic. After explaining the reasons for the "freeze" on VHF allocations and why it was lifted, he continued his talk on UHF and the new problems and opportunities it presents to the television industry. RCAI members were then shown a film on the experimental UHF station KC2XAK at Bridgeport, Conn. and compared VHF and UHF transmission and reception.

The March meeting of the RCAI alumni will be held on March 26th at the RCA Institute. At that time Mr. Whitney Baston, Chief Audio Engineer of NBC will give a speech and demonstration (using an NBC field truck) on Audio Field and Studio Broadcasting Techniques.

Sylvan A. Wolin Forms New Advertising Agency

Sylvan A. Wolin, closely associated with the electronic parts field for twenty years, has just announced the establishment of his own advertising agency. The new corporation, Sylvan A. Wolin & Associates, has its offices at 15 West Palisade Avenue, Englewood, New Jersey.

Specializing in accounts relating to the electronics field, his new corporation will offer complete advertising, public relations and salespromotional merchandising of clients' products. Mr. Wolin believes that his long experience in advertising and sales activities, on the manufacturer's side of the fence, can be of benefit to his accounts.

TV Interference, etc. (Continued from page 28)

line is equivalent to a series resonant circuit, and a quarter-wave shorted line equivalent to a parallel resonant circuit.



Fig. 8. Graph indicating length of transmission line wavetraps for various frequencies.

In all calculations involving the design of traps of this type, the velocity of propagation in the material used must be taken into account. For ordinary twinlead this value is about 0.82, and for coaxial cable about 65.9. Thus, for an interfering f-m station operating at a frequency of 100 mc, the length of a 300-ohm stub required becomes:



Fig. 9. Methods of connecting twin-lead or coax cable as %-λ wavetraps.

A graph giving the size of quarter-wave traps for a range of frequencies from 20 to 200 mc is shown in Fig. 8. Notice that coaxial-cable traps, because of their lower velocity of propagation are somewhat shorter than 300-ohm twinlead stubs. The manner in which open stubs may be connected in the antenna line is shown in Fig. 9.



"Quick-Service" Capacitor Kits in handy crystal clear plastic cases! ... and you pay only for the capacitors. The case costs you nothing!



6 basic kits to service over 85% of your twist-prong electrolytic capacitor replacement needs. Transparent case is excellent storage bin for screws, other small parts—even for fishing tackle. See your local Cornell-Dubilier jobber today for details. Cornell-Dubilier Electric Corp., South Plainfield, New Jersey.



PLANTS IN SO. PLAINFIELD, N. J. • NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS. • PROVIDENCE, R. I. INDIANAPOLIS, IND. • FUQUAY SPRINGS, N. C. • SUBSIDIARY, RADIART CORP., CLEVELAND, OHIO Successful Servicing, March, 1953



A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: Tube, antenna sound and audio manufacturers again dominate the "change activity" scene, with spe-cial emphasis being placed on the introduction of new products. As noted for the past 3 months, tube manufacturers are continuing their tendency of increasing prices, while other product groups show no apparent trend.

New Items

- New Items AMERICAN TELEVISION & RADIO—Added a number of A1R inverter replacement vibrators. AMPEREX ELECTRONIC—Added a new series of germaouum diodes. Also added special pur-pose tube EC80 at \$7.50 dealer net. BARKER & WILLIAMSON—Added Model 600-A, coil set at \$4.64 net and Model 600-AB, blank coil at \$.75 net. CENTRALAB—Added No. PA2049, miniature ro-tary switch at \$3.45 dealer net. CLAROSTAT Added TV replacement controls RTVJ91 to RTVJ93 inclusive. CLEAR BEAM—Introduced new Yagi series YSD B element and YSD-2 8 element antennas. CREST LABS—Added Model 51, eathode-nay tube rejuvenator at \$2.40 dealer net.

- CREST LABS.—Added Model 51, eathode-ray tube rejuvenator at \$2.40 dealer net.
 FAIRCHILD RECORDING EQUIP. Added Model 650-C, preamplifier at \$47.50 dealer net . . . Model 651-B, power supply at \$51.00 dealer net and Model 652-C, preamplifier at \$47.50 dealer net.
 FLEXO INTERNATIONAL—Added Model 4303, hench lamp at \$18.95 list and Model 4324 port
- FLEXO INTERNATIONAL—Added Model 4303, bench lamp at \$18.95 list and Model 4324, port-able deak lamp at \$25.00 list. FRETCO—Added Four Stack at \$7.59 dealer net to their series of Mi Tee Ray UHF antennas and Model SA300 at \$1.11 dealer net to their Nu Design Mount line. Also added 8 element Yagi antenna series QTV8-2 to QTV8-12 inclu-sive and 10 element Yagi antenna series QTV10-2 to QTV10-13 inclusive.
- sive and 10 element Yagi antenna series QIV10-2 to OTV10-13 inclusive. GENERAL ELECTRIC—Added germanium diodes 1N81 at \$4.35 list and G7G at \$2.00 list ... receiving tube 12AY7 at \$3.00 list and to their test equipment series, Model ST-13A (single freq.) at \$250.00 dealer net ... Model ST-13A (dual freq.) at \$275.00 dealer net ... external anaenna mounting for ST-13A at \$8.30 dealer net and cable (BNC to UHF—six feet long) at \$7.95 dealer net.

- and cable (BNC to UHF-SIX teet 1018) as error dealer net. GON-SET-Added Model 3026, "communicator" at \$189.50 dealer net to their new 2 meter trans-mitter-receiver series. GREAT EASTERN MFG.-Added Stray-X fila-ment choke at \$.95 dealer net. HICKOK ELECTRICAL INSTR. Added Model 533DM, special tube merchandiaer at \$179.50 dealer net and Model 605, combination tube tester and set analyzer at \$184.50 dealer net. HYTRON-Added special purpose tube 6V6GTY at \$1.08 dealer net and TV picture tubes 21XP4 at \$1.08 dealer net and TV picture tubes 21XP4 TIME VINBAPOWR CO.-Added Model 12J7,
- JAMES VIBRAPOWR CO.—Added Model 12J7, interrupter type vibrator at \$2.88 dealer net. KRVLON—Added No. 1601, black spray at \$1.95

- KRYLON—Added No. 1601, black spray at \$1.95 list.
 LOUIS BROS.—Model 718, corner reflector an-tenna at \$12.45 dealer net and Model 2-82.WR, VHF UHF rhombic antenna with reflector at \$8.31 dealer net have been added to their line.
 LOWELL MANUFACTURING CO.—Added No. SS 24 at \$1.11 dealer net and No. SS 48 at \$1.59 dealer net, steel support channels for sus-pended ceilings. Also added "The Richmond", series of wall type speaker baffles.
 MALLORY & CO., P.R.—Added a new line of UE controls. Also added Model 4548, vibrator of the communications type at \$4.62 dealer net.
 MARKEL ELECTRIC PRODUCTS Added Model A 7165, metal clad crystal element car-ridge complete with 2 osmium tip stylus for microgroove records at \$7.20 dealer net. MASTER MOBILE MOUNTS—Added all band Civil Air Patrol Antennas, Models 2374KC, 4507.3 and 4585 all at \$9.95 net. Also added extra coila, Models M2374, M4507.5 and M4585 all at \$3.60 net.

- NUCLEAR INSTRUMENT & CHEMICAL Added Model 1413, "cloudmaster" geiger counter at \$99.00 dealer net. RADELCO MFG-Added UHF antennas US-102A at \$3.75 dealer net and US-104 at \$7.05 dealer net at \$7.05
- RADIO MERCHANDISE SALES-Added a num-
- ber of new UHF antennas. RAM LLECTRONIC—Added a number of vertical output transformers, V301 to V312 inclusive and also vertical blocking transformers V401 to V405
- also vertical blocking transformers V401 to V403 inclusive.
 RAYTHEON-Added germanium junction transistors CK/21 at \$12.50 dealer net and CK722 at \$7.60 dealer net. Also added special purpose tubes CK5670 at \$7.00 dealer net. . . CK5750 at \$3.25 dealer net . . . CK6212 at \$7.50 dealer net and CK6247 at \$14.65 dealer net.
 RIDER, JOHN F.-Added No. 143, TV Manufacturers' Receiver Trouble Cures, Vol 1 at \$1.80 dealer net.
 SCHOTT CO., WALTER L.-Added UHF antennas No. 4150, trombone at \$11.10 dealer net and Model 4152, trombone at \$32.97 dealer net.
 SYLVANIA-Added special purpose tubes 6BF7W at \$4.45 dealer net and 6X4W at \$2.00 dealer net.
 SGHS at \$2.45 list and 12B4 at \$2.00 list and TV picture tube 21ZP4A at \$4.00 dealer net.

- list and TV picture tube 21ZP4A at \$4.00 dealer net. TECHNICAL APPLIANCE CORP. Added a number of one and two bay, 5-element, 2 diameter Yagi antennas. TELEMATIC—Added TV receiver coupler, Model AM-44 at \$2.50 dealer net and CKT booster, Model CR-64 at \$1.26 dealer net. TELREX—Added a number of new UHF antennas. Also added Model DY6x1, dual channel "fishbone jr', cut for channel 4 and 5 at \$11.81 dealer net. THOMAS ELECTRONICS Added cathode ray tubes, 19BP4A at \$45.10 dealer net... 21WP4 at \$38.35 dealer net... 21YP4 at \$38.35 dealer net and 21ZP4 at \$39.80 dealer net. UTAH RADIO PRODUCTS—Model C-1272, filter choke at \$1.20 dealer net ... Model P-1061, power transformer at \$17.10 dealer net and Model VB-1170, vertical blocking oscillator at \$1.35 dealer net have been added to their line.

Discontinued Items

- GERRARD SALES-Discontinued Model 201/B5,
- RADELCO MFG.—Discontinued Model 201/BS, multi-speed transcription turntable.
 RADELCO MFG.—Discontinued Model 43, dual band dipole and mast kit and Model RS-531, dual band television array.
 RADIO CITY PRODUCTS—Discontinued Model 447BPK, multitester kit and Model 449A, pocket multitester.
- multitester
- nullitester. RCA Discontinued No. 201B1, television com-ponent and No. 37158, crystal pickup. SYLVANIA Discontinued sub-miniature tubes 6BF7 and 6BG7. TELREX—Discontinued their bi-channel 5 element
- TELREX—Discontinued their bi-channel 5 ciclicult series and their metro series. VIDAIRE ELECTRONICS Model PA-150, phono amplifier has been discontinued. WEBSTER ELECTRIC Discontinued Model 84-
- 25, public address amplifier.

Price Decreases

- BARKER & WILLIAMSON-Decreased price on Model 600, dipmeter to \$39.75 net and Model 3975, balum coils to \$3.75 net. CHATHAM ELECTRONICS Model 1Z2, high voltage vacuum rectifier decreased to \$4.25 dealer
- net. CREST TABS—Decreased price on cathode ray tube rejuvenators Model B to \$2.25 dealer net ... Model C to \$2.10 dealer net and Model D to \$2.25 dealer net. FAIRCHILD RECORDING EQUIP. Decreased price on Model 620-CL, power amplifier to \$190.00 dealer net. FRETCO—Decreased price on fretaray to \$23.97 dealer net and fretaray junior to \$11.97 dealer net.

- net. I.OWELL MANUFACTURING CO. Decreased price on Model H-24, hi-fidelity decorative grille to \$10.50 dealer net. MERIT TRANSFORMER Decreased price on deflection yokes Model MDF-30, Model MDF-70 and Model MDF-71 all to \$6.00 dealer net. Also decreased Model HVO-8, horizontal output and hi-voltage transformer to \$3.90 dealer net. PENTRON CORP. Decreased price on Model 9-T3M, duo-speed portable tape recorder to \$59.75 net.

- PRECISION ELECTRONICS Decreased price on Model 100-BA, basic amplifier to \$41.25 dealer net and Model 215-BA, high fidelity triode am-plifier to \$99.50 dealer net.
 RADELCO MFG.—Decreased price on Model RT. 51, high band television array to \$1.32 dealer net.
 RAYTHEON—Decreased price on special purpose tube CK6146 to \$4.15 dealer net and rectifilters Model RFR-1027B to \$44.00 user price and Model RFR-1027B to \$48.00 user price.
 SYLVANIA Radio receiving tube 12JSGT de-creased to \$1.55 list.



have been looking for, and the more data I receive, the more I will consider it indispensable,"

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TELL-A-FAULT is only a few months old, but the idea has caught on with thousands of progressive service technicians throughout the country.

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Radio's Master Reports (Continued from page 31)

Price Increases

- CANNON ELECTRIC—Increased price on No. XK-3-11, straight cord plug (with socket insert) to \$3.30 dealer net. ELECTRO-VOICE—Increased price on Model 6. HD, diffraction horn to \$15.00 dealer net. FRETCO—Increased price on fretline series, Model BC to \$38.40 dealer net and Model E to \$54.60 dealer net. RCA—Increased—price on Model 269S1, elec-tronic component speaker (PM type) to \$6.24 dealer net.

- tronic component speaker (PM type) to \$6.24 dealer net. SCHOTT CO., WALTER L.—Increased price on antenna kits; No. 4066, V-King, U-Install to 9.45 dealer net . . No. 4096, Signal King to \$9.45 dealer net and No. 4106, Double-Vee, U-Install to \$8.40 dealer net. SIMPSON MFG.—Increased price on their No. 52 series of tape recorders. SYLVANIA—Increased price on germanium crys-tal diodes 1N60 to \$.75 dealer net and 1N105 to \$.75 dealer net.
- dealer net. NICAL APPLIANCE CORP. Increased TECHNICAL.
- price on a number of one bay and two bay silver-streak antennas. WEBSTER ELECTRIC—Increased price on re-placement cartridge No. V1Q3 to \$7.50 dealer
- net.



Replacement Parts

(Continued from page 23)

falls within the limits of P100 and N750 is suitable for use where the SL or the other is specified, provided that the other related constants also are satisfied.

It is conceivable that replacement of micas, ceramics and paper dielectric capacitors may become a matter of concern because the units with the desired temperature characteristics and capacitance values may not be available. Where temperature compensation is a factor, replacement is fairly well limited to the specific general type of capacitor used as original equipment. An exception is the replacement of a temperature compensating mica with a temperature compensating ceramic. - This need will not be encountered too frequently because virtually all temperature compensating capacitors used in television equipment are ceramic dielectric components.

When it is necessary to replace a general purpose or an SL variety of ceramic or a general purpose mica and the particular capacitance is not available, an NPO type of proper capacitance tolerance and working voltage rating is a good replacement. The reverse is not true; an NPO unit must be replaced with another NPO capacitor.

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ENCYCLOPEDIA ON CATHODE-RAY OSCILLOSCOPES AND THEIR USES, by Rider & Uslan. Most complete 'scope book! Cloth cover. 992 (81/2 x 11") pp. 3,000 illus.\$9.00 TV INSTALLATION TECHNIQUES, by Marshall, "Howto-do-it" book on antennas, receiver adjustment, municipal laws on installing, etc. 336 (51/2 x UNDERSTANDING VECTORS AND PHASE IN RADIO, by Rider & Uslan. A shorthand method to easier understanding of radio theory. Cloth cover. 160 (5½ x 8½") pp., illus.\$1.89 TV AND OTHER RECEIVING ANTENNAS (Theory & Practice), by Bailey. All details on more than 50 latest type receiving antennas. Cloth cover. UHF PRACTICES AND PRINCIPLES, by Lytel. Complete discussion about theory and applications of ultra high frequencies. Cloth cover. 390 (5½ x 8½") pp., illus.\$6.60 TV MASTER ANTENNA SYSTEMS, by Kamen & Dorf. A practical working manual on master antennas; problems and solutions. Cloth cover. 356 (51/2 x 8½") pp., 270 illus.\$5.00 VACUUM-TUBE VOLTMETERS, by Rider. Revised. Theory, application, operation, probes, calibration, testing, etc. Cloth cover. 432 (51/2 x 81/2") FM TRANSMISSION AND RECEPTION, by Rider & Uslan. 2nd edition covers FM from start to finish, BROADCAST OPERATOR'S HANDBOOK, by Ennes. 2nd edition. All practical operations in or out of Place your order with your Parts Jobber NOW ... or write.

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Television receiver trap circuits are one of the few items that may be radically different from one manufacturer to the next. Some receivers have as many as six trap circuits, while others have only one. This may explain why the serviceman often neglects the trap circuits of a faulty receiver. Improperly aligned or missing trap circuits can give rise to important difficulties.

The Need for Traps

Trap circuits are placed in the intermediate-frequency and video sections of the receiver, and are named from the fact that they are used to "trap" certain undesired signals. To illustrate the need for trap circuits, let us assume that the receiver is being used in a locality where the signals of channels 2, 3, and 4 are present. (In general, this can occur midway between two large cities, such as between New York and Philadelphia.) Let us further assume that the receiver is tuned to channel 3, and that the new 44-mc i-f range is employed. The local-oscillator frequency will then be 107 mc. The local oscillator will hetrodyne with the picture and the sound carriers of channels 2, 3, and 4 to give the intermediate frequencies shown in Fig. 1. Notice that the local oscillator causes the frequencies to invert, so that channel 4 appears a a lower intermediate frequency than channel 3.



The i-f response curve of a receiver is relatively wide. In the absence of trap circuits, certain of the frequencies of Fig. 1 will reach the second detector and give rise to spurious effects. The response curves of Fig. 2 have been drawn to illustrate these effects. The dotted curve is the response curve of a receiver without i-f trap circuits, while the solid curve is the correct overall i-f response curve of a receiver. In the example chosen, improper trapping will result in the following effects.

1. The adjacent picture i-f carrier, 39.75 mc, will introduce the channel-4 picture at the same time that channel 3 is being received. The interfering picture will usually appear dimly in the background, but out of synchronization with the desired picture.

2. The 47.25-mc adjacent sound i-f carrier, if allowed to reach the second detector, will place horizontal sound bars of the channel-2 sound upon the channel-3 picture. Even more serious, however, is the fact that this signal will hetrodyne with the 45-75-mc picture i-f carrier to produce a 1.5-mc beat sig-



Fig. 2. The 44 mc i-f response curve of a TV receiver. Dotted curve - without traps. Solid curve - with a complete set of traps.

below 3 percent, the sound output of an intercarrier receiver will be unnecessarily reduced. If the amplitude is much above 3 percent, the sound output may contain the annoying 60-cycle buzz that often plagues intercarrier receivers. (The 60-cycle buzz is the way a picture signal "sounds" in a loudspeaker. It seems peculiar, therefore, that excessive 41.25-mc sound i-f carrier amplitude

I-F Trap Circuits in TV Receivers

by Sid Deutsch

nal. This will appear as an annoying verticalline interference in the picture.

3. The associated sound i-f carrier, 41.25 mc, is the most important signal to be acted upon by trap circuits. Excessive amplitude of this signal at the second detector will result in horizontal sound bar interference in the picture. It is also possible for the 41.25-mc



sound i-f carrier to hetrodyne with the 45.75mc picture i-f carrier. This will result in a 4.5-mc signal that can appear as interference in the television picture.

In non-intercarrier receivers, it is desirable to trap out as much of the associated sound i-f carrier as possible. In intercarrier receivers, on the other hand, the amplitude of this carrier at the second detector should be approximately at the 3 percent level, as shown in Fig. 2. The 4-5-mc signal mentioned in the previous paragraph is used, in intercarrier receivers, as the sound intermediate frequency. If the 41.25-mc amplitude in Fig. 2 is much can result in a buzz. When two signals hetrodyne together, however, the amplitude of the beat signal is controlled by the amplitude of the weaker of the two original signals. Thus, a weak 41.25-mc sound i-f carrier hetrodyning with a strong 45.75-mc picture i-f carrier will result in a clean 4.5-mc sound i-f signal.

The 35.25-mc and 51.75-mc signals of Fig. 1 are relatively weak in a properly aligned receiver, and will not cause interference effects.

In general, as shown in Fig. 2, each of the undesired i-f carriers should have an amplitude of 3 percent or less, while the desired picture i-f carrier of 45.75-mc should have an amplitude of 50 percent.

Almost all receivers employ associated sound traps. Some receivers have an additional 4.5-mc trap in the video section to eliminate the 41-25-mc—45.75-mc beat note. All intercarrier receivers use such a 4.5-mc trap for the purpose of developing the sound i-f signal. Some receivers have adjacent picture and sound traps in addition to associated sound traps.

Types of Trap Circuits

Figure 3 illustrates the four main types of trap circuit. All of these traps have one thing in common—very high Q's. The trap coils, for example, consist of a few turns of relatively heavy wire, since a low-Q trap circuit

(Continued on page 10)



Television receiver trap circuits are one of the few items that may be radically different from one manufacturer to the next. Some receivers have as many as six trap circuits, while others have only one. This may explain why the serviceman often neglects the trap circuits of a faulty receiver. Improperly aligned or missing trap circuits can give rise to important difficulties.

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Fig. 1. Intermediate frequencies that may be present when receiving channel 3 in the 44 mc i-f range.

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Successful Servicing, April, 1953



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Setting Up for TV Service

Because of the opening of new market areas and an awakening realization in old ones of the values of store-operated service, many dealers are asking: What does it take, in dollars and equipment, to set up for TV service? Herewith, from several experts, the answers.

by Ted Weber

The following article and its illustrations are reprinted through the courtesy of ELECTRICAL MERCHADISING and the McGraw-Hill Publishing Co., Inc. who acknowledge the cooperation of experts from Emerson Radio & Phonograph Corp., Allen D. DuMont Laboratories, Inc., and RCA Service Co. in providing data for this article.

Reckoned in dollars and cents, setting up a television service operation is an expensive undertaking.

But figured in terms of customer good will, a good service operation is a profitable investment.

There's no paradox here — it does take money to equip a service department to handle TV. But, once equipped, a wellmanaged service operation can hold old friends and make new ones.

Not every dealer wants to handle his own TV servicing. Some may find it more economical or more efficient to let a distributor or an independent service agency handle the work. Many others, however, will feel that it will pay them to set up their own service shop. Taving made that decision, the retailer is faced with a number of other questions boiled down they ask the how, what and where of setting up a TV service department.

For the answers, Electrical Merchandising asked a group of TV set makers for their recommendations. On this, and the following pages, their suggestions for shop layouts, test equipment, hand tools, installation tools and materials and parts inventories are summarized for the dealer interested in handling his own service.

Planning the Shop

Space limitations may prevent the dealer from choosing the "ideal" location or dimensions for a service shop. But good planning can turn a less than ideal space into an

If possible, service benches should be placed end to end and flush against the wall to facilitate supervision. Storage area for incoming and outgoing work should be as near to the benches as possible; if it is any great distance away some sort of wheeled "dolly" should be provided for moving chassis from the storage area to the benches.

If a one-man shop is planned, test equipment can be permanently fixed in a panel. However, in shops employing more than a single technician, flexibility must be considered and the solution would appear to be a shelf (12 to 24 inches high) mounted at the rear of the bench. An adequate number of AC outlets should be provided along the length of the shelf. Test equipment can then be moved from place to place on the shelf.

Generally speaking, the bench surface should be large enough to allow one receiver



HAND TOOLS \$30

to be set aside for a heat run while the technician is working on a second set. The bench should be at least six feet long, four feet deep and be from 36 to 38 inches high. Placement of drawers, AC outlets and the selection of a bench top are largely matters of personal preference. Generally, a single drawer will be sufficient for the storage of hand tools; too many drawers will lead service men to regard them as a last resting place for parts and junk. There are arguments for and against metal top benches. One firm suggested the use of either copper or tempered masonite bench tops, terming the decision a matter of personal preference. But a second manufacturer's service manager said that the use of a metal top "is not recommended."

Sufficient AC outlets must be provided not only for the shelf holding test equipment but for the service bench itself. One service (Continued on page 25)

Successful Servicing, April, 1953



18th Edition

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VOLUME 14 NUMBER 4

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Curtain Time

The Itinerant TV Service Technician

A Detroit TV Service Association publication has commented on our editorial on the itinerant service technician which appeared in the January, 1953 issue of SUCCESSFUL SERVICING. The contention is that we have changed our minds concerning the disadvantages of doing service work in the home; that is, we expressed contrary opinions some time ago and now seem to be in favor of it. The fact of the matter is that we spoke about what seems to be

The fact of the matter is that we spoke about what seems to be the trend, and fairly definite at that. Moreover it is not unusual to change one's opinion with changing times. Trends do appear and while all individuals and concerns having an interest in it may not agree, only time tells which is proven right or wrong.

There is no question about the advantages of doing service work in the shop and the disadvantages of working in the home. But the public has learned that service work can be done in the home. Perhaps it has been mainly tube changing in the past, but in the eyes of the public it has been service—and they like the idea of not having the chassis removed from the home. Admittedly they accepted the idea of chassis pulling and removal to the service shop, but by and large they were unhappy about it and prefer service in the home. Add to this the fact that more than just a random few service facilities in different parts of the country are making an effort to render service in the home, and others are talking about it more and more, and there you have your trend. The likelihood of it growing is very great, if for no other reason that the public likes it.

The statement was made that a complete repair cannot be made in the home. Isn't it determined by the type of fault present in the receiver and what is involved in the repair? We agree that a good job should be done, that certain tests should be made on a receiver, but it is not inconceivable that many complete repairs and tests can be made in the home. It all depends on the nature of the trouble; the availability of the proper types of test equipment for diagnosis in the home, the availability of parts—the competency of the service technician and his sales ability, etc. These are problems but their solutions are not impossible.

The cardinal item is the public reaction to a servicing approach which has been set by TV servicing facilities. In the past it has been tube changing by many; but others have changed yokes, focus coils, variable resistance controls, tuner coil strips, electrolytic capacitors, peaking coils, fixed capacitors, width and linearity coils and numerous small inductor type components in the home. Defects associated with these components are not necessarily complicated although they may be so, if the fault found is multiple. In that event the chassis is removed to the service shop. Major repairs like overall alignment, power transformer and horizontal output transformer changes are shop jobs. It is interesting to note that one receiver manufacturer has unitized chassis for sectional replacement in the home; another has introduced horizontal-output transformers with phone tip connectors.

There are no laws which dictate that service work must be done in the home, but isn't it somewhat unwise to shut one's eyes to a trend? Picture if you will the possibilities of having a removable bottom to every table model cabinet . . . access to the bottom of the chassis without pulling it!—One manufacturer already has a screen at the bottom of the table model cabinet. Now it is there for ventilation purposes, but if it were made removable, consider the convenience for home servicing.

Manufactures are adding tests points available at the top of the chassis as a convenience for trouble diagnosis. Naturally it is a convenience in shop servicing, but it also aids in the evaluation of the type of fault possibly present in the receiver when diagnosis is carried on in the home.

One of the points raised against home service is that the family watches the repair operations and becomes a time keeper. Another contention is that if a schematic is used, the receiver owner suspects incompetency. A third is the matter of bickering over price. All of the conditions described happen, but the question is are they valid reasons for not performing home service—or should the visiting technician also be a salesman who will educate the public to undertand each of the points being raised? Perhaps the final result will be understanding from only 90 percent of the television receiver owners, but it is a step in the right direction. The public does not know—and some do not want to learn—but by and large, the majority can be sold. It all depends on the approach... It may be a long drawn out affair, but it is the problem of the servicing industry and all those who cater to it, to try to find the answer for better public relations and more profitable operation. Maybe it will take years for the home servicing trend to develop

Maybe it will take years for the home servicing trend to develop Maybe it will grow for a year or so, and then change because of some other situation. Maybe the arrival of color television (in about two years) may nullify the trend; then again maybe the reverse will happen—receiver manufacturers may so design their equipments that substantial amount of service can be done in the home. We're not fortune tellers—but neither do we fail to note the appeal which home TV service has to the public. Nor can we shut our eyes to the fact that more than just a few service facilities operating in different parts of the nation are doing more than just tube changing TV service in the home.

When we examine public reaction, we must be objective. Consider the expansion of department stores. Traffic problems make it difficult for suburbanites to come into town—so, many large stores open branches in the suburbs. This is a trend which is developing around all large cities. All stores don't comply, but many do the idea being to meet the desires of the public—who in the final analysis foots the bills.

Ask any design engineer active in the electronic field about printed circuits . . . It's a trend, and little by little it is growing. Can tube manufacturers ward off the semi-conductor (transistor) trend? Of course not! How will the transistor and printed circuits affect other component manufacturers in time? The impact is a relatively long time off, but the trend is there. The point is raised that adequate numbers of competent per-

The point is raised that adequate numbers of competent personnel may not be available for good home service . . . Perhaps this is true and it may limit the extent of the activity . . . Perhaps the shortage may be so great as to actually prevent the realization of the trend . . . But does this mean that we should not see the trend? . . . As we said before, all organizations may not welcome a change of this kind. It is their privelege to try to ward it off, but how is it possible to ward off something if we don't see it looming in the distance?

We repeat that if the trend takes hold, it will be necessary for competitive organizations to follow suit. Isn't this normal in competitive activities which render a service? The prices need not be the same but the modus operandi for satisfying the public's wishes cannot differ too greatly.

John F. Rider

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Triplett

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Fig. 1. Sample of the set manufacturer's blueprint used for reference, describing all electrical mechanical and physical details of the original parts.

Some Questions & Answers About Rider's Dependable Replacement Parts Listings

We have received numerous letters asking questions concerning the Replacement Parts Listings which appeared for the first time in Rider's TV Manual 10 and in the Tek-Files beginning with pack 57. We feel that these questions can best be answered by listing the query and explaining the answer.

Q-Why are there vacant spaces in the parts manufacturers' columns?

A-The vacant spaces under the various parts manufacturers' listings indicate that, at the time of preparation of the list for inclusion in the Rider Manual or Tek-File, the parts manufacturer did not have a replacement which, upon analysis, was considered suitable as a replacement for the original part used by the set manufacturer.

Q-It it important to adhere to the tolerance specifications given in the tolerance column in the fixed capacitor listing?

A-The answer is yes. The tolerance listed in the tolerance column relates to the original capacitor used in the receiver. Numerous circuits in TV receivers are critical. Unless it was necessary, the receiver manufacturer would not pay a premium price to the parts supplier for capacitors which are closer to the nominal value than the industry standard of plus or minus 20%. It is always best servicing practice to use replacements which conform with stated tolerance ratings, also those which are expressed in terms of micro

micro farads. It is conceivable that under certain conditions a capacitor rated at a higher tolerance may function satisfactorily in a circuit, wherein a more rigid tolerance is specified, but this does not indicate that it will happen in many cases. On occasion a 20% capacitor may display a capacitance which is within 1% of the normal rating. This is just a fortunate circumstance. Unless the set manufacturer's engineers felt that they needed a 5 or 10% capacitor, they would not so specify on the blueprint and pay the extra money for the higher accuracy.

O-How is the suitability of a replacement part decided?

A-The replacement parts listed are selected by comparing the electrical, physical and test specifications on those parts with the corresponding specifications of the original parts used in the receiver. If the specifications for the suggested replacement match the specifications for the original parts, the replacement is listed. The receiver manufacturers furnish us with blueprints of the various components which we embrace in the Replacement Part Program. An example of one of the blue prints is shown here. It is for a horizontal output transformer. Although the Rider Dependable Replacement Parts Program is only about eight months old, we already on hand, for reference purposes, blueprints covering more than 20,000 components

such as transformers, capacitors, variable resistor controls and speakers, used in television receivers. Many are received each day. Using blueprints of the original components is the most reliable means of determining rhe constants of the parts used in all of the production runs of television receivers produced by manufacturers.

Q-How do you take care of the different kinds of speakers which are used in the different models?

A-The information we receive from receiver manufacturers indicates to us the variety of speakers which are used in the table models, consoles, and consolette Models of television receivers. The new replacemnt parts listing which will accompany Rider's TV Manual 11, and shown herein, will in many instances, disclose from 3 to 10 different versions of loud speakers which are used for the chassis listed. Competitive parts listing services that are incomplete frequenly show just one speaker as being applicable for perhaps 10 to 20, or more, receiver models. Q-Are the parts listed as replacements in

Rider listings subject to much fabrication?

A-No. The need for extensive fabrication is one of the reasons for disqualifying a suggested replacement part. The blueprints covering original components received from the receiver manufacturers, stipulate the mechanical requirements. Only such replacement parts as fit within these mechanical limitations, with minor variations, are listed. This means

that when a service technician purchases one of the parts shown in our listing, fabrication or alteration by him is unnecessary, or at least is kept to the absolute minimum.

Q-What does "compliance with test specifications mean? "

A-One of the requirements set by us for listing a replacement part, is that its test specifications conform with those which cover the original part in the receiver. In other words, if the set manufacturer stipulates that the original part must withstand the application of 2,500 volts rms between the winding and the coil of a transformer, the replacement part must do likewise in order that it be considered acceptable for listing. This is a safeguard for the service technician and is one of the many reasons why the Rider listings are the most dependable.

Q-Do you ever check parts in receivers? A-Yes, many times. This is why we consider the matter of tolerance on inductive and capacitive components to be such a serious matter. Time and again we establish that as little as 10% difference in the inductance of a horizontal deflection winding from that of the original part can be very troublesome; that as little as 10% difference in the turnsratio of a vertical output transformer from the rating of the original part can cause substantial non-linearity and correction would

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(Continued on page 32)

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A Note on TV in England

Observations made by one of our servicemen-authors who has been trying his hand at TV Servicing in a shop in England while "vacationing" abroad.

by John D. Burke

One of my biggest problems since starting to work in a London TV repair shop two months ago, has been in reading the diagrams provided for our use.

First of all — there is a considerable difference just in terminology, between the two countries — even though we both speak the "same" language.

Here are some of the translations:

American	British
B Plus Power Line	High Tension (H.T.) Extra High Tension
High Voltage	(E.H.T.)
Tube	Valve (except for a CRT—which is a "tube")
Antenna	Aerial
Ground	Earth
Shielding	Screening
Chassis	(Sometimes called "the deck")
	Reiminen Resistor
Globar Resistor	Erema
Vertical	rame
Horizontal	Line Dice Fored
Micromicrofarad	Scan Coile
Yoke	Medium Wave
Broadcast Dand	Frequency Changer
Mixer	Decimpling
By-Pass Saalaat	Valve Holder
Disto	Anode
Plate	Gramophone
Damper	Efficiency Diode
B Plue Plus	Boosted H.T.
Sweep Circuits	Time Bases
"Open"	0/C
Short	S/C
Unsoldered Connection	Dry Joint
Filter Capacitor	Smoothing Capacitor
Input Capacitor	Reservoir Capacitor
VTVM	Valve Voltmeter

May I hasten to add the fact that there are many more words which are the same in both countries — we can read one another's technical literature. For example, such words as focus, definition, radio frequency, alignment, synchronization — mean the same.

It was just the fact that these strange words had to be understood by me, quickly, and while I was struggling with other problems of a foreign country's TV system.

The shop in which I work employs four

bench mechanics — called "service engineers". We have a rather good supply of service information. Good, that is, in that it covers most of the sets we are likely to see; and good in comparison with the service information a smaller shop might have been able to acquire. This word "acquire" is used advisedly. For, service information in not offered to the whole trade. Some manufacturers will only supply such information to those dealers who are franchised to sell and service their brand of sets.

Other manufacturers have released diagrams for publication — but there are limitations. A book has just been published giving a great deal of information about quite a few sets. But the price is very high. Also, the diagrams are so small I cannot read them without a magnifying glass!

There are two magazines with restricted circulation which publish one TV and one radio schematic each month. One of these magazines goes only to full-time professional repairman. The other *only* to dealers. The information they give is very welcome, and I have been working with such forms of technical guidance for two months.

However, I find a number of great shortcomings in practically all British radio and TV service sheets:

Size — generally much smaller print than can be read comfortably.

Values of resistors and capacitors — not given on the diagrams. Sometimes they are, but usually one has to hunt up the parts lists, with a great loss of time, and much annoyance.

Tubes not designated by type — that is, the diagram only bears V1, V2, V3, etc. Again, time is spent looking for the list of tubes (valves).

Pin numbers not given — a few English diagrams do show the pin connections but

ATTENTION AUTHORS:

We are soliciting articles concerning radio, television, and allied electronic maintenance. All aspects are of interest. Articles of 1,000 to 2,000 words are desired. Preference is given to subject matter which reflects practical work rather than theory. The presentation should be direct, to the point, and amply illustrated. Finished art work will be prepared by us from the roughs submitted. Photographs are welcome. The rate of payment is on a word basis — and, needless to say, good writing rates good pay!

Submit all articles and inquiries to Editor, Successful Servicing.



Our author - John D. Burke

most do not. Sometimes they will have a basing chart printed near the schematic. Other times, one must hunt for it.

Chassis layout charts also have the same defect — they show you where V6 is, but they do not say what type of tube it is, nor what function it has in the set.

Voltage readings are not given on the schematic. Usually this is given on a separate chart.

Ohms readings on coils are also given separately, if given at all.

Of course, my criticisms of English schematics are prompted mostly by my having worked with those used by our trade in the U.S. My shopmates are accustomed to using what they have, and manage to get along quite well in spite of the handicap.

In time I will be able to do the same. But I hope for an improvement. Perhaps it will come as Britain gets more flooded with TV sets. They now have about 2,000,000 in use.

It must be added, in their favor, that the sets are quite good, and compare favorably with American sets.

There are many varieties of chassis — with some 20 to 30 manufacturers — less than in the States, but quite enough to satisfy my wish to always have new and interesting problems to solve each day.

I brought along with me some technical literature, including some copies of Rider's Tek-Files. Looking through several as I write this, let me assure you that the English TV repairman quite often has only about 10% of the information furnished to him that you are getting.

English shops do not promise quick-as-awink service. And most repair jobs go into the shop. The average job in my shop takes two to three days from pick-up 'til delivery.

Also the sets are simpler, and the problems of 405 line television, and one-channel television, are much less. However, that will provide material for other articles.



A brand new series of practical books that will give you the exact directions for correcting TV receiver performance "bugs." Each remedy is the one developed by the receiver's own manufacturer. It is positive! Each cure is official, factory-authorized. It will help correct some of the most difficult faults-picture jitter, hum, instability, buzz, tearing, etc.

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I-F Trap Circuits in TV Receivers

(Continued from page 1)

is useless. Trap circuit capacitors must be of a low-loss type in order to obtain high Q's. For convenience, we will assume that each of the diagrams of Fig. 3 represents an associated sound traps, although trap circuits do not depend upon the frequency to which the trap is tuned.

The coil of an inductively-coupled trap, as in Fig. 3(A), is placed near the i-f interstage coil with which it is to work. If a 41.25-mc associated sound signal is present in the i-f interstage coil, it will induce a signal in the trap circuit. This will result in a relatively large circulating current in the trap because of its high Q. The circulating current produces a magnetic field that acts to oppose the 41.25-mc signal in the i-f interstage coil, thereby considerably reducing the strength of the associated sound signal. (The amplitude of this signal cannot be reduced to zero, of course, because then there will be no magnetic field in the trap circuit). A second type of circuit, the capacitivelycoupled trap, is shown in Fig. 3(B). Although the operation of this circuit is different than that of the inductively-coupled trap, the end result is the same. At 41.25 mc, for example, coupling capacitor C_C in combination with L and C, will produce a lowimpedance series-resonant path to ground. This will "short-circuit" the 41.25-mc signal that is present in the i-f interstage coil. The capacitively-coupled trap also produces a peak to the left of 41.25 mc, but in this case it is caused by a high-impedance parallel-resonant condition between the i-f interstage coil and the trap circuit.

The effectiveness of the capacitively-coupled trap is partly determined by the size of the C_c . If this capacitor is too large, the trapping action will remove some of the picture signals, while an undersized coupling capacitor will result in insufficient trapping action. A typical value for C_c is 1.5 $\mu\mu f$.



Fig. 3. Various trap circuits. (A) Inductively-coupled trap. (B) Capacitively-coupled trap. (C) Series-coupled trap. (D) Cathode trap.

As the solid line of Fig. 2 shows, the 41.25-mc trap produces a response-curve peak slightly to the left of 41.25-mc. If a 40.5mc signal is present in the i-f interstage coil, for example, it will also produce some circulating current in the trap circuit. The magnetic field that is produced in this case, however, will aid the 40.5-mc signal because of phase differences between the 40.5-mc and 41.25-mc operation. Fortunately, there is little likelihood of a signal at 40.5 mc, and the peak at this point should cause no trouble. Similar peaks may be created to the left of 39.75 mc and to the right of 47.25 mc.

If the inductively-coupled trap coil is too near the i-f interstage coil, the trapping effect becomes broadened out until some of the picture signals are trapped out in addition to 41.25 mc. If the trap coil is too far from the i-f interstage coil it will have insufficient effect. The series-coupled trap of Fig. 3(C) acts by introducing a high-impedance parallelresonant circuit in series with the signal path. This trap is also characterized by a peak to the left of 41.25 mc. The action of the trap is controlled by the size of C. When C is too small, the picture frequencies will be affected. When C is too large, the size of L becomes correspondingly small and it becomes difficult to build a high-Q trap coil. C is generally over $100\mu\mu f$ in value.

The fourth circuit, the cathode trap, is shown in Fig. 3(D). The action of this trap is based upon the reduced gain that results when an impedance is introduced into the cathode circuit of a tube. At 41.25 mc the trap coil reflects a high impedance into the cathode circuit, while at other frequencies it has very little effect. The cathode coil by itself is a small inductance, and does not

(Continued on page 18)



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engineering team (and you) seek. Constantly CBS-Hytron carries on teamwork like this. Socket by socket analysis. Day in, day out — with 9 out of 10 leading TV set makers. Both tube and set engineers pool their specialized skills. Scores of the nation's foremost TV set engineers help make endless CBS-Hytron improvements. Help assure you of unsurpassed performance in virtually *all* leading TV sets. Small wonder that your CBS-Hytron

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Replacement Parts in TV Receivers (Part 1-Capacitors con'td)

This is the sixth in a series of articles on "Replacement Parts in TV Receivers." "Transformers" will be discussed next month.

Maximum Operating Temperature

We have already referred to the item of operating temperature. In a sense, the maximum operating temperature is a constant for a capacitor although it might, perhaps, be better viewed as a rating. By and large the general run of capacitors intended for use in television receivers are designd for operation at either maximum temperatures of 65°C or 85°C. In either case, whatever are supposed to be the other constants of the unit are assumed to be true only if the capacitor is used within the maximum operating temperature rating.

An attempt towards standardizing maximum operating temperature ratings of paper dielectric capacitors used in TV receivers at 85°C is under way. However, 65°C capacitors are still commonplace. Operating a capacitor above its maximum operating temperature rating generally results in a reduction in the insulation resistance of the capacitor and in an increase in the power factor, that is, in the electrical losses in the unit.

Receiver manufacturers have displayed during the past few years, a trend towards the use of 85°C capacitors in place of the 65°C capacitors which they used in the past. Unfortunately, the specific capacitor used in a receiver does not bear a label which indicates its maximum operating temperature rating. Hence, when replacement is the issue it is a matter of either replacing with a component which is similar to that used in the receiver, which may be a 65°C unit or buying a 85°C and using it. In this respect, reference to the catalogues made by the capacitor manufacturers will disclose the maximum operating temperature ratings of their components. It is pretty much standard today that molded capacitors are 85°C rated. As a matter of fact, the replacements shown in the Rider Dependable Replacement Parts Lists for tubular capacitors are the molded variety even when the original part was a paper tubular. Summarizing the entire matter, the use of molded case paper dielectric tubulars with the various synthetic impregnants as replacements for tubular capacitors used in TV receivers will satisfy the maximum operating temperature ratings set by the receiver manufacturers with very rare exceptions.

Insulation Resistance

The insulation resistance is a rating associated with paper dielectric tubulars, mica dielectric and ceramic dielectric fixed capacitors. It expresses the d-c resistance of the capacitor at rated temperatures. It is an im-

by John F. Rider

portant item when capacitors are used as blocking devices to prevent the application of d-c voltage present at one point, at another point. The blocking capacitor, also known as the coupling capacitor in many amplifier circuits is the example of such an application.

The usual way in which the insulation resistance of paper dielectric capacitors is mentioned, is megohms times microfarads. On the average, the insulation resistance of paper dielectric tubular capacitors at the temperatures from 20 to 25°C runs around 2,000 megohms per microfarad for values above .1 mfd. On occasion the rating is 1,000 megohms per microfarad. This means that if the capacitance is .5 microfarad the insulation resistance may vary from 500 to perhaps 1,000 megohms. If the capacitance is less than .1 mfd the insulation resistance usually is specified at a fixed amount, as for example, 5,000 megohms for the unit. As to the change in insulation resistance with temperature, it may decrease to as low as 1/70th of its base value at 20°C, when the temperature rises 40 to 50°C.

In the case of ceramic and mica capacitors which are generally available in the lower values, the insulation resistance is generally expressed as a fixed quantity as for example 5,000 megohms, or more or less. The receiver manufacturers generally specify the insulation resistance when they order capacitors and their requirements extend from 5,000 to 7,500 megohms. Replacement units of this kind of capacitor generally display similar values of insulation resistance.

The lower the insulation resistance of a capacitor, the greater is the possible leakage



in this issue.

of the d-c voltage applied to the plate of a tube, through the capacitor, to the grid of the next tube, assuming that the capacitor is the d-c blocking device between these two tube electrodes. On the face of it, it may seem as though 1,000 megohms insulation resistance is a tremendously high ohmic value, yet receiver manufacturers frequently require that paper, ceramic and mica capacitors in certain capacitance ranges display insulation resistance of from 6,000 megohms to 7,500 megohms minimum, when measured at 100 volts dc at from 20 to 25°C. For example, if the insulation resistance is 1,000 megohms and the voltage is 250 volts, a current of .25 microampere will flow through the capacitor. If this amount of current is allowed to flow through, a 10 megohm grid leak and a 21/2 volt drop will develop across the resistor and by virtue of the polarity, can very materially and adversly affect the existing grid bias. This accounts for the requirement of 5,000 to 10,000 megohms insulation resistance for capacitors less than .1 mf used in this manner. Frequently, in order to maintain the high insulation resistance present between the terminals of mica capacitors for example, they are waxed dipped.

Although we have not mentioned this point earlier, it is always advisable before wiring in a replacement capacitor to check its capacitance and its insulation resistance. On more than one occasion, we found that this brief test saved a great deal of time, because in some cases the capacitor was wrongly labeled and in other cases its insulation resistance had for some unknown reason, fallen from far below its normal value. This does not happen too frequently, but the few moments necessary to make these tests will be worthwhile in the long run.

Relative to insulation resistance it is well to take note of another very important consideration, namely the voltage at which the capacitor is tested. The ordinary ohmmeter test is not satisfactory because the voltage applied is too low. Whenever possible, the insulation resistance test should be made with at least 100 volt dc applied, preferably several hundred volts.

Quite frequently the insulation test made with an ordinary ohmmeter shows a tremendously high resistance, but when the applied voltage is increased from 100 volts dc to perhaps 300 volts dc, the insulation resistance falls to a value which indicates excessive leakage through the capacitor and its unsuitability for use in the circuit.

Power Factor

Power factor is a constant for all capacitors. It is an expression which denotes the (Continued on page 28)

Successful Servicing, April, 1953

HINT FOR FINDING TV CHANNEL FREQUENCIES

The following hint, which appeared originally in "The Relay" (published by the Fred C. Harrison Co., Elmira, N. Y.) is based on an idea submitted by John Mulligan.

1. To find the frequencies corresponding to any uhf channel (channels 14 to 83) proceed as follows. Multiply the channel number by 6, then add 389 mc. This will give the center frequency of the channel. The frequency of the picture carrier is 1.75 mc below the center frequency, and the frequency of the sound carrier is 2.75 mc above the center frequency.

2. To find the frequencies corresponding to a channel in the high vhf band (channels 7 to 13) proceed as follows: Multiply the channel number by 6, then add 135 mc. This will give the center frequency of the channel. The picture-carrier frequency is 1.75 mc below the center frequency, and the sound-carrier frequency is 2.75 mc above the center frequency.

3. To find the frequencies corresponding to a channel in the low vhf band (channels 2 to 6) proceed as follows: Multiply the channel number by 6, then add 49 mc for channels 5 or 6 or add 45 mc for channels 2, 3, or 4. This will give the center frequency of the channel. The picture-carrier frequency is 1.75mc below and the sound-carrier frequency is 2.75 mc above the center frequency.

As an example, assume you are interested in knowing the frequencies coresponding to uhf channel 44. The center frequency is 44 times 6 plus 389 mc, or 653 mc. The picture-carrier frequency is 1.75 mc lower, or 651.25 mc while the sound-carrier frequency is 2.75 mc higher, or 655.75 mc.

As a second example, assume you are interested in knowing the frequencies of vhf channel 11. The center frequency is 11 times 6 plus 135 mc, or 201 mc. The picture-carrier frequency (1.75 mc lower) is 199.25 mc, while the sound-carrier frequency (2.75 mc higher) is 203.75 mc.

Maintenance and Repair

(Continued from page 15)

be glad to pay the extra charge when he sees the improvement made on performance.

In conclusion, we might say that you only get out of the radio-TV service business what you put into it. If you put your full time into doing the best possible work on your customer's sets, using all of the helps available, you will be more than repaid in the increased service business, especially in the repeat business that high-quality work will always bring in.

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MODEL &	PART #	CATALOG	FUNCTION	DESCRIPTION	LIST		MODEL &	PART	CATALOG	FUNCTION	DESCRIPTION	LIST PRICE
ARVIN				2000 /0 5 14	12.10		CHASSIS	W-148861	Order From	AGC	1000 Ω 1W-W.W.	
6175TM 6179TM	E22464-20	RTV-259	Vert. Lin./ Height	3000/2.5 Meg, 2W-W.W./carbon Conc. Dual	\$3.10		EMERSON		MTK			
	E22464-27	RTV-352	Contrast Vol ./Sw .	1500/250 Ω Conc . Dual carbonSPST	\$3.70		7118 7128	390156	AG-61-5 KSS-5	Vert. Hold	1 Meg. Ω carbon	\$1.25
	E22464-34	AG-49-5 KSS-3	Bright.	100 K Ω carbon	\$1.25		7208	390181	AG-52-S KSS-5	Bright.	200K Ω carbon	\$1.25
CHASSIS TE-331	E22464-36	AG-83-5	Vert. Hold	1.5 Meg. Ω carbon	\$1.25			390183	AG-44-S KSS-5	Hor. Hold	50K Ω carbon	\$1.25
TE-331-2	E22464-38	AG-14'	Hor.	25K Ω carbon	\$1.25			390196	AG-83-5 FKS-1/4	Height	2 Meg. Ω carbon	\$1.25
BELMONT-		<u></u>					CHASSIS 1201648	390196	AG-83-S FKS-1/4	Focus	2 Meg. Ω carbon	\$1.25
C-1729A	A10A-18#1	RTV-218	Contrast/	5000/1Meg. Tap 100K	\$4.50			390197	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2₩-₩.₩.	\$1.25
M-1726A M-1726A M-1726A			voi./ 3w.	DPST	\$1.25			390201	RTV-296	Contrast Vol./Sw.	1500/1 Meg. Conc. Dual carbonSPST	\$3.70
	PART # CATALOG # FUNCTION DESCRIPTION E22464-20 RTV-259 Vert. Lin./ Height 3000/2.5 Meg. 2W-W. W. / Cob Conc. Dual E22464-27 RTV-352 Contrast Vol./Sw. 1500/250 Ω Cor carbon-5851 E22464-34 AG-49-5 K55-3 Bright. 100K Ω carbon E22464-36 AG-49-5 K55-3 Bright. 100K Ω carbon E22464-38 AG-47 Hoid 1.5 Meg. Ω car Ω Conc. Dual E22464-38 AG-47 Hoid 25K Ω carbon A108-1847 RTV-218 Contrast/ Vol./Sw. 5000/1Meg. Ta Ω Conc. Dual of DPST A108-17275 AG-49-5 K55-3 Bright. 50K Ω carbon A108-17264 AG-44-5 K55-3 Bright. 50K Ω carbon A108-17218 AG-41-5 FK5-1/4 Height 750K Ω carbon A108-19218 AG-61-5 HES-1/4 Height 750K Ω carbon A108-19242 AG-63-Z K55-3 Hor. FS-1/4 Inverter IMeg. Ω carbo CH262022-4 AG-85-5 HS-1/4 Height 30K Ω carbon Carbon RV4(10 CH262025-12 AG-85-5	TOUR S2 Corbon	¢1.25			390202	AG-83-5	Fringe Com-	2 Meg. Ω carbonSPST	\$1.25		
	A108-17764	AG-44-S KSS-3	Bright.	50K Ω carbon	\$1.25		EADA					
	A 108-19218	AG-19-5 FKS-1/4	Vart. Lin.	5000 Ω carbon	\$1.25		7C42	D220076G20	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	\$1.25
	A 108-19220	AG-61-5 FKS-1/4	Height	750K Ω carbon	\$1.25		7.52	52.24	AG-84-5 FKS-1/4	Height	2.5 Meg. Ω carbon	\$1.25
	A 108-19542	AG-63-Z KSS-3	Tone	1 Meg. Ω carbon	\$1.25			52.64	RTV-109	Contrast/ Vol./Sw.	750 Tap 500/500K Ω 2W-W.W./carbon	\$4.50
BENDIX								1			Conc. DualSPST	
0AK3 21K3	CH262022-4	AG-42-5 FS-3	Hor. Hold	30K Ω carbon	\$1.25			52.66	RTV-110	Vert./ Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	\$3.10
21KD 21T3 21X3	CH262024-15	AG-27-5 FKS-1/4	Noise Inverter	10K Ω carbon	\$1.25			52.69	AG-44-5 FS-3	Bright.	50K Ω carbon	\$1.2
	RV4C10 CH262025-4	AG-83-5 FKS-1/4	Vert. Hold	2 Meg. Ω carbon	\$1.25			52.74	AG-84-5 FKS-1/4	Focus	2.5 Meg. Ω carbon	\$1.2
	CH262025-14							Some Models	Ușe Part # 52.6	в		
	RV4C07 CH262025-7	AG-85-S FKS-1/4	Height	3 Meg. Ω carbon	\$1.25		7T32, 77T32, 721	52.24	AG-84-5 FKS-1/4	Height	2.5 Meg. Ω carbon	\$1.2
	RV4C07 CH262025-7	AG-85-5 FKS-1/4	Focus	3 Meg. Ω carbon	\$1.25			52.24	AG-84-S FKS-1/4	Focus	2.5 Meg. Ω carbon	\$1.2
	RV4C11 CH262025-10	AG-58-S FKS-1/4	Vert. Lin.	600KΩ carbon	\$1.25			52.64	RTV-109	Contrast Vol./Sw.	750 Tap 500/500K Ω 2W-W.W./carbon Conc. DualSPST	\$4.5
	CH262025-13 CH262041-2	AT-90	Vol./Sw.	500K Ω carbonSPST	\$1.25			52.66	RTV-110	Vert/ Hor. Hold	1 Meg/50K Ω Conc. Duat carbon	\$3.1
	LH262045-1	RTV-373	Bright./	100K/1200 Ω Conc.	\$3.10	,		52.68	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	\$1.2
	<u> </u>							52.69	AG-44-5	Bright.	50K Ω carbon	\$1.2
DU-20CDM,	B-148952	AG-83-5	Vert. Hald	1.5 Meg. Ω carbon	\$1.25			* Some Models	Use Alternate P	ant ∮ 52.74		
COB, COM,	B-148953	AG-44-S	Hor.	50K Ω carbon	\$1.25		20C22 20T12	52.24	AG-84-5 FKS-1/4	Height	2.5 Meg. Ω carbon	\$1.2
CDN, CHM, COB, COL,	B-148966	AG-43-5 RS-2	Bright.	40K Ω carbon	\$1.25		24110	52.54	RTV-109	Contrast/ Vol./Sw.	750 Tap 500/500K Ω 2W-W.W./carbon Conc. DualSPST	\$4.5
	B-149893	A 10-1500 K\$\$-3	Focus	1500 Ω 4W-W.W.	\$1.85			52.66	RTV-110	Vert./Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	\$3.
	B-151634	AG-15-5 RS-2	Vert.	3000 Ω carbon	\$1.25	5		52.68	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	\$1.
CHASSIS 357	B-152129	AG-83-5 RS-2	Height	1,5 Meg. Ω carbon	\$1.25	5		52.69	AG-44-5 FS-3	Bright.	50K Ω carbon	\$1.
357-1	C-151111	RTV-327	Contrast/ Vol ./Sw .	1500/1Meg. Tap 250K Ω Conc. Dual carbon	\$4.30							



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18

Mismatched TV Components

Numerous comments concerning the effects of improperly matched TV components have appeared in SUCCESSFUL SERVICING in the past. These have led to numerous telephone calls from service technicians asking that we publish information concerning the effects of such conditions. These articles will appear in this magazine beginning with the May, 1953 issue.

The Editor

RIDER'S TV 11



Rider's Dependable Replacement Parts Listing published in TV Volume 10.

SWEEP TRANSFORMERS

Set Mfr. Gamble-Skogmo	Set	Mfr's	Origi	nal	
Gamble-S	Skogmo		Part 51X	No. 1 56	
Correction:	Transpose	A-8141	from	Ram	column

to Stancor column. RCA 74114

Correction: Change Part No. 74114 to 74144 in Part No. column.





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Successful Servicing, April, 1953

I-F Trap Circuits etc.

(Continued from page 10)

cause much degeneration. A transformer arrangement is used to obtain a high-Q trap circuit. The coupling between primary and secondary determines the effectiveness of the trap.

The cathode trap generally does not produce a peak to the left of 41.25 mc. However, the trap loses its effectiveness if the transconductance of the associated tube is low. This tube should operate, therefore, with a constant bias. If agc bias is applied to the tube, the trap will become useless when strong station signals are being received.

Any of the four arangements shown in Fig. 3 may be used to trap out a 4.5-mc signal in the video section of the receiver.

Tuning of Traps

In non-intercarrier receivers, the sound i-f signal is removed from one of the 41.25-mc traps, while in intercarrier receivers the sound signal is obtained from a 4.5-mc trap. The question arises, when tuning these traps, as to whether to tune for maximum sound output or minimum picture-signal output. The answer is that i-f traps should always be adjusted for minimum second-detector output, so as to obtain the solid-line response curve of Fig. 2. Similarly, 4.5-mc traps should be adjusted for minimum 4-5-mc signal at the cathode-ray tube. A properly designed receiver will have sufficient sound output when the traps are adjusted in this manner, and it is more important to optimize the picure presentation. Receiver schematics usually specify the frequency at which each trap is intended to operate. In most cases, the trap circuits are slug tuned.

Conclusion and Summary

From the foregoing discussion, one may conclude that many television receiver faults may be traced to improperly aligned traps, or to traps that have been omitted in the design of the receiver. In all cases, improperly aligned traps may trap out picture signals rather than the signals they were intended for. This may be checked by examining the overall i-f and video response curves of the receiver. Summarizing, we may note that:

1. Improperly aligned or missing associated sound traps may result in sound-bar and 4.5mc interference in the picture, and buzz in intercarrier receivers;

2. An improperly aligned or missing adjacent sound trap may result in sound-bar and 1.5-mc interference in the picture;

3. An improperly aligned or missing adjacent picture trap may result in adjacentpicture interference in the desired picture;

4. An improperly aligned or missing 4.5mc trap may results in 4.5-mc interference in the picture, and weak sound in intercarrier receivers.



Are You a TV Troubleshooting EXPERT?

What caused the abnormal picture tube pattern in this TV receiver?





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(NOTE: Refer to CIRCUIT GUIDE IV-9(A) for identification of components.)

The unstable picture-tube pattern evident while the receiver was defective is shown, as photographed at different instants, in Figs. 1 and 2. The raster was shrunken in size and jumped erratically over the face of the picture tube at a rapid but visible rate, giving the appearance of a flickering raster. Neither vertical nor horizontal sync could be restored by adjustment of the hold controls. The bright vertical line, marked by intermittent horizontal streaks, was conspicuous at all times. While audio-output level was normal, a steady oscillation of undetermined frequency accompanied the sound.





BR HT VERTICAL LINE

Since symptoms of faulty operation appeared to involve both vertical and horizontal synchronization and the highvoltage section, which depends on the horizontal-sweep circuit, operation of the common sync strip was checked. The sync separator and clipper (VI and V2) appeared to be operating normally. However, at the grid of the sync splitter (V3), the unstable, distorted waveform of Fig. 3 was obtained, with an isolating probe, at H/3. Normally, the well-defined steady pulse of Fig. 4 is present. A similar condition existed at the vertical-scanning frequency.

Output from this stage was then investigated. Waveforms at the plate were badly distorted in shape. For example, at V/2 through the low-capacitance probe, the pattern of Fig. 5 was noted. This stage, when functioning properly, produces a plate waveform like that shown in Fig. 6 at the frequency mentioned.

The cathode-output waveform (obtained at the junction of R9 with R10) was similar to but out of phase with the plate output, as expected (see Fig. 7). However, it was much lower in amplitude. Cathode and plate output waveforms are normally of the same amplitude. The normal output waveforms of Figs. 6 and 8, for example, are similar in shape, opposite in polarity, and of the same P-P height. The positive d-c voltage at the junction of R9 and R10, however, was considerably larger than the normal low value.

A check of the output side of capacitor C6, feeding from the cathode, revealed the expected display, already shown in Fig. 7; but the d-c voltage, normally negative, was identical to the positive reading found at the previously mentioned junction of R9 and R10. In addition, resistance readings on either side of capacitor C6 were the same.

Normal operation of this receiver was restored by replacing a defective component in the cathode-output circuit of the phase splitter, V3. Coupling capacitor C6 was found to be shorted.

_ .



The Rider Manual pages and TEK-FILE pack which include the original data and shematics to which the following production changes apply, appear in the index on page 29 of this issue.

GAMBLE-SKOGMO (CORONADO) MODELS 05TV1-43-9014A, 15RA2-43-9105A CHASSIS 16AY210

Circuit Changes, Audio

A 6T8 tube (triode-triple diode) replaces the audio amp. 6AV6 (V12) and the audio det. 6AL5 (V21), performing the same functions as these two tubes.

In the audio strip assembly, 72 (Part No. B-13M-19257, the ratio detector coil) is replaced by Part No. B-13M-17273.

NOTE: Chassis stamped with RMA date code number 124031 or higher incorporate these changes.

MAGNAVOX

CHASSIS CT-275, 276, 277, 278, 279, 280, 281, 282

R-F Unit

These chassis use either r-f unit 700349 or 700354.

SYLVANIA

MODEL 1110X CHASSIS 1-329

Sound I-F Limiter (Circuit Change) 1. Dual ceramic capacitor C-103 and C-104

- (.004µf, 450v), connected to pins 6 and 7 of the Sound I-F Limiter (V-9, 6AU6),
- is removed from the circuit.
- 2. Resistor R-105 (330 ohms, ½w), connected to pin 7 of V-9, is removed from the circuit.
- 3. The cathode of V-9 (pin 7) is connected directly to ground.
- 4. New capacitor C-103 (.005µf, 500v, ceramic, Service Part 166-500D) is added to the circuit as screen grid bypass for V-9 (pin No. 6 to ground).
- NOTE: Chassis coded C02 and later incorporate this change.

SYLVANIA

MODELS 71M, 72M, 73B, 73M CHASSIS 1-366(C08), 1-441(C02)

Sound I-F Limiter (Circuit Change)

- 1. Resistor R-105 (330 ohms) and capacitor C-103 (.004µf) are removed from the cathode (pin 7) of the Sound I-F Limiter (V-10, 6AU6).
- 2. The cathode is connected directly to ground.
- 3. Capacitor C-103 (pin 6 of V-10, 6AU6) is changed from .004µf, 500v to .005µf, 500v (Service Part 166-5000D).
- NOTE: Chassis 1-366 coded C09 and chassis 1-441 coded C03 incorporate this change.



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Pro	Mfr.	Tubes Tested	Tubes Failed	Point Quality
T REPORT	Α	8	3	76
SYLVANIA ELECTRIC PRODUCE	В	8	4	79
NEW YORK 19. NEW YOR	С	8	6	62
	D	8	4	74
	E	8	4	67
	F	8	5	42
UNITED STATES TESTING CO	G	8	4	52
HOBOKEN, N. J.	Н	8	5	30
HR.	SYLVANIA	8	0	93

Exhaustive tests by United States Testing Company prove Sylvania Picture Tubes out-last, out-perform all others tested!

• Hour after hour for over 1,400 consecutive hours, Sylvania Picture tubes were tested side by side with tubes of 8 other manufacturers. The chart at right tells the remarkable performance record. Note that only Sylvania Picture tubes showed no failures. Here's the conclusion of the U. S. Testing Company Report: "On the basis of an ultimate Life Test Evaluation of the eight tubes of each brand tested, it can be

22

concluded that the averaged overall qualities measured on the Sylvania Tubes were superior to the averages of the other brands tested."• HERE ARE

THE

CONCLUSIONS!

•United States Testing Company, Inc., Test No. E-5526.





RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT LAMPS, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULDS: PHOTOLAMPS; TELEVISION SETS

What Is The Fastest Way To Trouble-Shoot A TV Set?

This material originally appeared in A.G. RADIO NEWS, published by the AG Radio Parts Co.

Every service technician has his own little private system of trouble shooting because it is developed from day to day experiences in dealing with an endless variety of problems.

In beginning to trouble shoot a chassis brought into the shop, some prefer to check prominent B voltage points first; others choose to test suspected groups of tubes first; some rely on observation of the end result of both picture and sound for the prime indication of a defect and still others turn directly to signal tracing or signal injection methods.

Each of these approaches has it own definite advantages and because of this, furnishes grounds for argument, which incidentally, is not the concern of this review.

Regardless of the system of trouble shooting which you may employ, it may be wise to stop and analyze it occasionally to find if you are competitive in today's modern service market.

How does your system of trouble shooting measure up to the following questions?

(1) Is it fast enough to be competitive even when severe problems are encountered?

(2) Is it a sure-fire direct approach to the source of a defect right down to the very component at fault?

(3) Does it furnish positive proof of correction enabling you to gain control over the cause of trouble so you can repeat bad or good operation at will?

When the going gets tough and extraordinary demands are placed on any particular system, it may soon be found to be limited to the extent where tests methods of another system must be reverted to in order to reach a conclusion. On may suppose then, that a combination of the above listed systems might be best, but this hardly seems practical. From another aspect, trouble shooting practice can be relegated to two broader classifications:

(a) The "case history" or "experience" method and

(b) progressive testing.

Many technicians depend on their experience with one set to guide them in repairing another one like it. When an unfamiliar problem arises, someone else's experience is sought, either through conversation or by resorting to technical files.

The popularity of direct solutions to characteristic problems is responsible for the introduction of many technical data sheets hints and kinks, and other printed helps. Therein other peoples' experience are described so the technician can avoid the costly process of working them out for himself. The limitation to this "case history" method, however, lies in the extensive filing job necessary to organize sufficient data and to constantly amend it for all makes of sets. Filing could conceivably take more time than trouble shooting!

Where specialization on a single line of receivers alone is practiced, the "case history" method with its repeatedly used short-cut experiences, becomes highly practical. This is a point in favor of having exclusively franchised dealers or large specializing contractors.

Progressive testing should appeal more to the independent technician who services all makes of receivers. His pet system of trouble shooting, plus schematics, voltage charts, and other pertinent basic information will enable him to rush through most problems.

When his routine practice is completed, the employment of his extended knowledge of various systems of trouble shooting, quickly leads to conclusive results.

This "general practitioner", therefore, must rely more on his ability to think of a test that will solve his unusual problems than to rely solely on finding a case history that will match any problem which he may encounter.



Let Art Liebscher, former RCA Test Equipment Specialist and authority on the subject, give you all the answers on . . .

TV SWEEP ALIGNMENT TECHNIQUES

Never before has there been a book such as this on TV sweep alignment! Here you have techniques set up by an expert in the field a man who gives you accurate, time-saving methods — and tells you how they work. The new Supermark method of TV sweep alignment is introduced. Learn new uses for your test equipment. Chock-full of sweep curve pictures taken from actual jobs using the test equipment set-ups and techniques discussed. Valuable for servicing in UHF signal areas. Covers TV sweep alignment methods completely from all angles. Know how to check video amplifier response with a sweep generator applied to the antenna input; how to peak align tuned circuits with sweep equipment; how to tune traps rapidly, etc. This book shows you how ! Over 100 pages 51/4"x81/4" illus. \$2.10

Ø

John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y.



So compact they fit anywhere. So many listings (over ten dozen) that you can meet any capacitance, voltage and combination requirement. Yes, singles, duals, triples and quads.

Multiple-section units have stranded wire leads and safety sleeves. Hi-purity aluminum construction minimizes corrosion. Vented for excessive gas pressures.

If ever there was a Jack-of-alltrades electrolytic, this is it— Aerovox Type PRS Dandee.

Ask your Aerovox distributor for Aerovox Dandees. Ask for latest catalog—or write us.



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IMPS WON'T FREEZE OR MELT!

They'll operate faithfully In temperatures ranging from -40°C. to +100°C. (212°F.) and that's the boiling point of water !

DCVW





IMPS ARE REALLY RUGGED!

The tough thermo-setting plastic will take an astounding amount of abuse —yet IMPS will still look and perform like new!

IMPS ARE MOISTURE-PROOF!

No moisture can get through the varnished plastic case, or even through the lead anchor points.





IMP LEADS CAN BEND AND BEND!

Tinned leads that are really securely anchored you'll be amazed at how much punishment they'll take without breaking !

All over the country service-engineers are praising the newest and finest molded tubular paper capacitor—the Pyramid IMP! IMPS are available in all popular ratings in 200, 400 and 600 volt ranges.

If you haven't tried the new IMP, send for your free sample today-

PYRAMID ELECTRIC COMPANY 1444 HUDSON BOULEVARD · NORTH BERGEN, NEW JERSEY

Setting Up for TV Service

(Continued from page 3)

manager specified seven outlets served through a circuit braker and isolation transformer. A switch pilot light should also be incorporated.

Two sets of antenna leads should be available at the bench. Provisions for the mounting of a test CRT should also be provided.

As far as storage space is concerned, the shop should have adequate space to heat run repaired chassis for at least four hours, preferably in their cabinets.

Generally speaking, lighting should be such that the service man does not cast shadows on his work. Recommendations as to fluorescent and incandescent lamps vary. If the former is used, it must be properly installed to minimize interference. Overhead lighting should be supplemented by gooseneck or floating-arm lights.

There is some tendency to locate service shops in basements or other poorly ventilated spots. In any shop, efficiency can be stepped up by giving some attention to good ventilation. Actual sound-proofing of the shop is usually impractical but a little attention to layout and some inexpensive soundproofing measures are often sufficient. In addition, the shop noise level can often be reduced by care on the part of service personnel.

A regard for efficiency alone will dictate the minimums as regards shop layout, lighting and ventilation. Dividends in the form of better employee morale and a better impression on the public can be realized by going one step further in providing a neat, well-laid out shop. An operation of this type can be well publicized, rather than being relegated to obscurity.

Test Equipment

Many of the service managers contributing advice to Electrical Merchandising in preparing this article emphasized that purchase of inferior test equipment was no economy.

Said one, summarizing the problem: "A big headache to manufacturers is the type of equipment offered by test suppliers, since there is a good chance that test equipment will not perform as advertised. We have spent considerable time in analyzing test equipment offered to the trade and have found some of it almost worthless. . . . Generally speaking, a serviceman gets what he pays for. . . . Much of the equipment offered to the serviceman two years ago is not acceptable for use on TV receivers today because of the increased sensitivity built into sets since that time."

What test equipment does the dealer need for his service shop? Four manufacturers provided answers, varying in detail.

A spokesman for Admiral Corp. suggested that the minimum would include an oscilloscope, a vacuum tube voltmeter with high

CHART I ___TEST EQUIPMENT (Du Mont Recommendations)

The Minimum

- Oseillograph with horizontal probe (from \$150 ta \$330). Vacuum tube voltmeter (\$55 to \$125). Sweep generator (\$220 to \$550).
- Peak to peak scope calibrator (\$40). Isolation transformer (\$25).

Useful Additions

Tub tester with CRT test adaptor (\$100 to \$165). Capacitor checker (\$70). Couch hatch generator (\$175). Field attength meter (\$85). High frequency and high voltage probes for VTTM.

How Much Equipment

to bench should have an occillegraph and VITM. A de lase shop would have see sweep generator setup for every two benches and a Scope P-P Calibrator for every bench. As a minimum, howvere, one of each of these pieces of equipment would be adequate.

What To Look For In Buying This Equipment

- What 10 LOOK PGT its mayneng error maynengen. 1. Oneilograph Sensitivity-minimum 30 mv/in. R.M.S. Vertical amplifier response-Flat from a few cycles per accord to a minimum of 100KC (at 10% point). Shielding-CRT, not input terminals must be fully shielded. Screen Size-Preferably 5'. 2. Vacama tube velinated termination in the fully shielded. Notage and the velinated of the shift of the shi
- 3.
- 2479 Course Section Section Section 2010 (Section 2010) (Section 2 weep width—Minimum 10mc. Center Freq.—Minimum 4me to 216 me.
- Center street. Marker Senskivity-At least a maximum 0,1v ontput. Accumery-Within ± 0.5%. Nodulation-Should provide frequency for internal modulation of ew
- Romanness versus proves the provide the second second second construction of the second seco

voltage test leads and RF probe, a sweep generator and calibrator.

In describing the test equipment needed by a servicing dealer, DuMont and Emerson experts went into considerable detail, not only as to the equipment but also as to the features and performance characteristics which should be found in such equipment. For these opinions, see Charts I and II.

RCA, whose subsidiary, RCA Service Co., is the largest servicing organization in the field, suggested these guides for purchasing test equipment. (The large shop shown in the table employs from 16 to 20 technicians, the small has only three or four.)

Large	Small
Item Shop	Shop
Audio amplifiers 1	1
Antenna rotor kits	2
Dual turntable racks	1
High voltage test probe 1	1
Oscilloscope	1
Circuit tester	5
Sweep generator	1
Crystal calibrator	1
Signal generator 1	1
Monitor TV set	1
RF unit test jig 1	1
Junior Voltohmyst 2	1
Sound power phone (hand) 7	2
Sound power phone (chest) 7	2
Telescopic survey truck 1	1
Tube tester 1	0
Survey receiver1	0
Record player	3
Capacitor analyzer 1	0
16" test jig 2	1
17" test jig 2	1
21" test jig 2	1

Tools: Hand, Shop, and Installation

Chart III gives a good idea of the variety of tools required for servicing a set and for installation work. Generally speaking one set of hand tools is required for each bench. A single set of shop tools, however, should be sufficient for the entire shop.

Installation Supplies

A crew handling installations must carry a wide variety of supplies; these can be broken down roughly into antennas (and masts) and mounting accessories. An ample supply of accessories should be maintained on the truck at all times. The antennas and masts can be drawn from stock each morning to cover that day's jobs. Each truck should carry about 1,000 feet of antenna lead-in wire.

In determining his stock levels on installation supplies, the dealer must take into consideration the number of trucks being used and the number of installations handled on an average day. Generally speaking, a two-

The Equipment Jugerproduct Oscillororpe (from \$175 to \$300). Vieuum Tobe Voltmeter (\$50 to \$65). Nurop and marker generators (\$175 to \$500). A Wi-M Signal Constants (\$75 to \$200). Tube Tester (\$150). How Much Equipment Usually only one alignment set "acope, swrep and marker generators) is necessary for the entire shop. Each man should have a VTTM and oscilloscope. What To Look For In Buying This Equipment What To Look For in Buying this Equipment An oscillar-rape - should have at least .05 volts per inch vertical deflec-tion cessibility and have a pool forquentry response to at least 150KC. Be cretain that the input resistance is in the order of 35 mmf. or least and at least 1 mmg ohm, and that it has provision for at least 50KC sweep synt rate. Be certain that the scanning line has enough inten-sity and ran he focused on high intensity vertings. A good yere is also desirable. A more elaborate a corp. 100KC and a very bright and well formed examing beam. The vertical sensitivity in about 39M. The also two pieces of equipment are required for service work. The following sequences in needed for allignment work which sometimer is the ranse of many service headsches.

- is the raise of many service nearestate. 2. Vacuum table voltimeter D.C. input impedance about 11 megohus for minimum loading of circuits. b) Low voltage scale of at least 5v. r1 Zero corner varie for a silenment of Disr. is good but not necessary. d) Should also read A.C. volts and ohum. (x 1 meg). A more claborate V.T.V.M. should also have a high input impedance on A.C. and be relatively fast for a wide rance of and/o frequencies. so that it can be used as an output meter and test probe. The cost for such a V.T.W. is about §65.

- Swrep and marker generators

 Swrep 20 and 40 mr LF, ranges. Plus F.M.
 Swrep rolifer T.V. RF, spectrum.
 Linearity of swrep to be constant with output setting. (Voltage output is a state of the sta
- For Linearity at service to the trainant with subject serving a "comparing the part should be characterized and the result of the service service result of the service - marker. In any event, the most important factors are sufficient output and good linearity, especially with a change in attenuator setting (output voltage).

- AME/FN Signal Generator

 Cover (requestics of from about 100KC to 120 mc.)
 Sufficient couptart i locat. I volt.
 Good stability after warm up and at least 3% accuracy.
 Amplitude medulated by about 400 cycles at approximately 30% medulation.
- medulation. Chesper units operate mainly on harmonics, have low output, poor eta-bility and tracking scenarcy, about 590. Better units operate on submannials, have approximately 1% securacy, have provisions for varying percent modulation and frequency of modulation, and also can frequency modulation and frequency of modulation, and also can frequency modulate the R.F. carier. These units are approximately \$200.
- 5. Tube Tester A tube tester is necessary for counter use, (testing customers tubes). Is should be of the dynamic mutual conductance type and take all different type tubes including miniatures. It should have provisions for testing aborts and noise with an internal replaceable tube chart roll.



RADIO & TELEVISION NEWS

February, 1953, says:

... those planning high-fidelity music systems for their homes will save themselves time, money and trouble by reading this book first then moking their purchases."

EXCLUSIVE OFFER

By special arrangement with Columbia Records, Inc., each purchaser of this book can procure for only 25 cents a 7-inch "Lp" test record with excerpts by the N. Y. Philharmonic Symphony Orchestra and the Philadelphia Symphony.

HIGH-FIDELITY

January-February, 1953, says:

"We could make this just about the shortest book review ever written by saying only: 'This book fulfills its title'... this is a good book

BROADCASTING-TELECASTING

December 22, 1952, says:

"...a simple well illustrated information source...a 'how-to-do-it' guide...' 208 pages (5 1/2 x 8 1/2 "), over 100 illus. For your copy of this invaluable book, go to your jobber, bookstore, or send \$2.50 to:



West Coost Office-4216-20 W. Jefferson Blvd., Los Angeles, Calif: In Canada, Mr. Charles W. Pointon 1926 Gerrard Street, East, Toronto, Ontario Export Agent: Roburn Agencies, Inc., 39 Warren St., N. Y. 7 Coble Address: Roburnage N. Y.

Setting Up for TV Service

(Continued from page 25)

CHART III-TOOLS . . . Hand, Shop and Installation

Suggested by Du Mont	Suggestions by Admiral	Suggestions by RCA Service Co.	Suggestions by Emerson
Screw driver set (regular and Philips bad) \$ 3,0.1 Set of splittights. \$,60 Long nose pliers. 2.00 Diagenal centers. 2.00 Set, alignment and adjustment tools. 4.00 Seldering gan 12.00 Table pailler .75 Pin straightener (7 and 9 pin base) .75 Hex and spline wrench set. 1.25	Nrtew driver set (½" to ¼" blade) Net, spin type wrenches, 3/32" to %" Diagonal pilers Long nose pilers Noldering sun/iron Alignment wrenches	Diagonal pilere 6" Silp joint pilere6" Screw driver, est in 8"- Screw driver, est of 6 Ratchet4" Socket set 11 pieces Soldering gran Needle-soac pilere6" Crescent wrench6" Phillips acrew driver. ½" Allen wrenches Mirror, 4 x 5 inches	200 wat soldring gan
B. SHOP TOOLS		· · · ·	
Vise \$15.00 200 watt soldering iron 6.50 V'r electric hand drill and set of drills 60.00 Wire stripper 4.00 Adjustable hark aaw 1.75 Center punch 75 Tool steel reamers 2.00 Set of files 4.90 Hammer 1.55 Set, open-end wrenches 3.00 Bitrore, stand 5.00 Electric grinder 15.00	Electric drill Vise Socket panches Drill set—1/16" to at least 14"	Fatension curd. 100 feet Saldering iron Hammer, double fare, 3 lba. Wood lever, 12" Files (2), 8" med. Keyhole aw: hark saw Serew driver, 6" blade Serew driver, Phillips Pliern, side cut, 7" Conter panch, %" dia. Ratchet wrench host type (1½ a 9/16", Ratchet wrench host type (1½ a 9/16",	Use 200 watt soldering iron instead of gun Each technician is furnished mare ex- possive set of alignment tools than sperified under hand tools Shop tools such as vise, electric drill, etr.
. INSTALLATION TOOLS Adjustable 50 ft ladders Pipo wranches Rope (100 ft) Extension cord (200 feet with multi- pic oullets) Set masonry drills Hammer heavy construction type Set chieses Pair of phones—sound powered Heavy daty electic drill		Flashight, right angle Channel lock pliers Triplug Bit brace Claw hausmer, 16 oz. Serew driver sid. itj. 37 halde Cab. tip and serew Diagonal pliers, ?" Pliers, needle-noor, ?" Pliers, needle-noor, ?" Paint brash. 1"; putty knife End wrench. 8" Steel tape, 6 ft. Ulers. akin isint	Hack sam

man crew should be able to handle four installations per day.

For some idea of what's required in the way of supplies for installations, see Chart IV

CHART IV-INSTALLATION SUPPLIES

A. HAND TOOLS Sue

C. INS

Set mator Hammer Set chiseli Pair of ph Heavy dut COST:

Antennas, Masis and Mast extensions, Mast connectors 300 ohm antenna wire Consial cable (73 or 73 ohm, Should be used only for special applicat electrically moisy areas, damp saily areas where 300 ohm line would de contensibility.

er raphily), H. low loss upen wire line. (to be used only in extreme fringe urea-re minimum line loss is necesary). sing arre-tor, aluminum ground wire, ground rlamps and ground rid-is: chimnes, wall, adjustable wall (for clearing obstructions) and have

mount: Gay Wire via strand steel wires, turnbuckley and gay rings Anchor bolts for mounting brarkets to masoary Lead plugs for seruing standods to masoary Stand offs for: twin lead in wire; cossial antenna wire Single and double mast stand-offs for securing antenna wire to mast Insulated tarks, black friction tage Spring wing toggle bolts for mounting brackets against hollow wall Rotors and boostere.

Parts

A good service operation is no stronger than its weakest link-and the most elaborate service set-up will be rendered ineffective if the dealer fails to stock an adequate supply of parts and tubes.

What constitutes an adequate stock of these items is a question which is best determined with reference to past experience. Some general rules can be set up as a preliminary guide. They may have to be adjusted or supplemented when a dealer has put them into effect and determined whether they suit the conditions he is meeting.

One manufacturer tells his dealers: maintain two replacement parts unless you find that you need more. Have at least 10 tubes of each type on hand and for the more popular types, keep 50 on hand.

RCA Service Co. carries a two-month supply of parts available within 30 days and keeps an additional month's supply on order.

Maintenance of a parts inventory system is strongly recommended, both as a control measure and as a means of determining satisfactory inventory levels. These records can be maintained in a variety of forms. Dealers should remember that the more information required by the system, the more valuable it will be to management. The following items, listed in order of their importance, could be included:

- 1. Record of purchases by description, purchase order number and date and quantity ordered.
- 2. Record of receipts by quantity and date.
- 3. Cost of item to dealer and list price.
- 4. Usage and balance on hand.
- 5. Minimum and maximum stock quantities.
- 6. Location of items.

According to Harold Schulman, manager of the Du Mont teleset service control department, the information provided in items (1) and (2) above automatically provide the dealer with:

- a. The approximate rate of usage. Quantity to be purchased can then be judged according to the frequency and quantities of past orders.
- b. A safeguard against reordering parts already on order-a major cause of overstocking.
- c. A steady reference file for giving approximate dates of delivery and timing of purchases.

This system has one drawback, Schulman warns: it provides no usage report. The dan-(Continued on page 31)

Mr. Newton Cook

Manager,-Standard Products Section CHICAGO TRANSFORMER

says: "You can see the difference with the Regency Booster"

Kegency

largest selling Booster at any price.

REPLACEMENT PARTS, Etc.

(Continued from page 13)

magnitude of electrical losses. It is expressed in terms of percentage. The range of power factor for paper dielectric tubulars at base temperatures of 20 to 25° C is from perhaps .25 to 1%. As a general rule, power factor increases with both decrease and increase in operating temperature relative to the rated base temperature, so that an increase of from 3 to perhaps 5% for a temperature rise of 40--60°C is not unusual. Generally, the power factor increases very rapidly when a capacitor is used at temperatures beyond its rated operating temperature.

In the case of mica capacitors and ceramic capacitors, the power factor figures are substantially lower than for the paper dielectric type of unit. Assuming these types of capacitors are being used within their rated operating temperatures, the power factor of mica capacitors generally is substantially below 0.2%, especially the silver mica variety. Ceramics are in the same category, generally even better, frequently displaying power factor values as low as .02%, if not less.

The general order of paper dielectric tubular, mica dielectric and ceramic dielectric offered for replacement are within the general ratings set by the receiver manufacturers for the original components used in their receivers.

Summary

We realize that all possible items relating to capacitors have not been treated in this series. As it is, and even with these omissions the articles have extended over six issues of SUCCESSFUL SERVICING. We have much more to go in covering the other components used in television receivers.

The facts given herein, when supplemented with information contained in the capacitor manufacturers' catalogues, and when complemented with the information given in the Rider Replacement Part Listings, should be of material aid in the problem of understanding TV receiver capacitor components and replacements.

The statements made in these series of articles represent highlights of the factors which are important relative to this component. We say this to fend off possible misconceptions which may result from the occasional hap-hazard selection and use of a replacement capacitor in a television receiver without noting any undesirable effects. This may lead one to believe that the important points raised here are simply efforts to fill space. This is not so. Many service technicians have been greatly confused by the peculiar behavior of receivers after a capacitor replacement which, to all intents and purposes, should have worked properly because the capacitor was electrically perfect.

We might emphasize to the servicing industry that, as time passes, closer and closer attention will have to be paid to capacitance tolerance and temperature coefficients and that when a service technician takes in a stock of fixed capacitors he will require 10% units as well as 20% units, and in some few instances even 5% units. Fortunately this is not a problem, because an examination of the Rider Replacement Part Listings found in Rider Manuals, discloses the fact that some specific values of capacitors more than others, are of the 10% capacitance tolerance rating. Incidentally, this might be of interest also to the capacitor manufacturers who sell to the parts jobbers, and to the parts jobbers who in turn sell to the servicing industry.



C-D does it again!

6 capacitor assortments in beautiful plastic cases!

Ideal for storing screws, tubes, small parts of all sorts. Even fishing tackle. And you pay no more than if you bought the capacitors individually.

The majority of sets can be serviced with these six twist-prong electrolytic replacement kits. See your jobbertoday for full details. Cornell-Dubilier Electric Corp., South Plainfield, New Jersey. KIT #1 — UNIVERSAL KIT #2 — FOR RCA SETS KIT #3 — FOR PHILCO SETS KIT #4 — FOR MOTOROLA SETS KIT #5 — FOR GENERAL ELECTRIC SETS KIT #6 — FOR ADMIRAL SETS

A service of **CORRELL - DUBILIER** world's largest maker of capacitors PLANTS IN SO. PLAINFIELD. N. J. * NEW BEDFORD. WORCESTER AND CAMBRIDGE. MASS. * PROVIDENCE. R. I. INDIANAPOLIS. IND. * FUQUAY SPRINGS. N. C. * SUBSIDIARY. RADIART CORP., CLEVELAND, OHIO



A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: Over-all product activity continues to be heavy, with more manufacturers reporting changes for this period. As noted last month, tube, antenna and noted last month, tube, alterna and sound manufacturers continue their dominance of the "change activity" scene, while the steady increase in tube prices noted over the last three months has slackened off slightly.

New Items

- AMERICAN MICROPHONE Added Model RCS crystal microphone with slide switch at \$8.10
- crystal incrogeneet and dealer net. AMERICAN PHENOLIC Added new bo-ty and reflector antenna package No. 114-065 at \$4.65 dealer net, containing No. 114-053, bo-ty and No. 114-560, bo-ty reflector, with stacking bar

- dealer net, containing No. 114-055, Do-ty and No. 114-560, bo-ty reflector, with stacking bar included.
 CLEVELAND ELECTRONICS Added Model 88, UHF TV antenna at \$5.97 dealer net.
 CORNELL-DUBILIER Added auto radio replace-ment vibrators; Model 6326 at \$2.76 dealer net.
 Model 6330 at \$2.76 dealer net.
 Model 6330 at \$2.76 dealer net.
 Model 6370 at \$2.52 dealer net and Model 5370 at \$2.52 dealer net, which supercedes Model 5520-4.
 CREST LABS. Added a number of Universal Variable Inductance Kits. Also added a new series of receiver replacement output transformers.
 FRETCO Added Bo-Ti UHF antennas; Model Bo-Ti at \$2.70 dealer net.
 Model Bo-Ti reflector at \$8.97 dealer net.
 GENERAL ELECTRIC Added GL-6130, a hy-drogen chyroton especially designed for pulsing applications which require a tube that will give dependable operation at high altitudes under stringent operating conditions at \$18.00 dealer net.
 MARVEY-WELLS ELECTRONICS Added Banddealer net. HARVEY-WELLS ELECTRONICS — Added Band-

- dealer net.
 HARVEY-WELLS ELECTRONICS Added Bandmaster VFO at \$47.50 dealer net.
 HYTRON Added point-contact transistors No. PT-2A at \$17.40 dealer net and No. PT-2S at \$17.40 dealer net. Also added receiving tubes 12X4 at \$1.55 list . . . 12AQ5 at \$2.00 list at \$2.00 list at \$2.00 list at \$2.00 list and germanium diode 1N133 at \$1.20 dealer net.
 ILLINOIS RESEARCH LABS. Added Silencer, gallon size at \$24.00 dealer net. and Sta-Clear, quart size at \$4.50 dealer net.
 MALLORY & CO., P. R. Added new 12 volt replacement vibrator, Model G-874 at \$3.30 dealer et at \$1.30 dealer net.
 Model 12SAC5, battery charger with selenium rectifier at \$1.49 dealer net. . . Model R-670, output cable at \$1.49 dealer net.
 MARKEL ELECTRIC PRODUCTS Added No. A-7181 at \$9.98 dealer net and No. A-7181 at \$9.98 dealer net and No. A-7181 at \$9.98 dealer net and No. A-7157 and No. A-7158.)
- NATIONAL ELECTRONICS Added full-wave rectififer, Model NL-606 at \$16.63 dealer net and ignitron, Model NL-1005 at \$80.50 dealer

- and ignition, Model NU-1005 at \$00.70 dealer net. PERMOFLUX Added outdoor theater speakers Model 4C-DI at \$2.73 dealer net and Model 52C-DI at \$2.91 dealer net. PREMAX PRODUCTS Aluminum ground wire No. AW-810 at \$1.62 dealer net a. No. AW-825 at \$3.60 dealer net and No. AW-850 at \$7.20 dealer net have been added to their line. QUAM-NICHOLS Added Model QF-3, foralizer unit at \$3.57 dealer net and Model IT-4, ion trap at \$.60 dealer net. RCA Added No. 76323, sapphire at \$.90 dealer net. Also added Volume VII to their Service Data series at \$5.00 dealer net. RADIO RECEPTOR CO. Added a number of new germanium diodes. REEVES SOUNDCRAFT Added a number of new tape recording accessories.

- REEVES SOUNDERAFI Added a number of new tape recording accessories. RIDER, JOHN F. Added No. 143-2, TV Manu-facturers' Receiver Trouble Cures, Volume 2 at \$1.80 dealer net . . . No. 145, TV Sweep Alignment Techniques at \$2.10 dealer net and

- No. 2011, Rider Television Manual, Volume 11 at \$24.00 dealer net (available in April). SCALA RADIO Introduced Model BZ-4, volt-age doubler probe at \$10.75 dealer net. SCOTT INC., HERMAN Added Model 214-AB at \$196.75 dealer net and Model 214-X8 at \$29.95 dealer net, both remore control amplifiers and Model 120-AB, equalizer pre-amplifier at \$79.25 dealer net.

- \$29.95 dealer net, both remote control amplifier at and Model 120-AB, equalizer pre-amplifier at \$79.25 dealer net.
 SPRAGUE PRODUCTS Added a number of rwist-lok electrolytic capacitors.
 STANCOR Added new ultra-miniature transistor transformers; No. UM-110, output or match-ing at \$9.00 dealer net. . . No. UM-112, high imp. mic. input at \$8.25 dealer net . . . No. UM-113, interstage at \$6.60 dealer net and No. UM-114, output or matching at \$9.00 dealer net. . . No. UM-114, output or matching at \$9.00 dealer net. SYLVANIA Added 21" TV picture tubes; 21-WP4 at \$39.00 dealer net . . . 21XP4 at \$40.50 dealer net . . . 21YP4 at \$41.50 dealer net and 21ZP4 at \$40.00 dealer net. Also radio receiving tube 6CS6 at \$1.90 list.
 TRIPLETT ELECTRICAL CO. Added Model 420, volume unit meter at \$16.50 dealer net and Model 420 (illuminated) at \$18.00 dealer net.

- net. TURNER CO. Added Model 9R, microphone at \$14.10 dealer net. . . Model SR9R, mic-rophone at \$16.80 dealer net and Model C-4, stand at \$3.45 dealer net. WHARFEDALE SPEAKERS Added Model HS/ CR (3 a way crossover network at \$31.00 net.
- CR/3, 3 way crossover network at \$31.00 net.

Discontinued Items

- ASTATIC CORP. Discontinued Models AT-1B, BT-1 and BT-2 all TV and FM radio bossters. ELECTRONIC MEASUREMENT Discontinued Model 300, vacuum tube volt-ohm-capacity meter and Model 300P, same meter with portable case
- and cover. GENERAL ELECTRIC Discontinued Model RPX-GENERAL ELECTRIC — Distontinued relation 051, triple play variable reluctance cartridge . . . Model RPX.042, single variable reluctance cart-ridge and Model SPX.001, phono preamplifier. INTERNATIONAL RESISTANCE — Discontinued
- replacement control QJ-375. RAYTHEON Discontinued TV picture tubes
- RAYTHEON Discontinued TV picture tubes 3KP4 and 12LP4. SIMPSON MFG. CO. Discontinued a number of items including driver pre-amplifiers; Models DR-5, DR-5M, DR-5MP and DR-5P. SYLVANIA Discontinued radio receiving tubes 1S6... 1W5 and IX2. TRIPLETT ELECTRICAL CO. Discontinued Mo-del AG6. electrodynamometer.
- del 466, electrodynamometer. VIBRALOC Discontinued their "W" series containing sloping wall type baffle . . . grill plate
- and reducers. WIRT PRODUCTS Model S-924, auto radio iginition suppressor, snap-on plug type, discontinued.

Price Decreases

- CLEVELAND ELECTRONICS Decreased price on Model T-WA, lightning arrester to \$.90 dealer net.
- CONTINENTAL CARBON Model NF-1/2, metal film resistor, decreased to \$.48 dealer net. CORNELL-DUBILIER Decreased price on a

- CORNELL-DUBILIER Decreased price on a number of auto generator capacitots. DUMONT LABS. Decreased price on teletron tube 16K/RP4 to \$28.00 dealer net. GENERAL ELECTRIC Decreased price on in-dustrial and transmitting type tubes GL-5670 to \$5.25 dealer net and GL-5844 to \$2.25 dealer net. Also decreased TV picture tube 21ZP4A to \$38.50 dealer net. CONSET Decreased price on tocket antennas;
- GONSET Decreased price on batteries; No. VS216 to \$2,30 dealer net and VS236 to \$.21 dealer
- SYLVANIA -- Sub-miniature tube 5719 decreased to \$9.80 dealer net.

Price Increases

- ALPHA WIRE --- Increased prices on numbers 286, 289, 292, 295 and 296, tinned copper
- 286, 289, 292, 295 and 296, tinned copper bus-bar wire. GENERAL ELECTRIC Increased price on TV picture tube 17CP4 to \$26.15 dealer net. Also increased price on Model RKP-009, replacement parts kit for triple play cartridges (less stylus assemblies) to \$.19 dealer net. GONSET Model 3026, 2 meter transmitter receiver increased to \$199.50 dealer net. Also increased price on Model 1508, rocket antenna to \$5.67 dealer net and Model 1512, rocket ancenna to \$5.07 dealer net. HYTRON Increased price on radio receiving tubes 12A4 to \$2.40 list . . . 12B4 to \$2.40 list . . . 6BY5G to \$2.90 list and germanium diode 1N51 to \$.54 dealer net.

Correction

GONSET --- Only the 1521 model radarray has been discontinued---not the complete series as was published in error.

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(51/2 x 81/2") pp., illus.\$6.60 TV MASTER ANTENNA SYSTEMS, by Kamen & Dorf.

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INDEX OF CHANGES

or write:

Model No. Gamble-Skogmo 05TV1-43-9014A, 15RA2-43-9105A, Ch. 16AY210 Magnavox Ch. CT=275, -276, -277, -278, -279, 200 - 201 - 201	Manual F From	Page To	Tek-File Pack				
Gamble-Skogmo 05TV1-43-9014A.	6-1	6-16	3				
15RA2-43-9105A, Ch. 16AY210							
Magnavox	7-14	7-28	30				
Ch. CT=275, -276 -277, -278, -279, -280, -281, -282	,		30				
Svlvania	8-64	8-82	13				
1110X, Ch. 1-329							
Sylvania	8-140	8 - 153	13				
71M, 72M, 73B,							
73M, Ch. 1-366(C08	i),						
1-441(C02)							



with the all-weather "silver" pigmentation that lets you INSTALL IT and FORGET IT:

FEDERAL'S TV-1185-newest sensation of the top-quality twin-leads – is virtually a "*pipeline*" for better-thanever TV reception ... VHF or UHF!

Insulated with the revolutionary Federal-developed "silver" polyethylene, TV-1185 is amazingly tough and efficient. It repels sunlight...fights heat... resists moisture and salt spray and other destructive deposits. Dirt and dust tumble off its fine, smooth, tubular surface! TV-1185 keeps the energy field inside the weather-proof "silver" polyethylene sheath ... providing *low loss ... more constant impedance ...* a better TV picture regardless of area or length of lead!

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- Top performer in any area
- Attenuation- db/100 ft.

10 mc- 0.50	400 mc- 2.6
50 '' 🗕 0.95	500 "- 3.0
100 " - 1.11	1000 "- 4.6
200'' - 1.7	

SO EASY TO INSTALL:

Expose required length of wire by stripping off polyethylene. To tight-seal, heat end of tube with match or other flame and crimp together with pliers. Sealing assures quality performance under all atmospheric conditions.

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Setting Up For TV Service (Continued from page 26)

ger of running out of an item before it can be ordered can be minimized by keeping a "want book". Anyone drawing parts should be required to note in this book if the stock of that particular item is low. This, of course, poses a problem of what is "low stock". Although it is possible to rely on the judgment of the parts clerk, a more desirable solution is to establish a minimum quantity. This can be posted on the bin or drawer where the part is stored. On small parts, the minimum quantity can be placed in a scaled envelope; when it becomes necessary to open the envelope, parts should be reordered.

What Does it Cost

Determining what maintenance of a good service shop and an adequate parts inventory will cost a dealer in dollars and cents investment is difficult to determine. Most servicemen feel that the dollars and cents figure is relatively unimportant when measured in terms of the return the dealer can expect from his service operation.

In addition, the investment varies with the dealer's location, the size of his shop and the volume of business he handles. Even with all these variables, one must consider also that dealers in the same area with the same business volume may differ in the amount of money they invest. One may feel that the "minimum" investment in equipment and parts is the wisest decision; the second may decide to spend considerably more in setting up his shop.

Du Mont's Schulman estimates the cost of a service shop in these terms (truck not included):

- a. deluxe operation about \$2500 (including \$1000 in parts)
- b. average operation about \$1500 (in cluding \$600 parts)
- c. minimum operation about \$1000 (including \$300 in parts).

Harold Bernstein, service manager for Emerson, uses a different basis in coming up with his estimate. For a one man operation, he says, equipment, tubes, fixtures and basic parts would require about \$2500. For each additional man add about \$125 more for extra tools, meters, tubes and so forth.

No matter whose estimate you accept, establishing a service shop is an expensive move in terms of dollars and cents alone. A decision as to whether the investment will pay off—both tangibly in the form of dollar income from service work and intangibly in the form of a good service reputation which builds additional set sales for the dealers is one that must be made with reference to the dealer's own circumstances.



RIDER packaged tv service informationfactoryauthorized factoryapproved for easy tv servicing tailor-made for over 2800 receivers only ^{\$}2 per pack (at your jobbers) dependable replacement parts listing beginning with Pack 57 J*ohn* F. R*ider* Publisher, Inc. **480 Canal Street** New York 13, N.Y.

Successful Servicing, April, 1953

1.50

Some Questions and Answers, etc.

require substantial differences in the constants of the vertical output tube, or that the use of a 20% capacitance tolerance capacitor where a 5% unit is required results in instability and unsatisfactory receiver performance. We do not feel that a service technician should make changes in circuit constants in order to compensate for a replacement part that is not within the required tolerance ratings of the original component. Because we adhere to this philosophy in the listing of replacement parts, the service technician can have the greatest faith in the replacement parts which are shown in Rider Lists. It explains why our listings of suitable replacement parts show fewer parts than other listings.

Q-If you exercise care when selecting replacement parts for listing, why do you have to publish change notices?

A—For several reasons. Regardless of the extreme care which is used in checking, typographical errors in parts number listings occur. Remember that we are listing thousands upon thousands of numbers, and transpositions are possible. We try to keep the errors to the absolute minimum, but they occur.

A second reason is the changes which are made in receivers at the manufacturing point. If one part was a replacement and a change was made calling for a new replacement part, it is foolish to continue reprinting the original replacement part number—the new one with the changed part is the correct one.

We publish additions to the list because some of the replacement data arrives too late for inclusion in the printed list, and because the parts manufacturers we work with are adding new replacement parts to their line. Q-Your replacement parts lists show only

the set manufacturers' parts numbers, but not the receiver chassis in which they are used. Why?

A----This was so only in the Rider TV 10 Manual listing. In the new replacement parts listings for TV 11, which will be cumulative for TV 10 and TV 11, the parts numbers are related to the chassis in which they are used. A section of the replacement parts list for Emerson is shown herein as an example of our new listing format.

Q-Why don't you have replacement parts listing for Rider's TV 9 and earlier manuals? A-Because we started the replacement part listing program with TV 10. However, we now are in the process of preparing data on TV 9 and earlier Rider TV Manual contents. The task of preparing the data is prodigious; we must prepare information specification sheets for the parts manufacturers, and before we do this it is necessary to correlate the contents of the receivers made during all the production runs. It will take time to do this, but it will be done. Such replacement parts guides will be available to service technicians sometime in the near future.

Fig. 2. Below: Type of spec. sheet on which the part's manufacturer lists his replacement suggestion.



RECEIVER MANUFACTURER	e		/	/	/	/	/	/	//	//				NOTE:	V. For sing	ARIA le controle tal shaft m	BLE F	RESIS fication r shown for	TAN a single	ICE ar under control,	CON the Cat. it appear	No. or	OLS r Stock No. or Inner Sha	columns. ft column.						
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390142	X	x	x	X						AC	3-83-8	FKS-1/	4	Q11-139							SU56			+			+			
390143	X	X	X	X				-		A4	3-5000	FKS-1/	4	W-5000	-						11-54					DS-36	1			
390156					X	X	-	X	+	AG	3-61-8	KSS-5		Q11-137				+			11-54	-		1						
390163	X	X	X	X	_		-	-	-	AC	3-61-8	K88-3	-	011-137	+						11-35						1			
390164	X	X	X	X			-	+	+	AC	3-44-8	K88-3	+	011-123							11-43					DS-36				
390181		-	-		X	X	+	X	-	AC	3-52-8	KSS-5		011-129	+						U-35					DS-36				
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390207			_		-	-	X	+	+		V-378	Ves.9	+	011-129	10-0						U-43						1.			
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J.T.HERRIN

RADIO SERVICE CO. 1817 HARDY ST. HATTIESSURG, WISS.

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Successful Servicing, April, 1953



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Three especially valuable *new* features of the TO-4 include, (1) provision of a special low capacitance circuit for checking small ceramic and "gimmick" capacitors down to 1 mmf (in addition to a top capacitance range of 2000

mmf), (2) a simplified insulation resistance circuit with high reading of 20,000 megohms, (3) Safety-First! Automatic discharge of capacitors after test by releasing all push-buttons.

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SPRAGUE TEL-OHMINE

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Setting Up for TV Service

Because of the opening of new market areas and an awakening realization in old ones of the values of store-operated service, many dealers are asking: What does it take, in dollars and equipment, to set up for TV service? Herewith, from several experts, the answers.

by Ted Weber

The following article and its illustrations are reprinted through the courtesy of ELECTRICAL MERCHADISING and the McGraw-Hill Publishing Co., Inc. who acknowledge the cooperation of experts from Emerson Radio & Phonograph Corp., Allen D. DuMont Laboratories, Inc., and RCA Service Co. in providing data for this article.

Rup a television service operation is an expensive undertaking.

But figured in terms of customer good will, a good service operation is a profitable investment.

There's no paradox here — it does take money to equip a service department to handle TV. But, once equipped, a wellmanaged service operation can hold old friends and make new ones.

Not every dealer wants to handle his own TV servicing. Some may find it more economical or more efficient to let a distributor or an independent service agency handle the work. Many others, however, will feel that it will pay them to set up their own service shop. Taving made that decision, the retailer is faced with a number of other questions boiled down they ask the how, what and where of setting up a TV service department.

For the answers, Electrical Merchandising asked a group of TV set makers for their recommendations. On this, and the following pages, their suggestions for shop layouts, test equipment, hand tools, installation tools and materials and parts inventories are summarized for the dealer interested in handling his own service.

Planning the Shop

Space limitations may prevent the dealer from choosing the "ideal" location or dimensions for a service shop. But good planning can turn a less than ideal space into an

If possible, service benches should be placed end to end and flush against the wall to facilitate supervision. Storage area for incoming and outgoing work should be as near to the benches as possible; if it is any great distance away some sort of wheeled "dolly" should be provided for moving chassis from the storage area to the benches.

If a one-man shop is planned, test equipment can be permanently fixed in a panel. However, in shops employing more than a single technician, flexibility must be considered and the solution would appear to be a shelf (12 to 24 inches high) mounted at the rear of the bench. An adequate number of AC outlets should be provided along the length of the shelf. Test equipment can then be moved from place to place on the shelf.

Generally speaking, the bench surface should be large enough to allow one receiver



to be set aside for a heat run while the technician is working on a second set. The bench should be at least six feet long, four feet deep and be from 36 to 38 inches high. Placement of drawers, AC outlets and the selection of a bench top are largely matters of personal preference. Generally, a single drawer will be sufficient for the storage of hand tools; too many drawers will lead service men to regard them as a last resting place for parts and junk. There are arguments for and against metal top benches. One firm suggested the use of either copper or tempered masonite bench tops, terming the decision a matter of personal preference. But a second manufacturer's service manager said that the use of a metal top "is not recommended."

Sufficient AC outlets must be provided not only for the shelf holding test equipment but for the service bench itself. One service (Continued on page 25)



18th Edition

4

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Curtain Time

The Itinerant TV Service Technician

A Detroit TV Service Association publication has commented on our editorial on the itinerant service technician which appeared in the January, 1953 issue of SUCCESSFUL SERVICING. The contention is that we have changed our minds concerning the disadvantages of doing service work in the home; that is, we expressed contrary opinions some time ago and now seem to be in favor of it.

The fact of the matter is that we spoke about what seems to be the trend, and fairly definite at that. Moreover it is not unusual to change one's opinion with changing times. Trends do appear and while all individuals and concerns having an interest in it may not agree, only time tells which is proven right or wrong.

There is no question about the advantages of doing service work in the shop and the disadvantages of working in the home. But the public has learned that service work can be done in the home. Perhaps it has been mainly tube changing in the past, but in the eyes of the public it has been service—and they like the idea of not having the chassis removed from the home. Admittedly they accepted the idea of chassis pulling and removal to the service shop, but by and large they were unhappy about it and prefer service in the home. Add to this the fact that more than just a random few service facilities in different parts of the country are making an effort to render service in the home, and others are talking about it more and more, and there you have your trend. The likelihood of it growing is very great, if for no other reason that the public likes it.

The statement was made that a complete repair cannot be made in the home. Isn't it determined by the type of fault present in the receiver and what is involved in the repair? We agree that a good job should be done, that certain tests should be made on a receiver, but it is not inconceivable that many complete repairs and tests can be made in the home. It all depends on the nature of the trouble; the availability of the proper types of test equipment for diagnosis in the home, the availability of parts—the competency of the service technician and his sales ability, etc. These are problems but their solutions are not impossible.

The cardinal item is the public reaction to a servicing approach which has been set by TV servicing facilities. In the past it has been tube changing by many; but others have changed yokes, focus coils, variable resistance controls, tuner coil strips, electrolytic capacitors, peaking coils, fixed capacitors, width and linearity coils and numerous small inductor type components in the home. Defects associated with these components are not necessarily complicated although they may be so, if the fault found is multiple. In that event the chassis is removed to the service shop. Major repairs like overall alignment, power transformer and horizontal output transformer changes are shop jobs. It is interesting to note that one receiver manufacturer has unitized chassis for sectional replacement in the home; another has introduced horizontal-output transformers with phone tip connectors.

There are no laws which dictate that service work must be done in the home, but isn't it somewhat unwise to shut one's eyes to a trend? Picture if you will the possibilities of having a removable bottom to every table model cabinet . . . access to the bottom of the chassis without pulling it!—One manufacturer already has a screen at the bottom of the table model cabinet. Now it is there for ventilation purposes, but if it were made removable, consider the convenience for home servicing.

Manufactures are adding tests points available at the top of the chassis as a convenience for trouble diagnosis. Naturally it is a convenience in shop servicing, but it also aids in the evaluation of the type of fault possibly present in the receiver when diagnosis is carried on in the home.

One of the points raised against home service is that the family watches the repair operations and becomes a time keeper. Another contention is that if a schematic is used, the receiver owner suspects incompetency. A third is the matter of bickering over price. All of the conditions described happen, but the question is are they valid reasons for not performing home service—or should the visiting technician also be a salesman who will educate the public to undertand each of the points being raised? Perhaps the final result will be understanding from only 90 percent of the television receiver owners, *but* it is a step in the right direction. The public does not know—and some do not want to learn—but by and large, the majority can be sold. It all depends on the approach . . . It may be a long drawn out affair, but it is the problem of the servicing industry and all those who cater to it, to try to find the answer for better public relations and more profitable operation. Maybe it will take years for the home servicing trend to develop

Maybe it will take years for the home servicing trend to develop . . . Maybe it will grow for a year or so, and then change because of some other situation. Maybe the arrival of color television (in about two years) may nullify the trend; then again maybe the reverse will happen—receiver manufacturers may so design their equipments that substantial amount of service can be done in the home. We're not fortune tellers—but neither do we fail to note the appeal which home TV service has to the public. Nor can we shut our eyes to the fact that more than just a few service facilities operating in different parts of the nation are doing more than just tube changing TV service in the home.

When we examine public reaction, we must be objective. Consider the expansion of department stores. Traffic problems make it difficult for suburbanites to come into town—so, many large stores open branches in the suburbs. This is a trend which is developing around all large cities. All stores don't comply, but many do the idea being to meet the desires of the public—who in the final analysis foots the bills.

Ask any design engineer active in the electronic field about printed circuits . . . It's a trend, and little by little it is growing. Can tube manufacturers ward off the semi-conductor (transistor) trend? Of course not! How will the transistor and printed circuits affect other component manufacturers in time? The impact is a relatively long time off, but the trend is there.

The point is raised that adequate numbers of competent personnel may not be available for good home service . . . Perhaps this is true and it may limit the extent of the activity . . . Perhaps the shortage may be so great as to actually prevent the realization of the trend . . . But does this mean that we should not see the trend? . . . As we said before, all organizations may not welcome a change of this kind. It is their privelege to try to ward it off, but how is it possible to ward off something if we don't see it looming in the distance?

We repeat that if the trend takes hold, it will be necessary for competitive organizations to follow suit. Isn't this normal in competitive activities which render a service? The prices need not be the same but the modus operandi for satisfying the public's wishes cannot differ too greatly.

John F. Rider

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g. 1. Sample of the set manufacturer's blueprint used for reference, describing all electrical mechanical and physical details of the original parts.

Some Questions & Answers About Rider's Dependable Replacement Parts Listings

We have received numerous letters asking questions concerning the Replacement Parts Listings which appeared for the first time in Rider's TV Manual 10 and in the Tek-Files beginning with pack 57. We feel that these questions can best be answered by listing the query and explaining the answer.

Q-Why are there vacant spaces in the parts manufacturers' columns?

A-The vacant spaces under the various parts manufacturers' listings indicate that, at the time of preparation of the list for inclusion in the Rider Manual or Tek-File, the parts manufacturer did not have a replacement which, upon analysis, was considered suitable as a replacement for the original part used by the set manufacturer.

Q-It it important to adhere to the tolerance specifications given in the tolerance column in the fixed capacitor listing?

A-The answer is yes. The tolerance listed in the tolerance column relates to the original capacitor used in the receiver. Numerous circuits in TV receivers are critical. Unless it was necessary, the receiver manufacturer would not pay a premium price to the parts supplier for capacitors which are closer to the nominal value than the industry standard of plus or minus 20%. It is always best servicing practice to use replacements which conform with stated tolerance ratings, also those which are expressed in terms of micro

micro farads. It is conceivable that under certain conditions a capacitor rated at a higher tolerance may function satisfactorily in a circuit, wherein a more rigid tolerance is specified, but this does not indicate that it will happen in many cases. On occasion a 20% capacitor may display a capacitance which is within 1% of the normal rating. This is just a fortunate circumstance. Unless the set manufacturer's engineers felt that they needed a 5 or 10% capacitor, they would not so specify on the blueprint and pay the extra money for the higher accuracy.

Q-How is the suitability of a replacement part decided?

A-The replacement parts listed are selected by comparing the electrical, physical and test specifications on those parts with the corresponding specifications of the original parts used in the receiver. If the specifications for the suggested replacement match the specifications for the original parts, the replacement is listed. The receiver manufacturers furnish us with blueprints of the various components which we embrace in the Replacement Part Program. An example of one of the blue prints is shown here. It is for a horizontal output transformer. Although the Rider Dependable Replacement Parts Program is only about eight months old, we already on hand, for reference purposes, blueprints covering more than 20,000 components such as transformers, capacitors, variable resistor controls and speakers, used in television receivers. Many are received each day. Using blueprints of the original components is the most reliable means of determining the constants of the parts used in all of the production runs of television receivers produced by manufacturers.

Q-How do you take care of the different kinds of speakers which are used in the different models?

A-The information we receive from receiver manufacturers indicates to us the variety of speakers which are used in the table models, consoles, and consolette Models of television receivers. The new replacemnt parts listing which will accompany Rider's TV Manual 11, and shown herein, will in many instances, disclose from 3 to 10 different versions of loud speakers which are used for the chassis listed. Competitive parts listing services that are incomplete frequenly show just one speaker as being applicable for perhaps 10 to 20, or more, receiver models.

Q-Are the parts listed as replacements in Rider listings subject to much fabrication?

A-No. The need for extensive fabrication is one of the reasons for disqualifying a suggested replacement part. The blueprints covering original components received from the receiver manufacturers, stipulate the mechanical requirements. Only such replacement parts as fit within these mechanical limitations, with minor variations, are listed. This means

that when a service technician purchases one of the parts shown in our listing, fabrication or alteration by him is unnecessary, or at least is kept to the absolute minimum.

Q-What does "compliance with test specifications mean?"

A-One of the requirements set by us for listing a replacement part, is that its test specifications conform with those which cover the original part in the receiver. In other words, if the set manufacturer stipulates that the original part must withstand the application of 2,500 volts rms between the winding and the coil of a transformer, the replacement part must do likewise in order that it be considered acceptable for listing. This is a safeguard for the service technician and is one of the many reasons why the Rider listings are the most dependable.

Q-Do you ever check parts in receivers? A-Yes, many times. This is why we consider the matter of tolerance on inductive and capacitive components to be such a serious matter. Time and again we establish that as little as 10% difference in the inductance of a horizontal deflection winding from that of the original part can be very troublesome; that as little as 10% difference in the turnsratio of a vertical output transformer from the rating of the original part can cause substantial non-linearity and correction would

(Continued on page 32)



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SUBSIDIARY C

A Note on TV in England

Observations made by one of our servicemen-authors who has been trying his hand at TV Servicing in a shop in England while "vacationing" abroad.

by John D. Burke

One of my biggest problems since starting to work in a London TV repair shop two months ago, has been in reading the diagrams provided for our use.

First of all - there is a considerable difference just in terminology, between the two countries - even though we both speak the "same" language.

Here are some of the translations:

American	British
B Plus Power Line High Voltage	High Tension (H.T.) Extra High Tension (E.H.T.)
Tube	Valve (except for a CRT—which is a "tube")
Antenna	Aerial
Ground	Earth
Shielding	Screening
Chassis	(Sometimes called "the deck")
Globar Resistor	Brimistor Resistor
Vertical	Frame
Horizontal	Line
Micromicrofarad	Pica Farad
Yoke	Scan Coils
Broadcast Band	Medium Wave
Mixer	Frequency Changer
By-Pass	Decoupling
Socket	Valve Holder
Plate	Anode
Phonograph	Gramophone
Damper	Efficiency Diode
B Plus Plus	Boosted H.T.
Sweep Circuits	Time Bases
"Open"	O/C
Short	S/C
Unsoldered Connection	Dry Joint
Filter Capacitor	Smoothing Capacitor
Input Capacitor	Reservoir Capacitor
VIVM	Valve Voltmeter

May I hasten to add the fact that there are many more words which are the same in both countries --- we can read one another's technical literature. For example, such words as focus, definition, radio frequency, alignment, synchronization - mean the same.

It was just the fact that these strange words had to be understood by me, quickly, and while I was struggling with other problems of a foreign country's TV system.

The shop in which I work employs four

bench mechanics - called "service engineers". We have a rather good supply of service information. Good, that is, in that it covers most of the sets we are likely to see; and good in comparison with the service information a smaller shop might have been able to acquire. This word "acquire" is used advisedly. For, service information in not offered to the whole trade. Some manufacturers will only supply such information to those dealers who are franchised to sell and service their brand of sets.

Other manufacturers have released diagrams for publication --- but there are limitations. A book has just been published giving a great deal of information about quite a few sets. But the price is very high. Also, the diagrams are so small I cannot read them without a magnifying glass!

There are two magazines with restricted circulation which publish one TV and one radio schematic each month. One of these magazines goes only to full-time profesisonal repairman. The other only to dealers. The information they give is very welcome, and I have been working with such forms of technical guidance for two months.

However, I find a number of great shortcomings in practically all British radio and TV service sheets:

Size - generally much smaller print than can be read comfortably.

Values of resistors and capacitors - not given on the diagrams. Sometimes they are, but usually one has to hunt up the parts lists, with a great loss of time, and much annoyance.

Tubes not designated by type --- that is, the diagram only bears V1, V2, V3, etc. Again, time is spent looking for the list of tubes (valves).

Pin numbers not given — a few English diagrams do show the pin connections but

ATTENTION AUTHORS:

We are soliciting articles concerning radio, television, and allied electronic maintenance. All aspects are of interest. Articles of 1,000 to 2,000 words are desired. Preference is given to subject matter which reflects practical work rather than theory. The presentation should be direct, to the point, and amply illustrated. Finished art work will be prepared by us from the roughs submitted. Photographs are welcome. The rate of payment is on a word basis — and, needless to say, good writing rates good pay!

Submit all articles and inquiries to Editor, Successful Servicing.



Our author - John D. Burke

most do not. Sometimes they will have a basing chart printed near the schematic. Other times, one must hunt for it.

Chassis layout charts also have the same defect — they show you where V6 is, but they do not say what type of tube it is, nor what function it has in the set.

Voltage readings are not given on the schematic. Usually this is given on a separate chart.

Ohms readings on coils are also given separately, if given at all.

Of course, my criticisms of English schematics are prompted mostly by my having worked with those used by our trade in the U.S. My shopmates are accustomed to using what they have, and manage to get along quite well in spite of the handicap.

In time I will be able to do the same. But I hope for an improvement. Perhaps it will come as Britain gets more flooded with TV sets. They now have about 2,000,000 in use.

It must be added, in their favor, that the sets are quite good, and compare favorably with American sets.

There are many varieties of chassis - with some 20 to 30 manufacturers — less than in the States, but quite enough to satisfy my wish to always have new and interesting problems to solve each day.

I brought along with me some technical literature, including some copies of Rider's Tek-Files. Looking through several as I write this, let me assure you that the English TV repairman quite often has only about 10% of the information furnished to him that you are getting.

English shops do not promise quick-as-awink service. And most repair jobs go into the shop. The average job in my shop takes two to three days from pick-up 'til delivery.

Also the sets are simpler, and the problems of 405 line television, and one-channel television, are much less. However, that will provide material for other articles.



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I-F Trap Circuits in TV Receivers

(Continued from page 1)

is useless. Trap circuit capacitors must be of a low-loss type in order to obtain high Q's. For convenience, we will assume that each of the diagrams of Fig. 3 represents an associated sound traps, although trap circuits do not depend upon the frequency to which the trap is tuned.

The coil of an inductively-coupled trap, as in Fig. 3(A), is placed near the i-f interstage coil with which it is to work. If a 41.25-mc associated sound signal is present in the i-f interstage coil, it will induce a signal in the trap circuit. This will result in a relatively large circulating current in the trap because of its high Q. The circulating current produces a magnetic field that acts to oppose the 41.25-mc signal in the i-f interstage coil, thereby considerably reducing the strength of the associated sound signal. (The amplitude of this signal cannot be reduced to zero, of course, because then there will be no magnetic field in the trap circuit). A second type of circuit, the capacitivelycoupled trap, is shown in Fig. 3(B). Although the operation of this circuit is different than that of the inductively-coupled trap, the end result is the same. At 41.25 mc, for example, coupling capacitor $C_{\rm C}$ in combination with L and C, will produce a lowimpedance series-resonant path to ground. This will "short-circuit" the 41.25-mc signal that is present in the i-f interstage coil. The capacitively-coupled trap also produces a peak to the left of 41.25 mc, but in this case it is caused by a high-impedance parallel-resonant condition between the i-f interstage coil and the trap circuit.

The effectiveness of the capacitively-coupled trap is partly determined by the size of the C_0 . If this capacitor is too large, the trapping action will remove some of the picture signals, while an undersized coupling capacitor will result in insufficient trapping action. A typical value for C_0 is 1.5 $\mu\mu f$.



Fig. 3. Various trap circuits. (A) Inductively-coupled trap. (B) Capacitively-coupled trap. (C) Series-coupled trap. (D) Cathode trap.

As the solid line of Fig. 2 shows, the 41.25-mc trap produces a response-curve peak slightly to the left of 41.25-mc. If a 40.5mc signal is present in the i-f interstage coil, for example, it will also produce some circulating current in the trap circuit. The magnetic field that is produced in this case, however, will aid the 40.5-mc signal because of phase differences between the 40.5-mc and 41.25-mc operation. Fortunately, there is little likelihood of a signal at 40.5 mc, and the peak at this point should cause no trouble. Similar peaks may be created to the left of 39.75 mc and to the right of 47.25 mc.

If the inductively-coupled trap coil is too near the i-f interstage coil, the trapping effect becomes broadened out until some of the picture signals are trapped out in addition to 41.25 mc. If the trap coil is too far from the i-f interstage coil it will have insufficient effect. The series-coupled trap of Fig. 3(C) acts by introducing a high-impedance parallelresonant circuit in series with the signal path. This trap is also characterized by a peak to the left of 41.25 mc. The action of the trap is controlled by the size of C. When C is too small, the picture frequencies will be affected. When C is too large, the size of L becomes correspondingly small and it becomes difficult to build a high-Q trap coil. C is generally over $100\mu\mu$ f in value.

The fourth circuit, the cathode trap, is shown in Fig. 3(D). The action of this trap is based upon the reduced gain that results when an impedance is introduced into the cathode circuit of a tube. At 41.25 mc the trap coil reflects a high impedance into the cathode circuit, while at other frequencies it has very little effect. The cathode coil by itself is a small inductance, and does not

(Continued on page 18)



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Replacement Parts in TV Receivers (Part 1-Capacitors con'td)

This is the sixth in a series of articles on "Replacement Parts in TV Receivers." "Transformers" will be discussed next month.

Maximum Operating Temperature

We have already referred to the item of operating temperature. In a sense, the maximum operating temperature is a constant for a capacitor although it might, perhaps, be better viewed as a rating. By and large the general run of capacitors intended for use in television receivers are designd for operation at either maximum temperatures of 65° C or 85° C. In either case, whatever are supposed to be the other constants of the unit are assumed to be true only if the capacitor is used within the maximum operating temperature rating.

An attempt towards standardizing maximum operating temperature ratings of paper dielectric capacitors used in TV receivers at 85°C is under way. However, 65°C capacitors are still commonplace. Operating a capacitor above its maximum operating temperature rating generally results in a reduction in the insulation resistance of the capacitor and in an increase in the power factor, that is, in the electrical losses in the unit.

Receiver manufacturers have displayed during the past few years, a trend towards the use of 85°C capacitors in place of the 65°C capacitors which they used in the past. Unfortunately, the specific capacitor used in a receiver does not bear a label which indicates its maximum operating temperature rating. Hence, when replacement is the issue it is a matter of either replacing with a component which is similar to that used in the receiver, which may be a 65°C unit or buying a 85°C and using it. In this respect, reference to the catalogues made by the capacitor manufacturers will disclose the maximum operating temperature ratings of their components. It is pretty much standard today that molded capacitors are 85°C rated. As a matter of fact, the replacements shown in the Rider Dependable Replacement Parts Lists for tubular capacitors are the molded variety even when the original part was a paper tubular. Summarizing the entire matter, the use of molded case paper dielectric tubulars with the various synthetic impregnants as replacements for tubular capacitors used in TV receivers will satisfy the maximum operating temperature ratings set by the receiver manufacturers with very rare exceptions.

Insulation Resistance

The insulation resistance is a rating associated with paper dielectric tubulars, mica dielectric and ceramic dielectric fixed capacitors. It expresses the d-c resistance of the capacitor at rated temperatures. It is an im-

by John F. Rider

portant item when capacitors are used as blocking devices to prevent the application of d-c voltage present at one point, at another point. The blocking capacitor, also known as the coupling capacitor in many amplifier circuits is the example of such an application.

The usual way in which the insulation resistance of paper dielectric capacitors is mentioned, is megohms times microfarads. On the average, the insulation resistance of paper dielectric tubular capacitors at the temperatures from 20 to 25°C runs around 2,000 megohms per microfarad for values above .1 mfd. On occasion the rating is 1,000 megohms per microfarad. This means that if the capacitance is .5 microfarad the insulation resistance may vary from 500 to perhaps 1,000 megohms. If the capacitance is less than .1 mfd the insulation resistance usually is specified at a fixed amount, as for example, 5,000 megohms for the unit. As to the change in insulation resistance with temperature, it may decrease to as low as 1/70th of its base value at 20°C, when the temperature rises 40 to 50°C.

In the case of ceramic and mica capacitors which are generally available in the lower values, the insulation resistance is generally expressed as a fixed quantity as for example 5,000 megohms, or more or less. The receiver manufacturers generally specify the insulation resistance when they order capacitors and their requirements extend from 5,000 to 7,500 megohms. Replacement units of this kind of capacitor generally display similar values of insulation resistance.

The lower the insulation resistance of a capacitor, the greater is the possible leakage

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Pack 76. Stromberg-Carlson, Sylvania
Pack 77. Westinghouse, Zenith
For the individual models included in these Packs, refer to the TEK-FILE INDEX in this issue.

of the d-c voltage applied to the plate of a tube, through the capacitor, to the grid of the next tube, assuming that the capacitor is the d-c blocking device between these two tube electrodes. On the face of it, it may seem as though 1,000 megohms insulation resistance is a tremendously high ohmic value, yet receiver manufacturers frequently require that paper, ceramic and mica capacitors in certain capacitance ranges display insulation resistance of from 6,000 megohms to 7,500 megohms minimum, when measured at 100 volts dc at from 20 to 25°C. For example, if the insulation resistance is 1,000 megohms and the voltage is 250 volts, a current of .25 microampere will flow through the capacitor. If this amount of current is allowed to flow through, a 10 megohm grid leak and a 21/2 volt drop will develop across the resistor and by virtue of the polarity, can very materially and adversly affect the existing grid bias. This accounts for the requirement of 5,000 to 10,000 megohms insulation resistance for capacitors less than .1 mf used in this manner. Frequently, in order to maintain the high insulation resistance present between the terminals of mica capacitors for example, they are waxed dipped.

Although we have not mentioned this point earlier, it is always advisable before wiring in a replacement capacitor to check its capacitance and its insulation resistance. On more than one occasion, we found that this brief test saved a great deal of time, because in some cases the capacitor was wrongly labeled and in other cases its insulation resistance had for some unknown reason, fallen from far below its normal value. This does not happen too frequently, but the few moments necessary to make these tests will be worthwhile in the long run.

Relative to insulation resistance it is well to take note of another very important consideration, namely the voltage at which the capacitor is tested. The ordinary ohmmeter test is not satisfactory because the voltage applied is too low. Whenever possible, the insulation resistance test should be made with at least 100 volt dc applied, preferably several hundred volts.

Quite frequently the insulation test made with an ordinary ohmmeter shows a tremendously high resistance, but when the applied voltage is increased from 100 volts dc to perhaps 300 volts dc, the insulation resistance falls to a value which indicates excessive leakage through the capacitor and its unsuitability for use in the circuit.

Power Factor

Power factor is a constant for all capacitors. It is an expression which denotes the (Continued on page 28)



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Maintenance and Repair

by Jack Darr

Repair:

To remedy damage or harm. Maintenance:

> To keep in a specified state – keep supplied, equipped: To keep in operating condition. (New Century Dictionary, Appleton-Century-Crofts, Inc.)

A recent editorial in a trade magazine brought out the desirability of having men trained in *maintenance* work on radio and television, rather than in *repair*. Although this may seem to be a simple play upon words, the difference here is in the meaning: "maintenance" being used in the sense of performing such work upon the equipment so that it will *remain* in operating condition all the time, as opposed to waiting until some breakdown has occurred, and then repairing just that trouble.

This principle can very easily be applied by the working radio-TV serviceman, so that he becomes a true "maintenanceman" rather than a "repairman". Of course, it is impossible to make periodic checks upon all the radio or tv sets used by his customers, but he can and should perform each individual service job as if he were doing maintenance work instead of merely repair.

This implies a thorough knowledge of the characteristics and circuitry of the equipment he is working on. He must not only have the ability to remedy the fault which caused the unit to be brought into the shop, but also to foresee imminent troubles and remedy them in advance. The natural rejoinder to this statement will be, "Yes, but how are you going to forecast all of the possible trouble that will develop in any given set for any protracted period of time?" The obvious answer to this is of course that you aren't. Inasmuch as no test-equipment manufacturer has been able to develop a useful crystal ball, you will not be able to prevent all of the future troubles, but by careful checking of all possible trouble sources, whenever any unit is brought in for service, you will be able to eliminate a large majority of them.

Methods and Equipment

This kind of work obviously cannot be performed with a voltmeter and a screwdriver. It will require the intelligent use of every piece of test equipment in the shop, together with a thorough familiarity with the



Photograph showing the workbench of Ouachita Radio Service, Mena, Arkansas. Jack Darr is at the left and his helper, Delmer Lott, is at the right.

unit under repair. Inasmuch as it is quite impossible for any one man to carry all the necessary information in his head, this also implies the possession of a complete set of service information, covering all possible sets. This must also provide the very latest information on any changes or modifications made by the manufacturer of the unit, either to prevent failures or to improve performance. For simplicity's sake, let us assume a service job on an fm-am table model receiver of the ac-dc type. By questioning the customer, we learn that the set has not been in a shop for at least a year. We ask about the sensitivity, selectivity, fading, and other details of the set's performance in the period before the failure occurred. From this information, we can learn where to look for other possible troubles. Testing discloses the rectifier tube open. This is replaced; the other tubes are tested, and the power tube and i-f amplifier tube are found to be weak. After replacing the weak tubes and testing the filter and line bypass capacitors for leakage or shorts, we turn the set on. Voltage measurements show the plate voltage to be about 20 volts low. From the service manual, we learn that this set uses a 30 to 50 μ f filter capacitor rated at 150 volts, and the filter resistor is 1,700 ohms. This resistor is discolored so that the color code is unreadable, but the ohmmeter shows it to be about 2,400 ohms. The surge resistor is also burned and unreadable, but the schematic shows 33 ohms as the correct value. This resistor is also found to measure high. Therefore, the two resistors are replaced with the correct values. The capacitor-tester shows the filter capacitors to be within their capacitance rating and to have a good power factor. The line bypass capacitor is also checked, for both capacitance and voltage breakdown. If sufficient leakage is found in this important capacitor, it is replaced.

The set is turned on and the voltage returns to normal, although to the uninitiated ear, there is not too much difference. Experience has shown, however, that such changes in value denote the distinct possibility of a continuing change, ending in a failure. Voltage measurements are now made for the rest of the set, paying particular attention to such points as the power-tube grid (to check for coupling capacitor leakage), the oscillator grid (to check the oscillator tube and circuit), and the first audio amplifier plate and screen, if any. Any deviation from the norm here must be checked and remedied. Although little trouble is found in avc resistors and bypass capacitors in present-day sets, it will still pay to test them carefully.

Although the example given has been a small radio set, the same methods and principles will apply equally well to other units that come into the shop. We have occasion to deal with electronic organs, especially those used in churches. These are apt to go for long periods of time without attention, ending in a failure. We recently serviced an old Minshall-Estey for the local church here. The immediate cause of failure was a dead tube, but we took the main amplifier and generator unit to the shop on suspicion. This suspicion was well repaid. With the schematic and an ohmmeter, we found nine defective resistors, including phase-inverter plate loads. grid resistors, filter resistors, and practically all the tremolo-circuit resistors. Later, we pulled the "stops" unit, and in this, replaced the astonishing total of seventeen defective resistors! This restored the organ to its original fine performance, and the choir director was extremely grateful.

The above procedure sounds like a long, time-consuming job. It is not: the whole series of tests outlined can be made by a competent man, using proper equipment and the accurate service information necessary, in a short time. The results obtained will certainly justify the extra time. The customer will

(Continued on page 16)

HINT FOR FINDING

TV CHANNEL FREQUENCIES The following hint, which appeared origin-

ally in "The Relay" (published by the Fred C. Harrison Co., Elmira, N. Y.) is based on

an idea submitted by John Mulligan.

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1. To find the frequencies corresponding to any uhf channel (channels 14 to 83) proceed as follows. Multiply the channel number by 6, then add 389 mc. This will give the center frequency of the channel. The frequency of the picture carrier is 1.75 mc below the center frequency, and the frequency of the sound

> 2. To find the frequencies corresponding to a channel in the high vhf band (channels 7 to 13) proceed as follows: Multiply the channel number by 6, then add 135 mc. This will give the center frequency of the channel. The picture-carrier frequency is 1.75 mc below the center frequency, and the sound-carrier frequency is 2.75 mc above the center frequency.

carrier is 2.75 mc above the center frequency.

3. To find the frequencies corresponding to a channel in the low vhf band (channels 2 to 6) proceed as follows: Multiply the channel number by 6, then add 49 mc for channels 5 or 6 or add 45 mc for channels 2, 3, or 4. This will give the center frequency of the channel. The picture-carrier frequency is 1.75 mc below and the sound-carrier frequency is 2.75 mc above the center frequency.

As an example, assume you are interested in knowing the frequencies coresponding to uhf channel 44. The center frequency is 44 times 6 plus 389 mc, or 653 mc. The picture-carrier frequency is 1.75 mc lower, or 651.25 mc while the sound-carrier frequency is 2.75 mc higher, or 655.75 mc.

As a second example, assume you are interested in knowing the frequencies of vhf channel 11. The center frequency is 11 times 6 plus 135 mc, or 201 mc. The picture-carrier frequency (1.75 mc lower) is 199.25 mc, while the sound-carrier frequency (2.75 mc higher) is 203.75 mc.

Maintenance and Repair

(Continued from page 15)

be glad to pay the extra charge when he sees the improvement made on performance.

In conclusion, we might say that you only get out of the radio-TV service business what you put into it. If you put your full time into doing the best possible work on your customer's sets, using all of the helps available, you will be more than repaid in the increased service business, especially in the repeat business that high-quality work will always bring in.



16

TV SUPPLEMENTARY SHEET NO. 2

MODEL &	PART /	CATALOG !	FUNCTION	DESCRIPTION	LIST PRICE	MODEL &	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
ARVIN	£22464_20	RTV-259	Vert Lin /	3000/2 .5 Meg.	\$3.10		W-148651	Order From MFR,	AGC	1000 Ω 1W-W.W.	
61751M 6179TM	222404-20	KTV-237	Height	2W-W.W./carbon Canc. Dual		EMERSON					
	E22464-27	RTV-352	Contrast Vol ./Sw.	1500/250 Ω Canc . Dual carbonSPST	\$3.70	711B 712B	390156	AG-61-5 KSS-5	Vert. Hold	1 Meg. Ω carbon	\$ 1.25
	E22464-34	AG-49-5 KSS-3	Bright.	100K Ω carbon	\$1.25	720B	390181	AG-52-5 KSS-5	Bright.	200K Ω carbon	\$1.25
CHASSIS TE-331 TE-331-2	E22464-36	AG-83-5 K55-3	Vert. Hold	1.5 Meg. Ω carbon	\$1.25		390183	AG-44-5 KSS-5	Hor . Hold	50K Ω corbon	\$1.25
	E22464-38	AG-40-5 KSS-3	Har. Hold	25K Ω carbon	\$1.25		390196	AG-83-5 FK5-1/4	Height	2 Meg. Ω corbon	\$1.25
BELMONT- RAYTHEON						CHASSIS 1201648	390196	AG-83-5 FKS-1/4	Focus	2 Meg. Ω corbon	\$1.25
C-1729A C-1731A M-1726A	A10A-18441	RTV-218	Controst/ Vol./Sw.	5000/1Mey. Top 100K ΩConc. Dual carbon DPST	\$4.50		390197	A43-5090 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	\$1.25
M-1723A	A 10B-17275	AG-49-5 KSS-3	Vert. Hold	100K Ω carbon	\$1.25		390201	RTV-296	Contrast Vol./Sw.	1500/1 Meg. Conc. Dual carbonSPST	\$3.70
	A 108-17764	AG-44-5	Bright.	50K Ω corbon	\$1.25		390202	AG-83-5 FKS-1/4/SWB	Fringe Com- pensator	2 Meg. Ω corbonSPST	\$1.25 .60
	A 108-19218	AG-19-5 FKS-1/4	Vert. Lin.	5000 Ω carbon	\$1.25	FADA 7C42 * 7C52	D220076G20	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	\$1.25
	A 108-19220	AG-61-5 FKS-1/4	Height	750K Ω carbon	\$1.25		52.24	AG-64-5 FKS-1/4	Height	2.5 Meg. Ω carbon	\$1.25
	A 10B-19542	AG -63-Z KSS-3	Tone	1 Meg. Ω corbon	\$1.25		52.64	RTV-109	Contrast/ Vol ./Sw .	750 Top 500/500K Ω 2W-W.W./carbon	\$4.50
BENDIX OAK3	СН262022-4	AG-42-5	Hor .	30K Ω carbon	\$1.25		52.66	RTV-110	Vert./	1 Meg./50K Ω Conc.	\$3.10
21K3 21KD 21T3	CH262024-15	FS-3	Hold	10K O carbon	\$1.25		52.69	AG-44-5	Hor. Hold Bright.	Dual carbon 50K Ω carbon	\$1.25
21X3	BV/4C 10	FKS-1/4	Inverter	2 4444 0 4444	¢1.25		52.74	FS-3 AG-84-5	Focus	2.5 Meg. Ω corbon	\$1.25
	CH262025-4 CH262025-14	FKS-1/4	Hold	2 meg. \$2 carbon	31.23		Some Models (FKS-1/4			
	RV4C07 CH262025−7	AG-85-5 FKS-1/4	Height	3 Meg. Ω carbon	\$1.25	7T32, 77T32, 721	52.24	AG-84-5 FKS-1/4	Height	2.5 Meg. Ω carbon	\$1.25
•	RV4C07 CH262025-7 CH262025-12	AG-85-5 FK5-1/4	Facus	3 Meg. Ω carbon	\$1.25		52.24	AG-84-5 FKS-1/4	Focus	2.5 Meg. Ω carbon	\$1.25
	RV4C11 CH262025-10 CH262025-13	AG-58-5 FKS-1/4	Vert. Lin.	600ΚΩ carbon	\$1.25		52.64	RTV-109	Contrast Vol ./Sw.	750 Tap 500/500K Ω 2W-W.W./carbon Canc. DuolSPST	\$4.50
	CH262041-2	AT-90 FS-3/SWA	Vol./Sw.	500K Ω carbonSPST	\$1.25		52.66	RTV-110	Vert/ Hor. Hold	1 Meg/50K Ω Conc . Dual carbon	\$3.10
	LH262045-1	RTV-373	Bright./ Contrast	100K/1200 Ω Conc. Dual carbon	\$3.10		52.68	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	\$1.25
CROSEEY							52.69	AG-44-5 FS-3	Bright.	50K Ω carbon	\$1.25
DU-20CDM, CHB, CHM,	B-148952	AG-83-5 RS-2	Vert. Hold	1.5 Meg. Ω carbon	\$1.25	·	Some Models L	ke Alternate Pa	₫ 52.74		
DU-21CDM1,	B-148953	AG-44-5 RS-2	Hor. Hold	50K Ω carbon	\$1.25	20C22 20T12 24T10	52.24	AG-84-5 FKS-1/4	Height	2.5 Meg. Ω carbon	\$1.25
COB, COL, COB, COL, COLB, COM	B-148966	AG-43-5 RS-2	Bright.	40K Ω carbon	\$1.25		52.54	RTV-109	Contrast/ Vol./Sw.	750 Tap 500/500K Ω 2W-W.W./carbon Conc. DualSPST	\$4.50
	B-149893	A 10-1500 K\$S-3	Focus	1500 Ω 4W-W.W.	\$ 1.85		52.66	RTV-110	Vert./Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	\$3.10
	B-151634	AG-15-5 R\$-2	Vert. Lin.	3000 Ω carbon	\$1.25		52.68	A43-5000 FKS-1/4	Vert.	5000 Ω 2W-W.W.	\$1.25
CHASSIS 357	B-152129	AG-83-5 R5-2	Height	1.5 Meg. Ω carbon	\$1.25		52.69	AG-44-5	Bright.	50K Ω carbon	\$1.25
33/-1	C-151111	RTV-327	Controst/ Vol./Sw.	1500/1Meg. Tap 250K Ω Conc. Dual carbon SPST	\$4.30			r3=3			



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The Editor

JUST OUT: RIDER'S TV 11

CORRECTION TO:

Rider's Dependable Replacement Parts Listing published in TV Volume 10.

SWEEP TRANSFORMERS

Set Mfr.	Set Mfr's Original
	Part No.
Gamble-Skogmo	51X156

Correction: Transpose A-8141 from Ram column to Stancor column. RCA 74114

Correction: Change Part No. 74114 to 74144 in Part No. column.



I-F Trap Circuits etc.

(Continued from page 10)

cause much degeneration. A transformer arrangement is used to obtain a high-Q trap circuit. The coupling between primary and secondary determines the effectiveness of the trap.

The cathode trap generally does not produce a peak to the left of 41.25 mc. However, the trap loses its effectiveness if the transconductance of the associated tube is low. This tube should operate, therefore, with a constant bias. If agc bias is applied to the tube, the trap will become useless when strong station signals are being received.

Any of the four arangements shown in Fig. 3 may be used to trap out a 4.5-mc signal in the video section of the receiver.

Tuning of Traps

In non-intercarrier receivers, the sound i-f signal is removed from one of the 41.25-mc traps, while in intercarrier receivers the sound signal is obtained from a 4.5-mc trap. The question arises, when tuning these traps, as to whether to tune for maximum sound output or minimum picture-signal output. The answer is that i-f traps should always be adjusted for minimum second-detector output, so as to obtain the solid-line response curve of Fig. 2. Similarly, 4.5-mc traps should be adjusted for minimum 4-5-mc signal at the cathode-ray tube. A properly designed receiver will have sufficient sound output when the traps are adjusted in this manner, and it is more important to optimize the picure presentation. Receiver schematics usually specify the frequency at which each trap is intended to operate. In most cases, the trap circuits are slug tuned.

Conclusion and Summary

From the foregoing discussion, one may conclude that many television receiver faults may be traced to improperly aligned traps, or to traps that have been omitted in the design of the receiver. In all cases, improperly aligned traps may trap out picture signals rather than the signals they were intended for. This may be checked by examining the overall i-f and video response curves of the receiver. Summarizing, we may note that:

1. Improperly aligned or missing associated sound traps may result in sound-bar and 4.5mc interference in the picture, and buzz in intercarrier receivers;

2. An improperly aligned or missing adjacent sound trap may result in sound-bar and 1.5-mc interference in the picture;

3. An improperly aligned or missing adjacent picture trap may result in adjacentpicture interference in the desired picture;

4. An improperly aligned or missing 4.5mc trap may results in 4.5-mc interference in the picture, and weak sound in intercarrier receivers.



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ELL-A-FAULT Symptom Sheet

BRIGHT VERTICAL LINE



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(NOTE: Refer to CIRCUIT GUIDE IV-9(A) for identification of components.)

The unstable picture-tube pattern evident while the receiver was defective is shown, as photographed at different instants, in Figs. 1 and 2. The raster was shrunken in size and jumped erratically over the face of the picture tube at a rapid but visible rate, giving the appearance of a flickering raster. Neither vertical nor horizontal sync could be restored by adjustment of the hold controls. The bright vertical line, marked by intermittent horizontal streaks, was conspicuous at all times. While audio-output level was normal, a steady oscillation of undetermined frequency accompanied the sound.





Since symptoms of faulty operation appeared to involve both vertical and horizontal synchronization and the highvoltage section, which depends on the horizontal-sweep circuit, operation of the common sync strip was checked. The sync separator and clipper (VI and V2) appeared to be operating normally. However, at the grid of the sync splitter (V3), the unstable, distorted waveform of Fig. 3 was obtained, with an isolating probe, at H/3. Normally, the well-defined steady pulse of Fig. 4 is present. A similar condition existed at the vertical-scanning frequency.

Output from this stage was then investigated. Waveforms at the plate were badly distorted in shape. For example, at V/2 through the low-capacitance probe, the pattern of Fig. 5 was noted. This stage, when functioning properly, produces a plate waveform like that shown in Fig. 6 at the frequency mentioned.

The cathode-output waveform (obtained at the junction of R9 with R10) was similar to but out of phase with the plate output, as expected (see Fig. 7). However, it was much lower in amplitude. Cathode and plate output waveforms are normally of the same amplitude. The normal output waveforms of Figs. 6 and 8, for example, are similar in shape, opposite in polarity, and of the same P-P height. The positive d-c voltage at the junction of R9 and R10, however, was considerably larger than the normal low value.

A check of the output side of capacitor C6, feeding from the cathode, revealed the expected display, already shown in Fig. 7; but the d-c voltage, normally negative, was identical to the positive reading found at the previously mentioned junction of R9 and R10. In addition, resistance readings on either side of capacitor C6 were the same.

Normal operation of this receiver was restored by replacing a defective component in the cathode-output circuit of the phase splitter, V3. Coupling capacitor C6 was found to be shorted.

PRINTED IN U.S.A.

HT VERTICAL LINE



The Rider Manual pages and TEK-FILE pack which include the original data and shematics to which the following production changes apply, appear in the index on page 29 of this issue.

GAMBLE-SKOGMO (CORONADO) MODELS 05TV1-43-9014A, 15RA2-43-9105A CHASSIS 16AY210

Circuit Changes, Audio

A 6T8 tube (triode-triple diode) replaces the audio amp. 6AV6 (V12) and the audio det. 6AL5 (V21), performing the same functions as these two tubes.

In the audio strip assembly, 72 (Part No. B-13M-19257, the ratio detector coil) is replaced by Part No. B-13M-17273.

NOTE: Chassis stamped with RMA date code number 124031 or higher incorporate these changes.

0

MAGNAVOX

CHASSIS CT-275, 276, 277, 278, 279, 280, 281, 282

R-F Unit

These chassis use either r-f unit 700349 or 700354.

SYLVANIA

MODEL 1110X CHASSIS 1-329

Sound I-F Limiter (Circuit Change)

- Dual ceramic capacitor C-103 and C-104 (.004µf, 450v), connected to pins 6 and 7 of the Sound I-F Limiter (V-9, 6AU6), is removed from the circuit.
- Resistor R-105 (330 ohms, ½w), connected to pin 7 of V-9, is removed from the circuit.
- 3. The cathode of V-9 (pin 7) is connected directly to ground.
- New capacitor C-103 (.005µf, 500v, ceramic, Service Part 166-500D) is added to the circuit as screen grid bypass for V-9 (pin No. 6 to ground).
- NOTE: Chassis coded C02 and later incorporate this change.

SYLVANIA

MODELS 71M, 72M, 73B, 73M CHASSIS 1-366(C08), 1-441(C02)

Sound I-F Limiter (Circuit Change)

- Resistor R-105 (330 ohms) and capacitor C-103 (.004µf) are removed from the cathode (pin 7) of the Sound I-F Limiter (V-10, 6AU6).
- 2. The cathode is connected directly to ground.
- Capacitor C-103 (pin 6 of V-10, 6AU6) is changed from .004µf, 500v to .005µf, 500v (Service Part 166-5000D).
- NOTE: Chassis 1-366 coded C09 and chassis 1-441 coded C03 incorporate this change.



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RED	Mfr.	Tubes Tested	Tubes Failed	Point Quality
T "CPORT	А	8	3	76
SYLVANIA ELECTRIC PRODUCT	В	8	4	79
THE YORK 19, NEW YORK	С	8	6	62
	D	8	4	74
	E	8	4	67
	F	8	5	42
UNITED STATES TESTING CO	G	8	4	52
HOBOKEN, N. J.	Н	8	5	30
	SYLVANIA	8	0	93

Exhaustive tests by United States Testing Company prove Sylvania Picture Tubes out-last, out-perform all others tested!

• Hour after hour for over 1,400 consecutive hours, Sylvania Picture tubes were tested side by side with tubes of 8 other manufacturers. The chart at right tells the remarkable performance record. Note that only Sylvania Picture tubes showed no failures. Here's the conclusion of the U. S. Testing Company Report: "On the basis of an ultimate Life Test Evaluation of the eight tubes of each brand tested, it can be concluded that the averaged overall qualities measured on the Sylvania Tubes were superior to the averages of the other brands tested."[•] HERE ARE

THE

CONCLUSIONS!

•United States Testing Company, Inc., Test No. E-5526.

We'll be glad to send you full details of this report. Send your request to Sylvania Electric Products Inc., Department 3R-1804, 1740 Broadway, New York 19, N. Y.



RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT LAMPS, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS: PHOTOLAMPS; TELEVISION SETS

What Is The Fastest Way To Trouble-Shoot A TV Set?

This material originally appeared in A.G. RADIO NEWS, published by the AG Radio Parts Co.

Every service technician has his own little private system of trouble shooting because it is developed from day to day experiences in dealing with an endless variety of problems.

In beginning to trouble shoot a chassis brought into the shop, some prefer to check prominent B voltage points first; others choose to test suspected groups of tubes first; some rely on observation of the end result of both picture and sound for the prime indication of a defect and still others turn directly to signal tracing or signal injection methods.

Each of these approaches has it own definite advantages and because of this, furnishes grounds for argument, which incidentally, is not the concern of this review.

Regardless of the system of trouble shooting which you may employ, it may be wise to stop and analyze it occasionally to find if you are competitive in today's modern service market.

How does your system of trouble shooting measure up to the following questions?

(1) Is it fast enough to be competitive even when severe problems are encountered?

(2) Is it a sure-fire direct approach to the source of a defect right down to the very component at fault?

(3) Does it furnish positive proof of correction enabling you to gain control over the cause of trouble so you can repeat bad or good operation at will?

When the going gets tough and extraordinary demands are placed on any particular system, it may soon be found to be limited to the extent where tests methods of another system must be reverted to in order to reach a conclusion. On may suppose then, that a combination of the above listed systems might be best, but this hardly seems practical. From another aspect, trouble shooting practice can be relegated to two broader classifications:

(a) The "case history" or "experience" method and

(b) progressive testing.

Many technicians depend on their experience with one set to guide them in repairing another one like it. When an unfamiliar problem arises, someone else's experience is sought, either through conversation or by resorting to technical files.

The popularity of direct solutions to characteristic problems is responsible for the introduction of many technical data sheets hints and kinks, and other printed helps. Therein other peoples' experience are described so the technician can avoid the costly process of working them out for himself. The limitation to this "case history" method, however, lies in the extensive filing job necessary to organize sufficient data and to constantly amend it for all makes of sets. Filing could conceivably take more time than trouble shooting!

Where specialization on a single line of receivers alone is practiced, the "case history" method with its repeatedly used short-cut experiences, becomes highly practical. This is a point in favor of having exclusively franchised dealers or large specializing contractors.

Progressive testing should appeal more to the independent technician who services all makes of receivers. His pet system of trouble shooting, plus schematics, voltage charts, and other pertinent basic information will enable him to rush through most problems.

When his routine practice is completed, the employment of his extended knowledge of various systems of trouble shooting, quickly leads to conclusive results.

This "general practitioner", therefore, must rely more on his ability to think of a test that will solve his unusual problems than to rely solely on finding a case history that will match any problem which he may encounter.



Let Art Liebscher, former RCA Test Equipment Specialist and authority on the subject, give you all the answers on . . .

TV SWEEP ALIGNMENT TECHNIQUES

Never before has there been a book such as this on TV sweep alignment! Here you have techniques set up by an expert in the field a man who gives you accurate, time-saving methods — and tells you how they work. The new Supermark method of TV sweep alignment is introduced. Learn new uses for your test equipment. Chock-full of sweep curve pictures taken from actual jobs using the test equipment set-ups and techniques discussed. Valuable for servicing in UHF signal areas. Covers TV sweep alignment methods completely from all angles. Know how to check video amplifier response with a sweep generator applied to the antenna input; how to peak align tuned circuits with sweep equipment; how to tune traps rapidly, etc. This book shows you how ! Over 100 pages 51/4"x81/4" illus. \$2.10

John F. Rider Publisher, Inc., 480 Canal St., New York 13, N.Y.



So compact they fit anywhere. So many listings (over ten dozen) that you can meet any capacitance, voltage and combination requirement. Yes, singles, duals, triples and quads.

Multiple-section units have stranded wire leads and safety sleeves. Hi-purity aluminum construction minimizes corrosion. Vented for excessive gas pressures.

If ever there was a Jack-of-alltrades electrolytic, this is it— Aerovox Type PRS Dandee. Ask your Aerovox distributor for

Ask your Aerovox distributor for Aerovox Dandees. Ask for latest catalog—or write us.



TOPS! MPS are TOPS!

IMPS WON'T FREEZE OR MELT!

They'll operate faithfully in temperatures ranging from -40°C. to +100°C. (212°F.) and that's the boiling point of water !

600 DCVW





IMPS ARE REALLY RUGGED!

The tough thermo-setting plastic will take an astounding amount of abuse —yet IMPS will still look and perform like new!

IMPS ARE MOISTURE-PROOF!

No moisture can get through the varnished plastic case, or even through the lead anchor points.





IMP LEADS CAN BEND AND BEND!

Tinned leads that are really securely anchored you'll be amazed at how much punishment they'll take without breaking!

All over the country service-engineers are praising the newest and finest molded tubular paper capacitor—the Pyramid IMP! IMPS are available in all popular ratings in 200, 400 and 600 volt ranges.

If you haven't tried the new IMP, send for your free sample today— **PYRAMID ELECTRIC COMPANY** 1444 HUDSON BOULEVARD • NORTH BERGEN, NEW JERSEY

Setting Up for TV Service

(Continued from page 3)

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As far as storage space is concerned, the shop should have adequate space to heat run repaired chassis for at least four hours, preferably in their cabinets.

Generally speaking, lighting should be such that the service man does not cast shadows on his work. Recommendations as to fluorescent and incandescent lamps vary. If the former is used, it must be properly installed to minimize interference. Overhead lighting should be supplemented by gooseneck or floating-arm lights.

There is some tendency to locate service shops in basements or other poorly ventilated spots. In any shop, efficiency can be stepped up by giving some attention to good ventilation. Actual sound-proofing of the shop is usually impractical but a little attention to layout and some inexpensive soundproofing measures are often sufficient. In addition, the shop noise level can often be reduced by care on the part of service personnel.

A regard for efficiency alone will dictate the minimums as regards shop layout, lighting and ventilation. Dividends in the form of better employee morale and a better impression on the public can be realized by going one step further in providing a neat. well-laid, out shop. An operation of this type can be well publicized, rather than being relegated to obscurity.

Test Equipment

Many of the service managers contributing advice to Electrical Merchandising in preparing this article emphasized that purchase of inferior test equipment was no economy.

Said one, summarizing the problem: "A big headache to manufacturers is the type of equipment offered by test suppliers, since there is a good chance that test equipment will not perform as advertised. We have spent considerable time in analyzing test equipment offered to the trade and have found some of it almost worthless. . . . Generally speaking, a serviceman gets what he pays for. . . . Much of the equipment offered to the serviceman two years ago is not acceptable for use on TV receivers today because of the increased sensitivity built into sets since that time."

What test equipment does the dealer need for his service shop? Four manufacturers provided answers, varying in detail.

A spokesman for Admiral Corp. suggested that the minimum would include an oscilloscope, a vacuum tube voltmeter with high

CHART I-TEST EQUIPMENT (Du Mont Recommendations) The Minimum

- Oscillograph with horizontal probe (from \$150 to \$330).
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 Swerg generator (\$220 to \$550).
 Peak to peak scope caliborator (\$40).
 Isolation transformer (\$25).
- **Useful Additions**
 - Tube tester with CRT test adaptor (\$100 to \$165). Capacitor checker (\$70). Cross hatch generator (\$175). Field strength meter (\$85). High frequency and high voltage probes for VTTM.
- How Much Equipment

ar bench should have an excillegraph and VTTM. A dr luse shop would have one swarp generator setup for every two benches and a Scope P.P. Calibrator for every bench. As a minimum, however, one of each of these pieces of equipment would be adaquate.

- What To Look For In Buying This Equipment
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 Oscillagraph Sensitivity-minimum 30 mv/in. R.M.S. Vertical amplifier response-Flat from a few cycles per second to a minimum of 100K Ct 1055 point.
 Shielding-CRT, and input terminals must be fully shielded. Serven Size-Preferably 5'.
 Yaraum tabe voltmoster Input impedance-At least 10 megahma. Voltage ranses. Minimum law range-3'. Minimum bigh range-600*. Polarity witching-Should incorporate provisions for avtiching be-tween positive and orgalive voltage. Zero center scale-Should povolde one for simplified FM alignment.
 Sweep generater Flatene-Output should be fally shielded to minimize extraneous pickup. Shielding-Unit must be fully shielded to minimize extraneous pickup.

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 - Marker Sensitivity—At least a maximum 0,1v output,
- Accuracy—While ± 0.5%. Modulation—Should provide frequency for internal modulation of cw

voltage test leads and RF probe, a sweep generator and calibrator.

In describing the test equipment needed by a servicing dealer, DuMont and Emerson experts went into considerable detail, not only as to the equipment but also as to the features and performance characteristics which should be found in such equipment. For these opinions, see Charts I and II.

RCA, whose subsidiary, RCA Service Co., is the largest servicing organization in the field, suggested these guides for purchasing test equipment. (The large shop shown in the table employs from 16 to 20 technicians, the small has only three or four.)

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Item Si	bop	Shop
Audio amplifiers	1	1
Antenna rotor kits	8	2
Dual turntable racks	1	1
High voltage test probe	1	1
Oscilloscope	1	1
Circuit tester	27	5
Sweep generator	1	1
Crystal calibrator	1	1
Signal generator	1	1
Monitor TV set	1	1
RF unit test jig	1	1
Junior Voltohmyst	2	1
Sound power phone (hand)	7	2
Sound power phone (chest)	7	2
Telescopic survey truck	1	1
Tube tester	1	0
Survey receiver	1	0
Record player	3	3
Capacitor analyzer	1	0
16" test jig	2	1
17" test jig	2	1
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Tools: Hand, Shop, and Installation

Chart III gives a good idea of the variety of tools required for servicing a set and for installation work. Generally speaking one set of hand tools is required for each bench. A single set of shop tools, however, should be sufficient for the entire shop.

Installation Supplies

A crew handling installations must carry a wide variety of supplies; these can be broken down roughly into antennas (and masts) and mounting accessories. An ample supply of accessories should be maintained on the truck at all times. The antennas and masts can be drawn from stock each morning to cover that day's jobs. Each truck should carry about 1,000 feet of antenna lead-in wire.

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 There is more of a variation in price for the above items than practically any other. Better units have separate markers and sweeps and operate strictly on fundamentals. Cheaper units out any other all of a least 1 obsole for out about or repair of taners, Cheaper units which do a fair job cost about \$175\$ while better units cost anywhere sufficient output and good
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HIGH FIDELITY SIMPLIFIED "... fulfills its title"

RADIO & TELEVISION NEWS

February, 1953, says:

".... those planning high-fidelity music systems for their homes will save themselves time, money and trouble by reading this book first then making their purchases."

EXCLUSIVE OFFER

By special arrangement with Columbia Records, Inc., each purchaser of this book can procure for only 25 cents a 7-inch "Lp" test record with excerpts by the N. Y. Philharmonic Symphony Orchestra and the Philadelphia Symphony.

HIGH-FIDELITY

January-February, 1953, says:

"We could make this just about the shortest book review ever written by saying only: 'This book fulfills its title'... this is a good book

BROADCASTING TELECASTING

December 22, 1952, says:

"...a simple well illustrated information source...a 'how-to-do-it' guide...' 208 pages (5 1/2 x 8 1/2"), over 100 illus. For your copy of this invaluable book, go to your jobber, bookstore, or send \$2.50 to:



West Coast Office: 4216-20 W. Jefferson Blvd., Los Angeles, Calif: In Conoda, Mr. Charles W. Pointon 1926 Gerrard Street, East, Toronto, Ontario Export Agent: Roburn Agencies, Inc., 39 Warren St., N. Y. 7 Cable Address: Roburnage N. Y.

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Successful Servicing, April, 1953
Setting Up for TV Service
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(Continued from page 25)

CHART III-TOOLS . . . Hand, Shep and Installation

A. HAND TOOLS			
Suggested by Du Mont	Suggestions by Admiral	Suggestions by RCA Service Co.	Suggestions by Emerson
Serew driver set tregular and Phillips head) \$ 3.03 Set of splatights. \$ 5.00 Long nose pliers. 2.00 Diagonal entirer 2.00 Set, alignment and adjustment tools. 4.00 Seldering gun 12.00 Tabe paller. 75 Pin stralghteners (7 and 9 pin hase) 75 Hex and spline wench set. 125	Serew driver act 1 1/4" to 1/4" blade) Set, spin type wrenches, 3/32" to 3/4" Diagonal pilers Long nose pilers Soldering gun/iron Alignment wrenches	Diagonal pilers-6" Sitp joint pilers-6" Screw driver, eap tip 8"- Screw driver, est of 4 Ratchet-4" Socket set-11 pieres Soldering gun Needlenose pilers-6" Creserent wrench-6" Phillips screw driver. ½" Allen wrenches Mirror, 4 x 5 inches	200 watt soldering gun. \$11,8 Long nose pliers. 22 Diagonal rotters 22 Serew drivers 12 Serew drivers 12 Milliph tand serew drivers 12 Kit, allgument tools 1.0
B. SHOP TOOLS			
Vie \$15.00 200 wait soldering inn	Elerric deill Vise Sockei punches Drill set1/16" to at lesse 14"	Fatension cord, 100 feet Soldering iron Hammer, double face, 3 lbs. Wood lever, 12" Files (2), 8" med. Keyhole saw; hark saw Screw driver, 6" blade Screw driver, 6" blade Screw driver, Phillips Pliers, side cut, 7" Center panch, 34" dia. Ratchet wench los type (3/2 x 9/16") Ratchet wench los type (3/2 x 9/16") Plashlight, right angle Channel lork pliers	Use 200 watt soldering iron instead or gun Each technician la farnished mora en pensive set of alignment tools that sperified under hand tools Shop tools much as vise, electric drill cit.
Adjustable 50 ft laddces Pipo wrenches Rope (100 ft) Eatennion cord (200 feet with multi- ple outlets) Set masony drills Hammer beavy construction type Set chiels Pair of phones—sound powered Heavy duy telectric drill COST: About \$120 per truck		Clew basemer, 16 oz. Serew diver sd. tip, 3" hlade Cab. tip and serce Diagonal pliers, 7" Pliers, needlesoor, 1" Paini branh, 1": justy knife End wrench, 8" Steel tape, 6 ft. Pliers, alip joint	Hack saw 11.25 Pipe wrench 5.00 Vice grip wrench 3.00 Set, ben wrenches 3.00 Assorted size star drills 1.00 Medium aize hammer. 2.55 Large screw driver

man crew should be able to handle four installations per day.

For some idea of what's required in the way of supplies for installations, see Chart IV.

CHART IV-INSTALLATION SUPPLIES

- Antennas, Masta and Mast extensions, Mast connectors 300 data antenna wire Constal cable 13 or 23 data. Should be used only for special applications: electrically unity areas, damp salts areas where 300 data into would deter-orate raphlys. Gonset has how open wire line (to be used only in extreme fringe aroas where minimum line loss in necessary). Lightning arcetor, aluminum ground wire, ground elamps and ground rolls. Mounts: chinney, wall, adjustable wall (for clearing obstructions) and loss mounts.

A. HAND TOOLS Suggested by Du M

Cuy Nire to strand steel wire; turnbuckles and guy rings. Anchor bolis for mounting brackets to massonry Lead plugs for securing standoffs to massonry Nand offs for: twin lead in wire; coasial antenna wire Single and double mast standoffs for securing antenna wire to mast Invalated tarks. black (rfetion tape Springwhan togele bolis for mounting brackets against hollow wall Rotors and booster.

Parts

A good service operation is no stronger than its weakest link-and the most elaborate service set-up will be rendered ineffective if the dealer fails to stock an adequate supply of parts and tubes.

What constitutes an adequate stock of these items is a question which is best determined with reference to past experience. Some general rules can be set up as a preliminary guide. They may have to be adjusted or supplemented when a dealer has put them into effect and determined whether they suit the conditions he is meeting.

One manufacturer tells his dealers: maintain two replacement parts unless you find that you need more. Have at least 10 tubes of each type on hand and for the more popular types, keep 50 on hand.

RCA Service Co. carries a two-month supply of parts available within 30 days and keeps an additional month's supply on order.

Maintenance of a parts inventory system is strongly recommended, both as a control measure and as a means of determining satisfactory inventory levels. These records can be maintained in a variety of forms. Dealers should remember that the more information required by the system, the more valuable it will be to management. The following items, listed in order of their importance, could be included:

- 1. Record of purchases by description, purchase order number and date and quantity ordered.
- 2. Record of receipts by quantity and date.
- 3. Cost of item to dealer and list price.
- 4. Usage and balance on hand.
- 5. Minimum and maximum stock quantities.
- 6. Location of items,

According to Harold Schulman, manager of the Du Mont teleset service control department, the information provided in items (1) and (2) above automatically provide the dealer with:

- a. The approximate rate of usage. Quantity to be purchased can then be judged according to the frequency and quantities of past orders.
- b. A safeguard against reordering parts already on order-a major cause of overstocking.
- c. A steady reference file for giving approximate dates of delivery and timing of purchases.

This system has one drawback, Schulman warns: it provides no usage report. The dan-(Continued on page 31)

Mr. Newton Cook

Manager,-Standard Products Section CHICAGO TRANSFORMER

says: "You can see the difference with the Regency Booster"

Kegency

largest selling Booster at any price.

REPLACEMENT PARTS, Etc.

(Continued from page 13)

magnitude of electrical losses. It is expressed in terms of percentage. The range of power factor for paper dielectric tubulars at base temperatures of 20 to 25°C is from perhaps .25 to 1%. As a general rule, power factor increases with both decrease and increase in operating temperature relative to the rated base temperature, so that an increase of from 3 to perhaps 5% for a temperature rise of 40-60°C is not unusual. Generally, the power factor increases very rapidly when a capacitor is used at temperatures beyond its rated operating temperature.

In the case of mica capacitors and ceramic capacitors, the power factor figures are substantially lower than for the paper dielectric type of unit. Assuming these types of capacitors are being used within their rated operating temperatures, the power factor of mica capacitors generally is substantially below 0.2%, especially the silver mica variety. Ceramics are in the same category, generally even better, frequently displaying power factor values as low as .02%, if not less.

The general order of paper dielectric tubular, mica dielectric and ceramic dielectric offered for replacement are within the general ratings set by the receiver manufacturers for the original components used in their receivers.

Summary

We realize that all possible items relating to capacitors have not been treated in this series. As it is, and even with these omissions the articles have extended over six issues of SUCCESSFUL SERVICING. We have much more to go in covering the other components used in television receivers.

The facts given herein, when supplemented with information contained in the capacitor manufacturers' catalogues, and when complemented with the information given in the Rider Replacement Part Listings, should be of material aid in the problem of understanding TV receiver capacitor components and replacements.

The statements made in these series of articles represent highlights of the factors which are important relative to this component. We say this to fend off possible misconceptions which may result from the occasional hap-hazard selection and use of a replacement capacitor in a television receiver without noting any undesirable effects. This may lead one to believe that the important points raised here are simply efforts to fill space. This is not so. Many service technicians have been greatly confused by the peculiar behavior of receivers after a capacitor replacement which, to all intents and purposes, should have worked properly because the capacitor was electrically perfect.

We might emphasize to the servicing industry that, as time passes, closer and closer attention will have to be paid to capacitance tolerance and temperature coefficients and that when a service technician takes in a stock of fixed capacitors he will require 10% units as well as 20% units, and in some few instances even 5% units. Fortunately this is not a problem, because an examination of the Rider Replacement Part Listings found in Rider Manuals, discloses the fact that some specific values of capacitors more than others, are of the 10% capacitance tolerance rating. Incidentally, this might be of interest also to the capacitor manufacturers who sell to the parts jobbers, and to the parts jobbers who in turn sell to the servicing industry.

10

10

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Successful Servicing, April, 1953



C-D does it again! **6** capacitor assortments in beautiful plastic cases! Ideal for storing screws, tubes, small parts of all sorts. Even KIT #1 -- UNIVERSAL fishing tackle. And you KIT #2 - FOR RCA SETS pay no more than if KIT #3 - FOR PHILCO SETS KIT #4 - FOR MOTOROLA SETS you bought the capac-KIT #5 - FOR GENERAL ELECTRIC SETS KIT #6 - FOR ADMIRAL SETS itors individually. The majority of sets can be serviced with these six twist-prong electrolytic replacement kits. See your jobber today for full details. Cornell-Dubilier Electric Corp., South Plainfield, New Jersev.

A service of CORNELL-DUBILIER

world's largest maker of capacitors

PLANTS IN 50. PLAINFJELD, N. J. * NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS. * PROVIDENCE, R. J. Indiamapolis, Ind. * Fuguay Springs, N. C. * Subsidiary, Radiart Corp., Cleveland, Onio



A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: Over-all product activity continues to be heavy, with more manufacturers reporting changes for this period. As noted last month, tube, antenna and sound manufacturers continue their dominance of the "change activity" dominance of the "change activity scene, while the steady increase tube prices noted over the last thr months has slackened off slightly. in three

New Items

- AMERICAN MICROPHONE -- Added Model RCS crystal microphone with slide switch at \$8.10
- dealer net. AMERICAN PHENOLIC --- Added new bo-ty and reflector antenna package No. 114-065 at \$4.65 dealer net, containing No. 114-053, bo-ty and No. 114-560, bo-ty reflector, with stacking bar included.
- No. 114-500, bo-ty reflector, with stacking bar included.
 CLEVELAND ELECTRONICS Added Model 88, UHF TV antenna at \$5.97 dealer net.
 CORNELL-DUBILIER Added auto radio replace-ment vibrators; Model 6326 at \$2.76 dealer net . . Model 6330 at \$2.76 dealer net . . Model 6370 at \$2.52 dealer net and Model 5520-4.
 CREST LABS. Added a number of Universal Variable Inductance Kits. Also added a new series of receiver replacement output transformers.
 FRETCO Added Bo-Ti UHF antennas; Model Bo-Ti at \$2.70 dealer net . . Model Bo-Ti reflector at \$4.35 dealer net. GENERAL ELECTRIC Added GL-6130, a hy-drogen thyroton especially designed for pulsing

- EIVERAL ELECTRIC Added GL-6130, a hy-drogen thyroton especially designed for pulsing applications which require a tube that will give dependable operation at high altitudes under stringent operating conditions at \$18.00 dealer net and TV picture tube 21ZP4A at \$38.50 dealer net. HARVEY-WELLS ELECTRONICS -
- Added Band-
- master VFO at \$47.50 dealer net. HYTRON Added point-contact transistors No. PT-2A at \$17.40 dealer net and No. PT-2S at
- ATTRON Added point-contact transistors No.
 PT-2A at \$17.40 dealer net and No. PT-2S at \$17.40 dealer net. Also added receiving tubes 12X4 at \$1.55 list . . . 12AQ5 at \$2.00 list . . . 12V6GT at \$2.00 list and germanium diode 1N133 at \$1.20 dealer net.
 ILLINOIS RESEARCH LABS Added Silencer, gallon size at \$44.50 dealer net.
 MALLORY & CO., P. R. Added new 12 volt replacement vibrator, Model G-874 at \$3.30 dealer net.
 MALLORY & CO., P. R. Added new 12 volt replacement vibrator, Model G-874 at \$3.30 dealer net. Also added Model GSAC4, battery charger with selenium rectifier at \$10.00 dealer net . . . Model 12SAC5, battery charger with selenium rectifier at \$1.30 dealer net. . . Model R-670, output cable at \$1.30 dealer net. and Model 675, output cable at \$1.49 dealer net.
 MARKEL ELECTRIC PRODUCTS Added No. A-7180 at \$9.98 dealer net and No. A-7181 at \$9.98 dealer net, cartridges No. A-7157 and No. A-7158.)
- NATIONAL ELECTRONICS Added full-wave rectififer, Model NL-606 at \$16.63 dealer net and ignitron, Model NL-1005 at \$80.50 dealer

- net. PERMOFLUX Added outdoor theater speakers Model 4C-DI at \$2.73 dealer net and Model 52C-DI at \$2.91 dealer net. PREMAX PRODUCTS Aluminum ground wire No. AW-810 at \$1.62 dealer net . . . No. AW-825 at \$3.60 dealer net and No. AW-850 at \$7.20 dealer net have been added to their line. QUAM-NICHOLS Added Model QF-3, focalizer unit at \$3.57 dealer net and Model IT-4, ion trap at \$.60 dealer net. RCA Added No. 76323, saphire at \$.90 dealer net. Also added Volume VII to their Service Data series at \$5.00 dealer net. RADIO RECEPTOR CO. Added a number of new germanium diodes.
- new germanium diodes. REEVES SOUNDCRAFT Added a number of
- REEVES SOUNDCRAFT Added a number of new tape recording accessories. RIDER, JOHN F. Added No. 143-2, TV Manu-facturers' Receiver Trouble Cures, Volume 2 at \$1.80 dealer net . . No. 145, TV Sweep Alignment Techniques at \$2.10 dealer net and

- No. 2011, Rider Television Manual, Volume 11 at \$24.00 dealer net (available in April). SCALA RADIO Introduced Model BZ-4, volt-age doubler probe at \$10.75 dealer net. SCOTT INC., HERMAN Added Model 214-AB at \$196.75 dealer net and Model 214-XB at \$196.75 dealer net and Model 214-XB at \$29.95 dealer net, both remote control amplifiers and Model 120-AB, equalizer pre-amplifier at \$79.25 dealer net. SPRAGUE PRODUCTS Added a number of rwist-lok electrolytic capacitors. STANCOR Added new ultra-miniature transistor transformers; No. UM-110, interstage at \$7.35 dealer net . . No. UM-111, output or match-ing at \$9.00 dealer net . . No. UM-112, high imp. mic. input at \$8.25 dealer net . . No. UM-113, interstage at \$6.60 dealer net and No. UM-114, output or matching at \$9.00 dealer net. SYLVANIA Added 21" TV picture tubes; 21-WP4 at \$39.00 dealer net . . . 21XP4 at \$40.50 dealer net . . . 21YP4 at \$41.50 dealer net and 21ZP4 at \$40.00 dealer net. Also radio receiving tube 6CS6 at \$1.90 list. TRIPLETT ELECTRICAL CO. Added Model 420, volume unit meter at \$16.50 dealer net and Model 420 (illuminated) at \$18.00 dealer net.
- net. TURNER CO. Added Model 9R, microphone at \$14.10 dealer net . . . Model SR9R, mic-rophone at \$16.80 dealer net and Model C-4, stand at \$3.45 dealer net. WHARFEDALE SPEAKERS Added Model HS/
- CR/3, 3 way crossover network at \$31.00 net.

Discontinued Items

- ASTATIC CORP. Discontinued Models AT-1B, BT-1 and BT-2 all TV and FM radio boosters. ELECTRONIC MEASUREMENT Discontinued Model 300, vacuum tube volt-ohm-capacity meter and Model 300P, same meter with portable case
- and Model 300P, same meter with portable case and cover.
 GENERAL ELECTRIC Discontinued Model RPX-051, triple play variable reluctance cartridge . . . Model RPX-042, single variable reluctance cartridge and Model SPX-001, phono preamplifier.
 INTERNATIONAL RESISTANCE Discontinued replacement control QJ-375.
 RAYTHEON Discontinued TV picture tubes 3KP4 and 12LP4.
 SIMPSON MFG. CO. Discontinued a number of items including driver pre-amplifiers; Models DR-5, DR-5M, DR-5MP and DR-5P.
 SYLVANIA Discontinued radio receiving tubes 1S6 . . 1W5 and 1X2.
 TRIPLETT ELECTRICAL CO. Discontinued Mo-del 466, electrodynamometer.

- del 466, electrodynamometer. VIBRALOC Discontinued their "W" series con-taining sloping wall type baffle . . . grill plate and reducers. WIRT PRODUCTS Model S-924. auto radio
- iginition suppressor, snap-on plug type, discontinued.

Price Decreases

- CLEVELAND ELECTRONICS --- Decreased price on Model T-WA, lightning arrester to \$.90 dealer net.
- CONTINENTAL CARBON Model NF-1/2, metal film resistor, decreased to \$.48 dealer net. CORNELL-DUBILIER — Decreased price on a
- number of auto generator capacitors. DUMONT LABS. Decreased price rube 16K/RP4 to \$28.00 dealer net. - Decreased price on teletron
- tube 16K/RP4 to \$28.00 dealer net. GENERAL ELECTRIC Decreased price on in-dustrial and transmitting type tubes GL-5670 to \$5.25 dealer net and GL-5844 to \$2.25 dealer net. Also decreased TV picture tube 21ZP4A to \$38.50 dealer net. GONSET Decreased price on rocket antennas; Model 1511 to \$18.27 dealer net and Model 1510 to \$8.55 dealer net. RCA Decreased price on batteries; No. VS216 to \$2.30 dealer net and VS236 to \$.21 dealer net.

- SYLVANIA Sub-mir to \$9.80 dealer net. Sub-miniature tube 5719 decreased

Price Increases

- ALPHA WIRE Increased prices on numbers 286, 289, 292, 295 and 296, tinned copper bus-bar wire. GENERAL ELECTRIC -
- Increased price on TV
- GENERAL ELECTRIC Increased price on TV picture tube 17CP4 to \$26,15 dealer net. Also increased price on Model RKP-009, replacement parts kit for triple play cartridges (less stylus assemblies) to \$.19 dealer net. GONSET Model 3026, 2 meter transmitter receiver increased to \$199.50 dealer net. Also increased price on Model 1508, rocket antenna to \$5.67 dealer net and Model 1512, rocket antenna to \$5.07 dealer net. HYTRON Increased price on radio receiving tubes 12A4 ro \$2.40 liter 1286 ro \$2.40
- TRON Increased price on radio receiving rubes 12A4 to \$2.40 list . . . 12B4 to \$2.40 list . . . 6BY5G to \$2.90 list and germanium diode 1N51 to \$.54 dealer net.

Correction

GONSET — Only the 1521 model radarray has been discontinued—not the complete series as was published in error.

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TV TROUBLESHOOTING AND REPAIR GUIDE BOOK. R. G. Middleton. Finest practical book to make TV. servicing easy. Spot your TV receiver troubles fast! 204 (8½ x 11") pp...... \$3.90 TELEVISION-HOW IT WORKS, Rider Editorial Staff. Discusses all sections of TV receivers. Excellent introduction to TV servicing, 203 (81/2 x 11") pp. illus.\$2.70

ENCYCLOPEDIA ON CATHODE-RAY OSCILLOSCOPES AND THEIR USES, by Rider & Uslan. Most complete 'scope book! Cloth cover. 992 (8½ x 11") pp., 3,000 illus.\$9.00

TV INSTALLATION TECHNIQUES, by Marshall. "Howto-do-it" book on antennas, receiver adjustment, municipal laws on installing, etc. 336 (51/2 x 81/2") pp., 270 illus.\$4.50

UNDERSTANDING VECTORS AND PHASE IN RADIO. by Rider & Uslan. A shorthand method to easier understanding of radio theory. Cloth cover. 160 (5½ x 8½") pp., illus.\$1.89

TV AND OTHER RECEIVING ANTENNAS (Theory & Practice), by Bailey. All details on more than 50 latest type receiving antennas. Cloth cover. 606 (51/2 x 81/2") pp., illus.\$6.90 UHF PRACTICES AND PRINCIPLES, by Lytel. Complete discussion about theory and applications of ultra high frequencies, Cloth cover. 390

(5½ x 8½") pp., illus.\$6.60 TV MASTER ANTENNA SYSTEMS, by Kamen & Dorf.

A practical working manual on master antennas; problems and solutions. Cloth cover. 356 (51/2 x 8½") pp., 270 illus.\$5.00

VACUUM-TUBE VOLTMETERS, by Rider. Revised. Theory, application, operation, probes, calibra-tion, testing, etc. Cloth cover. 432 (51/2 x 81/2")

pp., illus.\$4.50 FM TRANSMISSION AND RECEPTION, by Rider & Uslan. 2nd edition covers FM from start to finish,

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Model	Manual F	age	Tek-File
No.	From	To	Pack
Gamble-Skogmo 05TV1-43-9014A, 15RA2-43-9105A	6-1	6-16	3
Ch. 16AY210 Magnavox Ch. CT=275, -276	7-14	7-28	30 30
-280, -281, -282 Sylvania	8-64	8-82	13
1110X, Ch. 1-329 Sylvania 71M 72M 73B	8-140	8-153	13
73M, Ch. 1-366(C08	۶) ,		

Presenting Federal's TV-1185 ... "PIPELINE" of the air!

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OUTSTANDING FEATURES OF FEDERAL'S TV-1185

- Exceptionally low loss
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- Leads in Weatherometer tests
- Flexible in low temperatures
- Rejects ultra-violet rays at higher temperature levels
- Top performer in any area
- Attenuation- db/100 ft. 10 mc = 0.50 400 mc = 2

10 mc-	0.50	400	mc—	2.0
50 '' 🛶	0.95	500	"	3.0
100 " -	1.11	1000	"-	4.6
200 " —	1.7			

• SO EASY TO INSTALL: Expose required length of wire

by stripping off polyethylene. To tight-seal, heat end of tube with match or other flame and crimp together with pliers. Sealing assures quality performance under all atmospheric conditions.

Setting Up For TV Service (Continued from page 26)

ger of running out of an item before it can be ordered can be minimized by keeping a "want book". Anyone drawing parts should be required to note in this book if the stock of that particular item is low. This, of course, poses a problem of what is "low stock". Although it is possible to rely on the judgment of the parts clerk, a more desirable solution is to establish a minimum quantity. This can be posted on the bin or drawer where the part is stored. On small parts, the minimum quantity can be placed in a sealed envelope; when it becomes necessary to open the envelope, parts should be reordered.

What Does it Cost

Determining what maintenance of a good service shop and an adequate parts inventory will cost a dealer in dollars and cents investment is difficult to determine. Most servicemen feel that the dollars and cents figure is relatively unimportant when measured in terms of the return the dealer can expect from his service operation.

In addition, the investment varies with the dealer's location, the size of his shop and the volume of business he handles. Even with all these variables, one must consider also that dealers in the same area with the same business volume may differ in the amount of money they invest. One may feel that the "minimum" investment in equipment and parts is the wisest decision; the second may decide to spend considerably more in setting up his shop.

Du Mont's Schulman estimates the cost of a service shop in these terms (truck not included):

- a. deluxe operation about \$2500 (including \$1000 in parts)
- b. average operation about \$1500 (in cluding \$600 parts)
- c. minimum operation about \$1000 (including \$300 in parts).

Harold Bernstein, service manager for Emerson, uses a different basis in coming up with his estimate. For a one man operation, he says, equipment, tubes, fixtures and basic parts would require about \$2500. For each additional man add about \$125 more for extra tools, meters, tubes and so forth.

No matter whose estimate you accept, establishing a service shop is an expensive move in terms of dollars and cents alone. A decision as to whether the investment will pay off—both tangibly in the form of dollar income from service work and intangibly in the form of a good service reputation which builds additional set sales for the dealers is one that must be made with reference to the dealer's own circumstances.





Some Questions and Answers, etc. (Continued from page 7)

require substantial differences in the constants of the vertical output tube, or that the use of a 20% capacitance tolerance capacitor where a 5% unit is required results in instability and unsatisfactory receiver performance. We do not feel that a service technician should make changes in circuit constants in order to compensate for a replacement part that is not within the required tolerance ratings of the original component. Because we adhere to this philosophy in the listing of replacement parts, the service technician can have the greatest faith in the replacement parts which are shown in Rider Lists. It explains why our listings of suitable replacement parts show fewer parts than other listings.

Q—If you exercise care when selecting replacement parts for listing, why do you have to publish change notices?

A—For several reasons. Regardless of the extreme care which is used in checking, typographical errors in parts number listings occur. Remember that we are listing thousands upon thousands of numbers, and transpositions are possible. We try to keep the errors to the absolute minimum, but they occur.

A second reason is the changes which are made in receivers at the manufacturing point. If one part was a replacement and a change was made calling for a new replacement part, it is foolish to continue reprinting the original replacement part number—the new one with the changed part is the correct one.

We publish additions to the list because some of the replacement data arrives too late for inclusion in the printed list, and because the parts manufacturers we work with are

200

adding new replacement parts to their line.

Q-Your replacement parts lists show only the set manufacturers' parts numbers, but not the receiver chassis in which they are used. Why?

A—This was so only in the Rider TV 10 Manual listing. In the new replacement parts listings for TV 11, which will be cumulative for TV 10 and TV 11; the parts numbers are related to the chassis in which they are used. A section of the replacement parts list for Emerson is shown herein as an example of our new listing format.

Q-Why don't you have replacement parts listing for Rider's TV 9 and earlier manuals? A-Because we started the replacement part listing program with TV 10. However, we now are in the process of preparing data on TV 9 and earlier Rider TV Manual contents. The task of preparing the data is prodigious; we must prepare information specification sheets for the parts manufacturers, and before we do this it is necessary to correlate the contents of the receivers made during all the production runs. It will take time to do this, but it will be done. Such replacement parts guides will be available to service technicians sometime in the near future.

Fig. 2. Below: Type of spec. sheet on which the part's manufacturer lists his replacement suggestion.



VARIABLE	RESISTANCE	CONTROLS	

COMPONENT TYPE and PART NUMBER	14	-	153.0	0	1-	10.D	8.19	1	10		REPLACEMENTS															
	MOR	150		8	8			200	168.	1 0	LAROST	AT	IRC							MALLORY						
	1.	120	120	27	120	120	120	150	120	Cat. No.	inner Shaft	Switch No.	Stock No.	Kit. No.	Panel Elem,	Rear Elem.	Outer Shaft	Inner Shaft	Switch No.	Stock No.	Kit. No.	Panel Elem.	Rear Elem.	Outer Shaft	inner Shaft	Switch No.
390142	X	X	X	2	(T			AG-83-9	FK8-1/4	4	Q11-139	-			-			SU56				-		-
390143	X	X	X	>	1	-	-	-		A43-5000	FKS-1/4	4	W-5000	1		1				R5000L					-	
390156				-				X	-	AG-61-8	K88-5	1	Q11-137							U-54	-			-	09-16	-
390163	X	X	X	2	4	-	-	-	-	AG-61-8	K88-3		Q11-137							U-54				1	24.00	
390164	X	X	X	2	4	-	-	-	-	AG-44-8	K89-3		Q11-123		T				3	U-35				1		
390181	+		-	+	X	1 2	-	X		AG-52-8	K99-5		Q11-129							U-43					DS-36	
390183	-	-	-	-	X		-	X	-	AG-44-8	K89-3		Q11-123							U-35					DS-36	
390184	X	X	-		4	-	-		-	RTV-296			QJ-313	K-2	B17-110	B13-137	P1-224	R1-308	76-1	1.1.1		UF152R	UR16A			US-26
390187	-	-	X	-	-	+	-	-	-	RTV-362			QJ-237	K-2	B17-110	B13-137X	P1-224	R1-308	78-1			UF152L	UR16T25			
390191	X	X	X	2	4	+	-	+	+	AG-52-9	R8-2	_	Q11-129	-	-		-			U-43						
390196	-	-	-		X		X	X	X	AG-83-9	FK8-1/4	4	Q11-139	-				-		SU56						
390197	-	-	-	-	X	X	X	X	X	A43-5000	FK8-1/4	4	W-5000	-				-	1000	SU14						
390201	-	-	-	-	X	X		X	+	RTV-296			QJ-313	K-2	B17-110	B13-137	P1-224	R1-308	76-1		_	UF152L	URIGA			US-26
390202	-	-		1 7	X	1 X	X	X	X	AG-83-8	FK8-1/4	SWB	Q11-139						76-1	U-56	_					US-26
390207	+		-	-	-	-	X	+	X	RTV-378		+ +	QJ-410	K-2	B17-109	B13-137	P2-116	R1-202	76-1			UF152L	URIGA			US-26
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recent and more exact meter movements being used in ordinary service-type VOM's have a somewhat closer tolerance than the 2-percent figure just mentioned.

The 5-percent accuracy usually specified for the a-c ranges also represents the maximum tolerable error at any point on the a-c scale. Of this figure, about 2-percent error may be the result of meter movement tolerances and 1-percent error may be the result of resistor tolerances. The remaining error is caused by variation in a-c rectifier characteristics.

D-C Current Ranges

The d-c current ranges of a representative VOM were checked up to a value of about 500 ma. The test set-up for low currents is shown in Fig. 1A, while the set-up for high currents is shown in part B of the figure. In both cases, a standard laboratory-type millia-

Checking the Accuracy of a Volt-ohm Milliammeter

large number of service technicians put a great deal of faith in the readings they obtain daily on their volt-ohmmilliammeters. These readings, when compared with normal values of voltage, resistance, and current given in receiver service notes or obtained from a study of the schematic diagrams of the sets, often locate faults or serve as a basis for further troubleshooting. The question may arise, however, as to just how accurate are the readings obtained on a service-type volt-ohm-milliammeter (VOM). To help answer this question, we put a typical VOM through its paces. This article will describe the tests performed and will show the results obtained.

Nominal Accuracy

The nominal accuracy given by most of the manufacturers of service-type VOM's is usually 3 percent on the d-c ranges and 5 percent on the a-c ranges. These figures are percentages of the full-scale deflection of the meter. An accuracy of 3 percent on the 100volt range, for example, indicates that the meter reading will be within 3 volts of the true voltage reading at any point on the scale. Assume for a minute, using this basis for rating, that a certain meter has a constant error of -3 percent over its entire 100-volt range. Then, at 100 volts applied, the meter reading will be 97 volts; at 50 volts applied, the meter reading will be 47 volts; at 10 volts applied, the meter reading will be 7 volts; and so on.

Suppose we stop to consider just what the error is at these points expressed as a percentage of the actual voltage being measured. At 100 volts, the error of 3 volts amounts to 3 percent (of 100 volts); at 50 volts, the error of 3 volts amounts to 6 percent (of 50 volts); and at 10 volts, the 3-volt error amounts to 30 percent (of 10 volts). Since the meter pointer is displaced from the true voltage reading by the same amount at these three

by Milton S. Snitzer

values (even though the percentages just calculated increase at lower voltages), it is customary to describe this meter's error by a constant percentage. This can be done if the error is given as a percentage of the full-scale reading. In this case, the meter would be said to have a constant 3-percent error. meter with an accuracy of 1/4 percent of full scale was inserted into the circuit in series with the VOM (switched to its d-c current ranges). Two 20,000-ohm power resistors, with 10 fixed taps on each, served as currentlimiting and current-regulating resistances. D-c voltages for the circuits were obtained from

(A)

(B)

YYYYYYYY - YYYY



The 3-percent accuracy usually specified for the d-c ranges of service-type VOM's represents the maximum tolerable error at any point on the d-c scale. In practice, the meter error is usually less than this amount and is *not* constant over the entire scale. In addition, the meter may read high (positive error) at some points on the scale or low (negative error) at other points. Of the 3 percent maximum possible error, a maximum of 2 percent may be caused by the meter movement itself and a maximum of 1 percent may be caused by series and shunt resistor tolerances. More

four 1½ volt dry cells in A or from the 0-500 volt d-c power supply in B. Input to the latter was regulated by means of a Variac; the output contained a variable voltage-divider resistor. With these set-ups, a wide range of currents was obtained, and it was only necessary to compare the current readings indicated on the VOM with those obtained on the laboratory-standard milliameter.

VOM

All d-c current ranges up to 500 ma were checked and the results were plotted on a graph. This graph showed the amounts by (continued on page 9)

Successful Servicing, May, 1953



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TVL
Mismatched Television Components Part 1 - The Vertical Output Transformer

This is the first in a series of articles on Mismatched TV Components.

Frequently a variety of conditions and circumstances relating to TV replacement parts set up a situation which requires very serious deliberation by the service technician. This is especially true where sweep components are concerned. Let's look into the matter of vertical output transformers. Some of the details will be presented in this issue of SUC-CESSFUL SERVICING and more will follow in subsequent issues.



The fundamental purpose of this transformer is to couple the vertical deflection windings to the vertical output tube. A typical circuit is shown in Fig. 1. More rigorously stated, the output transformer matches the impedance of the vertical deflection winding to the plate impedance of the output tube. This is a requirement because the impedance of the deflection winding is very much less than that of the output tube's plate circuit.

When the impedance conditions in the vertical output system are correct, a linear vertical deflection is obtained. In addition, the output tube is operating within its rated plate current limits. The necessary latitude in variation of all the preset controls tied to the vertical output system is available and the signal voltage amplitudes required for the full vertical deflection prevail.

Output Transformer Ratings

Although the design of the vertical output transformer, since it is a pulse transformer, is somewhat elaborate, the description necessary for the determination of what is a suitable replacement is relatively simple. Since the transformer is supposed to present a rated value of primary impedance with a fixed amount of direct current flowing through the primary winding, this constant can be stated by simple numbers. Since it is supposed to provide a specific step-down turns ratio bedo not necessarily indicate its complete suitability as a replacement. The reason for this is the absence of the required plate load impedance information for the vertical output tube in service data. So, a change in transformer description is warranted. The turns ratio rating remains, but instead of quoting the required primary impedance of the transformer, the device is referred to specific tube type number(s) of the output

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tube with which it can be used. By and large, a description of this type is not unsatisfactory for this reason: while all vertical output tubes of like type number are not necessarily operated under exactly the same voltage and current conditions they are not too far apart. However, similar type tubes are frequently used with vertical deflection windings of unlike inductance, therefore impedance. This means that, while the impedance ratings of the primary of the transformer may be alike in a variety of receivers, the turns ratio ratings of the transformers will differ: that is, if different vertical deflection windings are used.

How does this turns-ratio rating of the transformer modify the selection of the replacement part? Much more so than might seem to be the case upon a casual evaluation of the figures involved. The following tests, while not the full range of experimental verifications which are being carried on, will illustrate the point satisfactorily.

A Case of Mismatch

The standard of comparison in one series of TV receiver tests is a transformer rated at a primary impedance of 19,000 ohms with 15 ma of direct current in the primary and a 13:1 turns ratio. A 10:1 vertical output transformer with the same primary impedance rating was then substituted in the perfectly operating receiver in place of the original transformer of 13:1 turns ratio. Before any preset control adjustments were made the following were observable on the picture: the linearity was bad, with the top of the picture compressed severely and the bottom spread vertically. Overall picture height was appreciably smaller. This is shown in Fig. 2. The plate current in the vertical output tube rose to 16 ma instead of the original 15 ma. The operating plate voltage dropped from 300 volts to 285 volts d.c.

The various controls associated with the vertical output system were then adjusted for the best possible picture. This required a compromise between these adjustments, ending up with the vertical linearity control adjusted to maximum and the height control reduced. This sequence of adjustment resulted in a marked downward shift of the picture, with the result that the top of the picture tube screen was blank, while a considerable portion of the bottom of the raster was driven out of view. Fortunately, this receiver had a vertical centering control that provided a broad enough range of compensation to correct this condition. When the picture was recentered, a bright horizontal bar, indicating foldover, became evident

(continued on page 24)



by Sidney C. Silver

tween the primary and secondary windings, this too can be stated by simple numbers. For example, a description might be "primary impedance is 19,000 ohms at 15 ma d.c. and 13:1 turns ratio". Given any one set of constants for the transformer, the vertical output tube sees the required high impedance when it looks into the vertical winding, and the yoke winding sees the required low impedance when it looks into the plate circuit of the output tube.

These two ratings are, therefore, sufficient to describe a vertical output transformer, but

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Some TV service facilities have offered the public sales approaches which just cannot be lived up to—and still stay in business. Under the circufistances the only reasonable conclusion one can draw from these ads is that it is *bait advertising*. Beginning with April 14th, it can no longer be done in the Commonwealth of Massachusetts.

A new law, was signed by the Governor of that state, on the date mentioned above. It imposes a \$500 fine on any person, firm,

or corporation found guilty of advertising merchandise or service for sale as part of a plan or scheme with the intent not to sell said merchandise or commodity of service, or with the intent not to sell at the advertised price.

A law of this kind cannot be criticized, except by those whose operations are in conflict with it. While we do not believe in the idea of setting up new laws to take care of everything that happens in daily life, a regulation of this kind could well be on the statutes of every state. If it exists, but never has been put to use, the time has come to do so.

For what it may be worth, the Better Business Bureau declares bait advertising to be "an alluring offer to sell something which the advertiser does not actually intend to sell or deliberately avoids selling. Its purpose is to get the customer into the store, or a salesman into the home so as then to sell something else instead, usually at a higher price, or on a basis more advantageous to the advertiser." There are many examples of this in TV service sales offers.

Every state should have a law against bait advertising. Service facilities interested in combating this type of advertising might do well to get their state legislators to enact a similar bill. A law like the above is better than licensing! While on the subject of licensing radio and TV service technicians, it never ceases rearing its ugly head. We have not stopped analyzing the subject for more than 15 years. No matter how we look at it, it just is no good. If it would cure one evil it would create five others that are much worse. We have no axe to grind when we say that it will always be to the best interests of the servicing industry if they never cease their fight against licensing of the service technician.

Orchids to Raytheon

Raytheon TV and Radio Corp. has put on a series of UHF lectures to the public via several UHF television stations. The response has been tremendous. The talk, illustrated with slides and pictures of various kinds, attempts to get across to the public the idea that the station expends a substantial amount of money in the effort to put a program on the air, and that to receive the picture and sound properly, the receiving installation must be properly made.

Commercialism is made conspicuous by its absence. It is as much a public service as a program can be made. The sponsor's name is mentioned just twice—at the beginning and at the end of the program. From what we can gather, it is a sustaining program; hence the cost consists mainly in supplying the necessary talent and the displays. The lecture lasts about 30 minutes and Raytheon experienced no difficulty in getting time from a number of UHF stations. They have shown over stations in Atlantic City, Wilkes Barre, Reading, Youngstown, and are planning others.

They carry the viewer through various stages of receiver performance, involving such details as noise interference and good picture quality. The theme is that qualified technicians are required to make the installation, and unless it is done properly, all the effort made by the station to put a good program on the air is wasted, as is the knowledge and ingenuity of the TV receiver manufacturer.

Anything that can be done to bring the TV service technician to the attention of the public is worthwhile, as is everything which will aid the public in understanding not only the need for good UHF installations, but that it isn't just one of those casual things which involves no know-how. Congrats to Raytheon . . . Let's hope that other receiver manufacturers do likewise.

Picture Tube Implosions

It is said that familiarity breeds contempt. This certainly applies to the handling of picture tubes. Too many service technicians are prone to handle these tubes with a great deal of disdain, and in so doing are courting trouble — perhaps far more than they can take care of! Great credit is due the picture tube manufacturers for producing tubes which rarely implode. But this is no license for careless handling. The record of picture tube implosions is marvelous, but it is not perfect.

Personnel in factories are always cautioned and frequently penalized for not exercising the necessary care. But there is no one to remind the TV service shop owner or his service technician that one must always be on guard against implosions when handling these tubes. We have seen more than one technician grasp the tube by the neck and virtually heave it onto the back seat of an automobile, or even let it fall onto a bench.

One incident can be enough to maim someone for life. Why take the chance when it can be avoided. There is always the first time for everything — and usually when it is least expected. Wear gloves and protective glasses when handling picture tubes!

Knowledge is Power

One of the oldest phrases used in the field of education is "knowledge is power". Knowledge rather than luck or guesswork is behind the rise of civilization. From the highest to the lowest levels of human effort, knowledge has made things easier for the individual. The TV servicing industry is no exception. The more the technician knows the easier is his job . . . Even if you, as a technician, are interested in the practical details concerning receivers — get all the fact — not just some... There is only one place where you will find it — Rider Manuals—Tek-Files and Rider published text books . . . They are written to give you power through knowledge.

John F. Rider

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Successful Servicing, May, 1953

Video Amplifier Response Jesting

The following material is excerpted from Chapter 10 of the brand new Rider publication TV SWEEP ALIGN-MENT TECHNIQUES.

The broad response characteristics of video amplifiers generally exceed the range of service shop test facilities. Because of this, it becomes necessary to divide video response testing into two categories, namely, low frequency response and high frequency response. The low frequency response can be checked with square wave technique and the high frequency response, with a video sweep curve. square wave is, however, folded back on itself producing a block formation. By changing the scope timing to employ 60 cycle sawtooth deflection, the square wave can be unfolded and presented in conventional fashion as in Fig. 2A. Further change in scope timing to a 30 cycle sawtooth deflection produces the more desirable exhibit of two complete cycles of the 60 cycle square waveform. This is pictured in Fig. 2B.

When observing this waveform at the grid of the first video stage, it is advisable to check for overloading by applying a d-c vacuum tube



Although square wave generators are commonly available in receiver design laboratories, these instruments are rarely found in service shops, so it is impractical to assume that low frequency response testing can be done in the service shop with a square wave generator. An alternate source for an adequate low frequency signal is, however, to be found in the use of a rectified sweep signal.

The curve produced as the result of rectification of a sweep signal at the second detector and shown in Fig. 1A, is generally representative of frequencies in the lower portion of a 0 to 5 megacycle video spectrum.

Basically, this detector output curve is established by 60 cycle horizontal deflection of the cathode ray beam. The forward sweep through the curve consumes half of the cycle time and the return trace across the base line accounts for the other half.

By reducing the sweep width, the curve in Fig. 1A can be enlarged to a degree where the start and finish of the sweep range covers only a small portion of the original response range, as exhibited in Fig. 1B and C.

Fig. 1D shows how minimum sweep width includes only a very small part of the flattop of the original demodulated curve. Inasmuch as both ends of the sweep traces in Fig. 1D suddenly change between base line and maximum curve amplitude and both flattop and base line traces are parallel, the essential ingredients of a 60 cycle square wave are present in this segment jof the sweep curve. The Fig. 2. Using the sweep generator developed square wave to check the low frequency response of a video amplifier.

Fig. 1. Developing the

essential ingredients of a square wave from a small portion of a sweep curve. in an improvement and in restoration of the kind of waveform pictured in Fig. 2C,

As a short cut to low frequency video response testing, the flattop portion of a sweep curve may be used directly. Observations of the amount of tilt introduced by changing from video input to video output will serve as a test which simulates that performed by the flat part of a square wave. Fig. 3A, made from a signal at the video input grid can thus be compared favorably with Fig. 3B, made from the same input signal at the video output.

After completing the foregoing test for low frequency response, the scope probe can be returned to the second detector output connection for high frequency response checking. The regular sweep curve is again reproduced from either an i-f or an r-f applied sweep signal. This is followed, in Fig. 4A, by the addition of a picture carrier marker from a closely coupled marker generator.

Increasing the strength of the marker signal causes an extension of the tapered beat frequency pattern on both sides of the carrier zero beat location, as exhibited in Fig. 4B. A further increase in the marker signal level produces a strong beat pattern and overloads the i-f amplifier sufficiently to compress the entire curve amplitude as in Fig. 4C. By adding still more marker voltage or by reducing the sweep



voltmeter to the same grid. The sweep input signal should be kept just below the level where negative voltage is noticed, so the stage will not be tested in an overloaded condition. However, when observing a square wave in video output circuits following the last tube, some grid overloading at the input stage may establish a better waveform as a basis for further comparison.

Fig. 2C is indicative of the 60 cycle square waveform to be found at the video amplifier plate. Fig. 2D, taken after advancing the scope probe to the picture tube side of an output coupling capacitor, shows tilt in the waveform.

Due to the diminishing amplitude characteristic of the tilt, it indicates loss of low frequency response. Replacing the coupling capacitor with one of larger value should result input voltage, the original curve trace can be made to disappear completely into the base line. As shown in Fig. 4D the curve is completely replaced by a beat signal which extends to the extreme limit of the i-f pass band, simply because the sweep signal is applied through the i-f amplifier.

The result of impressing both the sweep and the strong marker signal on the second detector is the creation of a video sweep signal covering approximately 5 megacycles. The zero beat point is indicated by the notches both above and below the base line near the left end of the video sweep in Fig. 4D. The right end of the video sweep is limited by the maximum range of the i-f sweep signal, which is in turn controlled by sound trap absorption. Successful Servicing, May, 1953

Using Sweep Alignment Equipment

by Art Liebscher

The exponential type curve along the video sweep range is indicative of the bandpass characteristics of the oscilloscope used for this observation. By substituting a laboratory oscilloscope with a 10 megacycle amplifier response, the video sweep range can be seen in its entirety, as shown in Fig. 5A.



Fig. 3. Checking low frequency response of a video amplifier by noting the amount of flattop tilt.

After observing the video sweep signal with a direct scope connection at the second detector output, a crystal demodulator probe added to the scope cable and applied to the same test point will provide a peak rectified curve, as in Fig. 5B. This curve matches the outline of the video sweep signal of Fig. 5A.

Although, as previously indicated, scopes of moderate response capability can not show all of the video sweep signal, the signal is, nevertheless, present and is therefore responsible for the production of a complete demodulated curve. As an illustration of this typical condition, the demodulated curve in Fig. 6A originated from the video sweep signal portrayed incompletely in Fig. 4D by a service type oscilloscope.

The method explained herein, which is based on heterodyning a sweep signal and a fixed signal at the second detector has a technical advantage over the use of a 0 to 5 megacycle signal applied directly from a sweep generator to the video amplifier input. The advantage lies in the fact that it is not necessary to disturb any of the detector loading or to change any of the normal capacitive conditions surrounding the detector. The resultant video sweep signal thus incorporates the factors affecting the transfer of the signal from i-f to video.

The problem of distortion, constantly present in video curves just as in other sweep curves, can be checked in the usual manner of reducing the input signal to make the curve disappear into the base line and then observing the return of the curve to a level just below that which causes any change in its shape.

This test can be made by control of the marker generator output after the sweep generator has been set at a low enough output to maintain the video sweep signal in a consistently symmetrical form with equal amplitude both above and below the base line.

An RCA 17T153 receiver with a crystal second detector was used for the examples







Fig. 4. Overcoupling a marker generator to create a video sweep signal covering approximately 5 megacycles.

pictured here. It was noted that best results were obtained at less than -4 volts d-c, measured at the first video stage grid.

Adjustment of sweep output voltage made little difference below the -4 volts d-c indication. The video sweep signal level was essentially determined by marker output voltage.

After demodulating the video sweep signal, shown in Fig. 4D, to obtain the video curve in Fig. 6A, the latter should be studied for comparison with the video output curve in Fig. 6B. The actual difference between the video input curve in Fig. 6A and the output curve in Fig. 6B, indicates the change in video response resulting from the influence of the video amplifier circuits. Alteration of peaking coils, resistance loads, and capacitance values, including lead dress, may be employed to correct excessive differences between input and output curves.





Fig. 5. Video sweep range is seen in its entirety on a wide band laboratory oscilloscope in curve A. Curve B shows a peak rectified curve, obtained through a crystal demodulator probe, which matches the outline of curve A.

If it is desired to check frequency points on the video curve, an auxiliary signal generator with a range of .1 to 5 megacycles can be used to furnish a variable marker. The marker output may be loosely coupled to the video amplifier input.



Fig. 6. Probe detected video sweep signal obtained at the input (A) and at the output (B) of the video amplifier.

TV Replacement Parts Series

The continuation of the TV Replacement Parts series of articles will be picked up in June. Space limitations dictated its omission in the May issue.

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Checking the Accuracy of a Volt-ohm Milliammeter





which the VOM readings were higher or lower than the true current (as indicated on the standard meter). Curves of all the current scales were found to be practically identical. Then an average curve was carefully drawn for all the d-c current ranges checked. This average curve is shown in Fig. 2.

It can be seen from this figure that where there is error in the VOM readings, this error is negative; that is, the meter reads low. The maximum error occurred at 4/5 of full scale, at which point the VOM reading was 0.2 ma low on the 10-ma range, 2 ma (or 2µa) low on the 100-ma (or 100-µa) ranges or 10 ma low on the 500-ma range. This represents an error of -2 percent of full scale. Note that, at all other points on the scale, the error was less than this amount. At midscale, for example, the error amounted to less than -1 percent of full scale.

D-C Voltage Ranges

The d-c voltage ranges of the VOM were then checked up to a value of about 500 volts.

Fig. 4. D-C voltage readings of VOM compared with laboratory standard.

DEVIATION RE AI Р 00 z 00 the 0-500 volt power supply, whose input could be regulated with the Variac and whose output could be controlled by means of the two tandem voltage dividers. In this set-up, a laboratory-standard voltmeter, accurate to within 1/4 percent of full scale, was connected in

ADI

Fig. 2. D-C current

readings of VOM com-

pared with laboratory

standard .

shunt with the VOM (now switched to its d-c voltage ranges). The readings obtained on the VOM were then compared with those obtained on the standard meter. Individual curves were then plotted showing the error in the meter reading for the d-c voltage ranges. These curves were almost identical from one range to another. Then an

average curve was carefully constructed showing the extent by which the VOM readings



The same power supplies were used to supply voltages for this test as had been used to check the current ranges (see Fig. 3). Here, however, one of the 20,000-ohm power resistors (with its 10 taps) was used as a voltage divider across the source voltage. By varying the battery connections and the connections to the resistor a great number of test voltages were available to check the low-voltage ranges. The higher voltage ranges were checked on at least a dozen points on each scale by means of

Fig. 5. A-C voltage readings of VOM compared with laboratory standard.





of this amount, while at lower readings, the error diminished still more.

A-C Voltage Ranges

To check the a-c voltage ranges, the same test set-up as was shown in Fig. 3B was employed except that the full-wave rectifier tube was removed from the d-c power supply and the plate and filament transformers used furnished the required high and low a-c voltages. With this arrangement, sine-wave voltages up to almost 1,000 volts were available for checking. A laboratory-standard dynamometer, with an accuracy of 1/2 percent of full scale, furnished the a-c voltage readings against which the VOM (switched to its a-c voltage ranges) was checked.

When the individual curves were plotted showing the VOM readings against the true a-c voltages, it was found that, although the general shapes of the curves were similar, sufficient differences existed so that a single average curve would not tell the whole story. In the case of the d-c ranges, it was possible to draw an average curve that was, at any point, within 1/2 percent (of full scale) of corresponding readings taken on different ranges. The operation of the copper-oxide meter rectifier and the a-c shunts and multipliers made this impossible on the a-c ranges.

It was discovered that the error in readings obtained on the two high a-c ranges was just about identical. Hence, a single average curve was constructed for these two scales (see solid line in Fig. 5). This curve indicated a positive error over most of the scale (the VOM (continued on next page)



Fig. 3. Test set-ups for checking d-c voltage ranges on VOM.



Fig. 6. Test set-up for checking frequency response of VOM.

read high). The greatest extent of this error, which occurred between 1/10 and 2/10 of full scale, amounted to $+1\frac{1}{2}$ percent of the full-deflection reading. The results obtained on the two low a-c ranges were quite similar to each other, so that a single average curve (shown dashed in Fig. 5) could be plotted for these ranges. Here, the VOM read low over most of the range, reaching its maximum error at 4/5 of full scale. At this point, the reading on the 10-volt scale, for example, was 0.3 volt too low. This amounted to an error of -3 percent of full scale. The curve for the intermediate a-c voltage range, which is not shown in the figure, lies about midway between the curves that are drawn.

ings begin to fall off. These reduced readings, which are quite normal for this type of a-c meter, are due to the shunt capacitance of the copper-oxide rectifier, the increased impedence of the meter itself to higher-frequency ripple currents delivered by the rectifier, and the increased resistance of the multiplier resistors. The response curves show that the a-c reading is down 10 percent of the actual input voltage at a little above 20 kc. At about 60 kc, the meter reading is down 30 percent (3 db) from the 1-volt level; at about 90 kc, the reading is down 30 percent (3 db) from the 10-volt input level. The reading is reduced to one-half (6 db down) of the 1-volt input at about 100 kc, and of the 10-volt input at about 150 kc.

Note: All the a-c measurements described above were made with sine-wave input voltages. Other waveshapes would have resulted in a greater error in reading.

Resistance Ranges

To check the resistance ranges of the voltohm-milliammeter, it was only necessary to use the meter to read the values of highly accurate resistors. These resistors were installed in precision decade-resistance boxes which supplied resistances ranging from 1 ohm to 10 megohms to an accuracy of 1/10 percent. Because of the highly nonlinear scales that are used in the resistance ranges, the same type of curve which was used previously (showing the extent of the high or low reading) is not satisfactory. For example,



Fig. 7. Frequency-response curves of VOM at two input voltages.

Before leaving the a-c voltage ranges, it was decided to check the accuracy of the readings obtained over a wide band of frequencies to see the response of the meter and its copper-oxide rectifier. The test set-up used for this purpose appears in Fig. 6. Here the output of a wide-range laboratory audio oscillator, which can be adjusted over a frequency range from 20 cycles to 200 kilocycles, was connected to the VOM. A wide-band oscilloscope and a wide-range a-f voltmeter monitored the output of the oscillator at all times so that its signal could be kept at a constant level. Two frequency runs were taken, one with a constant input voltage of 1 volt and the other at 10 volts. The results of this procedure are shown in the curves of Fig. 7.

These response curves are quite flat from 20 cycles to 10,000 cycles, so that a-c readings taken between these frequencies need not be corrected. Above 10 kc, however, the read-

assume that the meter pointer reads low by about 1/16 inch on the resistance scale over most of the range. At the low end of the scale, 1/16 inch might represent about 0.2 ohm, while at the high end of the scale, this same 1/16-inch displacement might represent 500 ohms. As a result, if a curve were plotted in which the vertical axis showed the amount of high or low reading, such a curve would be highly misleading. This would be true since only a slight meter error could result in an actual reading that is many hundreds (or even thousands) of ohms too high or too low. If the vertical axis on such a graph could show these large values conveniently, it certainly could not show, on the same range, errors of a few tenths of an ohm such as might occur at the low end of the scale.

A much more satisfactory method of showing the results of a resistance check is illustrated by the curve in Fig. 8. This curve represents the average of similarly plotted curves for the individual resistance ranges of the VOM. Points on this graph show the extent of the error in reading expressed as a percentage of the actual resistance at these points. For example, consider the maximum error on the high side (positive error), which occurs at a resistance of 3 (or 300 or 30,000) ohms. This error amounts to about +4 percent of 3 (or 300 or 30,000) ohms. Thus, the VOM reads about 3.12 ohms on the lowest resistance scale when it should be reading exactly 3 ohms. The maximum error on the low side (negative error) occurs at a resistance of 100 (or of 10,-000 or 1,000,000) ohms. This error amounts to about -5 percent of 100 (or of 10,000 or 1,000,000) ohms. Thus, the VOM reads about 95 ohms on the lowest resistance scale when it should be reading exactly 100 ohms.

Although the curve just shown is fairly convenient to use in determining the errors in resistance readings on a VOM, it is not the most common method of giving the accuracy of the resistance scales. Most manufacturers, when they do give a figure for percentage accuracy of resistance measurements, almost always express the error as a certain percentage of a linear scale (or linear arc length). This goes back to the idea of meter accuracy expressed as a percent of full scale and ties in the error obtained on the resistance ranges to the linear d-c scales. If the percentages of resistance error shown in the curve of Fig. 8 are converted into errors on a linear scale, then it would be found that the resistance accuracy is better than 11/2 percent of the linear arc length on any resistance range.

Summary

This article has shown and described the methods used for checking the accuracy of a service-type volt-ohm-milliammeter. This accuracy was found to be within -2 percent of full scale on d-c current, within $-1\frac{1}{2}$ percent of full scale on d-c voltage, and from $+1\frac{1}{2}$ to -3 percent of full scale on a-c voltage. While the detailed step-by-step procedure described above was carried out in its entirety for one instrument, spot checks at various points on the scales of other volt-ohmmilliammeters disclosed that the results obtained are fairly typical.



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170107 170106 1701061	19	7=1 8-31	14808A, Ch. D1000D, Run 1	63	10=25
17C110, 17C111	າດເ	8=21 8-21	14808B, Ch. U1000D, Run 1	63	9=15 10=25
17C112	50	9=1 	17810C, 17810M, 17810MG, Ch.	49	9=53
17C114 17C115	50	9=9 9=1	G900S, P800S, U800S, Run 1 17811-H, Ch. Y800D, Runs 1-3	49 63	9=67 10=12
17C117	50	6=6 6=6	17812, 17813, Ch. L800D, Runs 1-3	40	5
17C120 17T1, 17T2, 17T3	50	9=9 8=21	17814, Ch. F900D, Run 1 17815-H Ch. I BOOD, Build 4 2	63	1=01
17T4, 17T5, 17T8 17T7	50	9=1 0	17816, 17817, Ch. Y800D,	5	9=53
196101	20.00	8=33 8=33	Huns 1-3 17819, Ch. L800D, Runs 1-3	63 49	10=12 9=53
20C150, 20C151	63 62	10=39 10=1	17824, 17825, Ch. L800D, Runs 1-3	10	
20T2, 21C200 24C101	63 62	10=39	17838, Ch. L800D, Runs 1-3 17848, 17849, 17850, Ch.	64	9=53
C18	19	7=13	L800D, Runs 1-3 17860-H, 17861-H, Ch. Y800D.	49	9=53
GENERAL INSTR	UMENT CORP.		Runs 1 - 3 17905, Ch. I.1000S, Bun 1	63	10=12
44, Tuner 45, Electuner	35 31	5=1 6-1	20823, Ch. M900D, Run 1 20823B, Ch. T000D, Run 1	49	10=59 9=37
THE HALLICE	AFTEDC CO		20823C, Ch. R1000D, Run 1	44 64	9=37 10=45
			U800S, Run I	49	9=87
B919120, Ch. C919120, Ch.	49 35	9=17 5=1	20882, Ch. E900D, Runs 1, 2 20990. 20990S. Ch. 1800D	63 19	10=1
D1000D, Ch. D919120. Ch.	63	10=25	20994, Ch. J800D	49	9=25
E800D, Ch. E900D, Ch.	49 49	6=1 9=25	21923, Ch. Q1000D, Run 1 21928, Ch. K1000D, Run 1	64 64	10=45 10=45
F900D, Ch.	63 63	10=1 10=1	21940, Ch. Q1000D, Run 1	64	10=45
1800D, Ch. X800D, Ch.	49 49 40	9=67 9=25	THE HERTNER EL	ECTRIC CO.	
K1000D, Ch. L800D, Ch.	64		L-10	35	5=1
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I	MODEL PÁCK	JACKSON INDUSTRIES, INC.	1400T, Ch. 114G, 116G, 117G, 120G	1700C, 1700T, Ch. 114G, 116G, 117G, 120G 6665	2000C, Ch. 114G, 116G,	11/G, 120G 2000C, 2000CD, 2000CDB, 65 Ch. 120H	3170C, Ch. 114G, 116G, 1170C, 120G	5120C, Ch. 114G, 116G, 117G, 120G	KAYE-HALBERT CORP.	Cambridge, Hideaway 30	Normandy, Windsor 30 014, 024, Ch. 253 6	044, 045, 046, Ch. 253 6 074, 076, 077, Ch. 253 6	231, Ch. 30 231, 232, 233, Ch. 231, 242 30	234, Ch. 231, 242, Hideaway 30 235, Ch. 231, 242, Windsor 30	236, Ch. 231, 242, Normandy 30 337, Ch. 231, 242, Cambridge 30	238, Ch. 231, 242 239, Ch. 231, 242, Hideaway 30	240, Ch. 231, 242, Windsor 30 242, Ch. 30	253, Ch. 424, Ch. 253	714, 724, Ch. 253 6 731, 733, Ch. 231, 242 30	744, 745, Ch. 253 6 777, Ch. 253 6	914, Ch. 253	MACY ASSOCIATES	Dee MACT'S	AR141. Ch. TVG. Artone.	Hyde Park AP : 68. Artone	ARITL, Ch. TVG, Artone, Tvde Park	AR-23TV-1, Artone 7 HP-21B, HP-21M 47-A	HP-11B, HP-11B, HPC-21B, HPC-21B, HPC-22X 47-A 47-A	HPD-21 47-A	MSILS, ATONE, ASULIA, Hyde Park Q-2617, Q-2617-1, Ch.	260-FM, 260-V, Macy Associates, Supremacy 7	Q-2619, Q-2619-1, Q-2620, Q-2620-1, Ch. 260-FM,	260-V, Macy Associates, Supremacy 7	S-20, Ch. 260-FM, 260-V, Macy Associates, Supremacy 7	S-210, S-211, S-212, S-213, Ch. 260-FM, 260-V, Marv Associates. Supremacy 7	TVG, Ch. 7 10C, 15Y, Artone Astoria	Hyde Park 7	Hyde Park 18TR, Artone, Hyde Park 7	17CD, Ch. TVG, Arcone, Hyde Park 17CR. Artone, Hyde Park 7	17CR, 17CRR, Ch. TVG, Artone, Hyde Park 17HDG, Ch. TVG, Artone,
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Ch. V-2173 H-636T17, Ch. V-2175	15	8=4 7-14	H-715K21, H-714K21, H-715K21, Ch. V-2217-2	17	10=11	Walton, H2328R Warton	42
H-637T14, Ch. V-2177	1 5	7=34	H-720K21, H-721K21,	73	10 = 1	Wordsworth, J2043R Wordsworth, H3469E	21 42
H-638K20, Ch. V-2178 H-639T17, Ch. V-2192.	21	1=10	H-124X21, Ch. V-2217-2 H-724T20, H-725T20, Ch.	77	10=11	H-2029R, H 2030E, H-2030R, Ch. 20H20	15
V-2192-1 H-640T17, Ch. V-2175-3,	15	8=14	V - 2220-2 H-730C21, Ch. V-2218-1 H-732C21, H-733C21.	77	10≈1 10=30	H-2041R, Ch. 20H20 H-2052R, H-2053R, Ch. 20H20	15
N -21/2-4	15	8=14 8≑28	Ch. V-2218-1 V-2150-94C, Ch.	77	10=30	H2260E, Сп. 22H20 H2226R, Ch. 22H20, Warton H222RDC Ch. 22H20	42
H-540T17, Ch. V-2192, V-21 V-2192-2, V-2192-3 H-640T173, CL T 2102	192-1, 15	8=14	V-2150-111, Ch. V-2150-136, Ch.	42	6=1 8=18	H2227E, Ch. 22H20, Garland H2227EO, Ch. 22H20, Garland	42
7410- A -417 4214 4 767-98	à	8=14	V-2150-146, Ch. V-2150-176, Ch.	42.	6=33 6=41	H2227R, Ch. 22H20, Walpole H2227RQ, Ch. 22H20	42 42

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6=1 6=1 6=1 6=1 6=1 6=1 6=1

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H2250R, Ch. 22H20, Lowell H2255G, Ch. 22H20, Morley H2255EQ, Ch. 22H20, Morley H2255EQ, Ch. 22H20 H2338E, Ch. 23H22 H2338E, Ch. 23H22 H2338RQ, Ch. 23H22 Ch. 23H22 Ch. 23H22 Ch. 23H22 Ch. 23H22 Ch. 23H22 H2338RQ, Ch. 23H22 H235RQ, Ch. 23H22 H235RQ, Ch. 23H22 H235RQ, Ch. 23H22 H235SEQ, Ch. 23H22 H23

7=1 7=9 6=25 6=25 7=16 7=16 8=4 7=16 7=34

6=1 6=1 6=1

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8=14 7=16 7=16 7=27 8=32 7=36

42

8=14

9=1 9=1

21 21

23H2ZE, 24H20, Fielding
H243TE, Ch. 24H20, Fielding
H243TR, Ch. 24H20, Aldrich
H243TR, Ch. 24H20, Aldrich
H243SR, Ch. 24H20, Aldrich
H244SR, Ch. 24H20, Aldrich
H244TR, Ch. 24H21, Fennyson
H244TR, Ch. 24H21, Byron
H244TR, Ch. 24H21, Byron
H244TR, Ch. 24H21, Byron
H244TR, Ch. 24H21, Byron
H244TR, Ch. 24H20, Hawthorne
H244TR, Ch. 24H20, Klimer
H34TSR, Ch. 24H21, Thackeray
H34TSR, Ch. 24H21, Wordsworth
H34TSR, Ch. 20121, Conrad
H34TSR, Ch. 20121, Wordsworth
H34TSR, Ch. 20122, Cartyle
H34TSR, Ch. 20121, Wordsworth
H34TSR, Ch. 20122, Cartyle
H3204SR, Ch. 2012

9=1 9=1 9=1 9=1

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ZENITH RADIO CORP. PACK

	and CORRECTIONS	V MANUAL 11	p your RIDER'S DEPENDABLE REPLACEMENT PARTS LIST- odate.				Add HVD-1-1000mmf 1KV to Aerovox column.	Add HVD-4-101111 LAV to Aerovox column. Add HVD-4-4700mm 1KV to Aerovox column. Add NPO-5117-566mmf to Aerovox column.	Add NPO-SI-19-120mmf to Aerovox column.	Add HVD-4-56mmf 2KV to Aerovox column. Add HVD-4-39mmf 2KV to Aerovox column.	Add HVD-4-68mmf 2KV to Acrovox column. Add SI-3-150mmf SL 1.5KV to Acrovox column.	Add NPO-CI-2-30mmf to Aerovox column.	Add 29C48 to Sprague column. Add 29C48 to Sprague column.	Add 20DK-T5 to Sprague column. Add MS-336 to Sprague column.			Change TVA 1716 to TC 49 in Mallory column.			Change AG-64-2 to AG-64-Z in Clarostat Cat. No. column. Change B-123 to B11-123 in IRC Rear Elem. column.			Delete Part No. from Vertical Output Transformer section.		Delete A-3037 from Merit column.	Delete 8-8123 from Stancor column. Delete A-102X from Triad column.	Delete A-97X from Triad column. Delete A-104X from Triad column.		Add 4616 to Jensen column and Viking to Remarks column. Add P5-V ST-107 to Jensen column.
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ZENITH

Successful Servicing, May, 1953

Mismatched Television Components

(continued from page 3)

at the bottom of the raster. An idea of what the picture looked like after readjustment appears in Fig. 3.



Fig. 2. Faulty picture-tube pattern produced by the substitution of a 10:1 vertical-output transformer for a 13:1 unit.

Equally important was the rise in plate current to 20 ma and the drop in plate voltage from 300 originally, to 250 volts with the compromise adjustments. As can be seen from these figures, the plate current of the vertical output tube has risen 33 1/3% above its normal value, as has the average value of the primary current through the transformer. It is conceivable that one might consider the picture shown in Fig. 3 as being an acceptable compromise, but let it be said immediately that it is far inferior to what was available with the correctly rated transformer in the receiver. Moreover, the increase in tube plate current is a hidden condition which can reduce the operating life of the tube as well as the transformer. The point being stressed here is that, while a tolerable compromise can be achieved in the appearance of the picture, it is not sufficient to let the matter go at that; it is also important to determine what hidden condi-

tions have been established in related parts of the circuit. It must be remembered that an increase in current drain of this amount can very easily affect the voltage available at the related plate voltage supply bus, and so cause reduced voltages all along the line.

As stated, some compression existed at the top of the picture even after adjustment, and there was definite foldover at the bottom. The transition in the sweep currents in the vertical deflection coil for the three different conditions is shown in Figs. 4,



Fig. 3. Picture tube pattern obtained under same conditions as Fig. 2 after compromise adjustment of controls.

5 and 6. In Fig. 4 is shown the vertical sweep current when the original vertical output transformer was used; in Fig. 5 is shown the change in vertical sweep current when the 10:1 turns-ratio transformer was used and before any adjustments were made on the preset controls in order to improve the picture. (Refer to Fig. 2.) The curvature introduced in the sweep trace is very easy to see. The peak-to-peak amplitude of the sweep voltage across the yoke winding also was substantially less.

When adjustments were made on the preset controls so as to improve the picture,



and that in Fig. 3 resulted, the corresponding sweep current waveform is that shown in Fig. 6. A fair amount of linearity is present in the waveform, but the foldover is evident at the top of the sawtooth. This is the flat portion of the current waveform. The rising part of the waveform still has some curvature, but it is very much less than before the controls were readjusted.

A series of other measurements were made with other vertical output transformers which differed in primary impedance ratings as well as turns ratio. Interestingly enough, the turns ratio rating seemed to be the more important of the two. For instance a 12:1 transformer rated at 15,000 ohms at 18 ma d-c primary impedance, proved to be a much better replacement than the one with a 10:1 turns ratio and 19,000 ohms at 15 ma d-c primary impedance. The results were not ideal but they were substantially less severe in degradation of the picture than when the lower turns ratio unit was used.



Fig. 4. Vertical-sweep current with original vertical output transformer.



Fig. 5. Vertical-sweep current with 10:1 vertical output transformer before adjustments.

Conclusions.

It is to be understood that tests made with a number of components on relatively few receivers cannot be declared as being conclusive without any reservations. However, it is entirely reasonable to say that such tests are productive of information. Interestingly enough, these findings conform with the opinions of people who have been close to the design of television receivers. When stated in general terms, the opinion is that when selecting a replacement for a vertical output transformer the turns-ratio constant should not differ by more than 10% from the rating of the original part.

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(continued on page 33)

Successful Servicing, May, 1953



In compliance with the many requests we have received from our readers, this and future issues of SUCCESSFUL SERVICING will again contain the feature, TV PRODUCTION CHANGES.

The Rider Manual pages and TEK-FILE pack which include the original data and schematics to which the following production changes apply, appear in the index on page 36 of this issue.

RCA

CHASSIS KCS66 series MODELS 17T150, -1, -3, -4, -5, 17T160, -2, -3, 17T172, -K, 17T173, -K, 17T174, -K

In some KCS66 series Chassis, the 1B3GT (V119) socket, terminal 5, has been used as a tie point. Some brands of tubes have an intermal jumper in the tube base between pins 5 and 7, however, and will not operate in the KCS66 series Chassis wired in the above manner. To avoid this difficulty the serviceman may employ any of the three following solutions:

1. Use a brand of tube which does not have a jumper between pins 5 and 7.

2. Rewire the 1B3GT tube stocket so that terminal 4 is used as the tie point instead of terminal 5.

3. If the tube has a jumper between pins 5 and 7, clip pin 5 off the tube base.

JACKSON INDUSTRIES

CHASSIS 114G. 117G, 120G

The part No. for C34 (located in the sound i-f circuit) is incorrectly shown in the original service infromation. The part No. should be CPZ06102M.

STROMBERG-CARLSON MODEL TC19 Resistor wattage change.

In the R152 position (located schematically near the power rectifier and focus control) the 1,000-ohm, 10-watt resistor (part No. 149216) has been changed to a 1000 char

149216) has been changed to a 1,000-ohm, 20-watt value (part No. 149367) to accommodate the required dissipation.

RADIO AND TELEVISION INC.

MODEL 3219B Model 3219B, "The Georgian," is a new model resembling Models 1116 and C-6161. The new model differs from the previous models using the same chassis in that it uses a 20-inch picture tube, has a built-in color jack, and is designed for uhf conversion.

Complete service information on Models 1116 and C-6161 applies in almost every case to Model 3219B. This service data will be found in TV Manual, Volume 6, pages 1-10.

STROMBERG-CARLSON MODEL 24 series Capacitor revision.

The voltage rating of the C-215 (part No. 110724) $.1\mu f$ paper capacitor in the retrace suppression circuit, has been increased from 400 volts to 600 volts (new part No. is 110743). All subject receivers date coded 51-31 and later include this change and it is recommended that the higher voltage rating capacitor be used for field replacement.

STEWART-WARNER MODELS 9126-A, -B Service data correction.

The r-f tuner for the 9126 series has been erroneously identified as part No. 520247. The correct tuner number is 508890.

PILOT

LOT

The basic chassis used in the above model is the same as that used in Model TV161. For complete service information on this chassis see TV Manual, Volume 5, pages 1-12.

STROMBERG-CARLSON MODEL 17 series Focus coil substitution.

When focus coil No. 114683 is used with General Electric or DuMont 17BP4 picture tubes in place of the 114687 focus coil, it should be positioned as far away as possible from the deflection yoke. This will permit picture focus within range of the focus control.



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MODEL TV116





The man who brought back a smile

ExciteD? Cynthia was practically bursting! Last thing Dad said was "Now you look close, Cindy. You'll see me right there in the audience tonight, and I'll wave to you." (They always do!) Long about three o'clock Cynthia's mother turned on the set ... "just to make sure."
Well, there was a picture, if you could call it that ... but so dim and fuzzy they'd never even recognize Dad that evening. And Cindy... disappointed? She was brokenhearted! But, you know the happy ending... the serviceman's competent analysis... replacement of a worn-out tube with a Federal "Best-in-Sight" Picture Tube... and there are smiles again.



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VACUUM TUBE DIVISION In Canada: Federal Electric Manufacturing Company, Ltd., Montreal, P. Q. Export Distributors: International Standard Electric Corp., 67 Broad St., N. Y.

Signal Generator Connections In Television Alignment Wm. P. Mueller

Engineer - Sylvania Radio Tube Div.

This material appeared originally in the Sylvania Electric Products, Inc. publication SYLVANIA NEWS.

The higher frequencies involved in tv receiver alignment require that precautions be taken to keep the loads between the coaxial cable of the signal generator and the receiver as short as possible. The alligator clip technique, though satisfactory in the majority of instances because it permits one to connect so conveniently from one stage to the other without even shifting the position of the ground connections, sometimes gets one into trouble from regeneration in aligning high-gain i-f amplifiers. When the i-f amplifiers are centered about 44 mc instead of 24 mc, the chances for trouble increase in proportion.



Figure 1-Acceptable connection to i-f grid.



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- Comparison between normal and abnormal patterns.
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The next time you encounter regeneration trouble try the connection shown in Figure 1. An even better arrangement, with somewhat reduced output, is that shown in Figure 2. The value of the resistor should be about equal to the characteristic impedance of the coaxial cable, which is usually 53 or 73 ohms. Keep the leads short as shown in the figures.



Figure 2-Preferred connection to i-f grid.

In aligning the front ends of tv sets the signal generator output is connected to the antenna terminals. To obtain the proper response characteristic, the signal generator should look like a source of the proper impedance, usually 300 ohms. The proper circuits to be used are shown in Figures 3 and 4 using standard values of resistances. (Be sure to use carbon or composition-type resistors, not wire-wound



USE CARBON TYPE RESISTORS 1 - 1 WATT SIZE

Figure 3—Connection for 300-ohm source impedance with 53-ohm cable.

resistors in these circuits). It is assumed that the generator end of the coaxial cable is terminated in its characteristic impedance. This may not be so, however, the circuit shown is about as good an approximation as is possible, without going to more elaborate matching sections of several db loss.



USE CARBON TYPE RESISTORS 1 - 1 WATT SIZE

Figure 4—Connection for 300 ohm source impedance with 73 ohm cable.

In r-f tuner alignment the output of the sweep generator is usually not high enough to enable one to put in matching circuits of appreciable loss. Sometimes it is necessary to have more output than that obtained with the circuits of Figures 3 and 4. If the sweep generator has a 73-ohm coaxial cable terminated (Continued on next page)

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(Continued from preceding page)

at the generator end in essentially 73 ohms, an acceptable connection to the receiver is shown in Figure 5. If the receiver has no obvious 75-ohm input connection, the circuit of Figure 6 may be used to convert a 75-ohm generator to a 300-ohm balanced-to-ground input.



Figure 5-Connection for greatest output from a 73 ohm source to a receiver with 75 ohm input terminals.

This circuit may be thought of as two 150ohm lines connected in series to match a 300ohm line at one end, and connected in parallel at the opposite end to match the 75-ohm



Figure 6—Connection for greatest output from a 73 ohm source to a 300 ohm receiver input.

coaxial cable. It produces a good match over a much broader band of frequencies than is possible with a half-wave coaxial matching section which has also been used for this purpose. The lengths, L, of the 150-ohm line are approximately a quarter wave at center frequency, or $39^{"}$ for use on channels 2-6 and $14\frac{1}{2}"$ for channels 7-13.

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Successful Servicing, May, 1953

Letter to the Editor

Successful Servicing, 480 Canal Street, New York 13, N. Y. Gentlemen:

Editor

Your editorial in the April issue of SUCESSFUL SERVICING observes that there is a definite trend to TV servicing in the home; and I agree, there is such a trend.

Whether or not this type of service will eventually supplant the shop in most service work is, to say the least, very doubtful. For one thing, what happens to that highly desirable feature of shop repair known as "preventive maintenance?" Home service does not lend itself to complete receiver checks after repair. Lack of necessary quipment for such checks in the home is self evident. And then, can't you just imagine the housewife's annoyance with the serviceman, when she observes him standing around, apparently doing nothing, for two or more hours, while the set is given a heat run? And yet, if this procedure is omitted, can a guarantee be honestly given?

I think the trend will evaporate; but only after the public is properly educated. This promises to be a very drawn out project, but one that must be undertaken by everyone even remotely connected with the servicing industry.

With every good wish, I remain, Faithfully yours, Harry M. Layden

Ed. Note: As we pointed out last month, shop service will always continue because certain types of service can never be done in the home.

Because of changes made, Tek-File Index No. 9 replaces all preceding ones. Be Sure To Use No. 9!

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TELL-A-FAULT Symptom Sheet HORIZONTAL FOLDOVER



FIG. 1

(NOTE: Refer to CIRCUIT GUIDE IV-3 for identification of components.).

Fig. 1 shows a faulty picture-tube pattern in which a slight horizontal foldover appears at the right-hand side. In addition, horizontal nonlinearity occurs along with a slight defocusing. Compare this with the normal pattern for this receiver shown in Fig. 2.





FIG. 2



The input waveform to the horizontal oscillator (multivibrator) was normal. When the scope was connected to the sweep-output plate of the multivibrator, the abnormal waveform shown in Fig. 3 occurred (F=H/3). Compare this with the normal waveform shown in Fig. 4, which occurred after the fault was repaired. The P-P value of the abnormal waveform was slightly less than normal. D-c voltage and resistance to ground from this point were both normal.

At the grid of the horizontal-output tube (V1), the abnormal waveform in Fig. 5 appeared (F=H/3). The normal waveform is shown in Fig. 6 for comparison. The P-P value of the abnormal waveform was about 10% below the normal value. The d-c voltage at the grid of V1 was only about 1/3 of the normal negative value, while the resistance to ground was less than $\frac{1}{2}$ of the anticipated value, which is the combined resistance of R1 and R2.

The waveform at the plate of V1, taken with a highvoltage capacitive-divider probe, appeared as in Fig. 7 (F=H/3). Note the abrupt but low-amplitude voltage rises which occur just before the high amplitude peaks. These do not occur in the normal waveform of Fig. 8. The P-P voltage of the abnormal waveform was about $\frac{3}{4}$ of the normal value. The d-c voltage was about 10% below normal. The P-P voltage at the plate of the h-v rectifier, obtained by using a capacitive-divider probe, was also only $\frac{3}{4}$ of normal.

The receiver fault which produced the above effects was a defective feedback coupling capacitor C3. This capacitor was found to have slight leakage.

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Suffix Letters on TV Receiver Chassis

Quite frequently suffix letters such as A, B, C, etc. are found after the chassis number. These suffix letters are, in many cases, extremely important relative to identifying the receiver on the service bench and in service notes. Every so often the addition of a suffix letter to a chassis reflects only a minor change in the electrical or mechanical organization of the chassis. But, much more often the letter denotes *major* changes of such character as would cause confusion in a service shop unless all the servicing data were on hand.

For instance, the difference between A and B suffix designations may be a difference in location of the preset controls and some of the continuously variable controls, resulting in two separate chassis views. Unless both views are on hand the service technician comparing one view with a chassis on the bench in which the components are differently arranged, can waste an hour or more in the attempt to correlate the controls with what is shown on the schematic.

In other instances the suffix letters can mean substantial changes in constants of components, thus demanding the presence of more than one schematic. The tube complement need not be too different for this to be true, which might conceivably make the entire matter even more difficult to cope with.

We can mention a number of variations which are introduced by the different forms of suffix letter chassis coding, but we believe that even these few words are sufficient to stress the fact that chassis number coding cannot be treated too lightly.

A serviceman has knowledge and time to sell. It is important that a job be done well, but is even more important that it be done in the shortest possible time. Diagnosis takes longer than actual repair, but a part of the repair effort is the proper identification of a circuitry relative to the chassis. This must be done most rapidly. Any item which is bought with the ultimate objective of saving servicing time is a capital investment of the most important kind.

The modifications which are made in manufacturing plants involving huge investments are, in most instances, means of *reducing manufacturing time*. In the servicing bus-

iness, this finds its parallel in reducing servicing time. The service technician cannot afford to ponder over the differences between schematic and chassis wiring. This particular point has always been uppermost in our minds during the preparation of Rider Manuals and Tek-Files. This is why, in many cases, 3 or 4 or even more schematics may be found associated with any one TV receiver model or with any one TV receiver chassis. It would be penny wise and pound foolish on our part to try to save on pages by using one schematic and assigning a series of chassis suffixes when whe know that the receiver manufacturer produced a number of different schematics to satisfy the suffix letters. Our function is to provide the service technician with the utmost convenience in his operations. Whenever possible it has been our practice to include every production run schematic because we feel that then and only then can the service technician accomplish his job in the least amount of time. If we can save a service technician only 10% of his time on every job, we feel happy in the thought that every Rider Manual which a TV service technician owns is being paid for by saving time on as few as from 15 to 20 jobs, if not less.

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PUBLISHER, INC. 480 Canal Street, New York 13, N. Y.

Successful Servicing, May, 1953

Mismatched TV Components

(Continued from page 24)

This relatively low tolerance is not unexpected in view of the fact that the impedance ratio varies as the square of the turns ratio rather than changing in direct proportion. For instance, the impedance transformation in a vertical output transformer rated at 13:1 is 169:1; whereas, in a transformer with a turns ratio of 10:1, the impedance transformation ratio is only 100:1. For a transformer rated at 12:1 turns ratio, the impedance transformation ratio is 144:1



Fig. 6. Vertical-sweep current with 10.1 vertical output-transformer after adjustments.

which is not too far from the rated 169:1. It might seem that a way around the inability to secure a picture as good as that obtained with the original part when a replacement part of somewhat different constants is used, is to modify the operating voltages fed to the vertical output tube. This is fine if someone will reimburse the technician for his time, and if the result can be assured. The former always is in doubt, and the latter, never a certainty, may result in wasted effort.

Some semblance of standardization of vertical output tube impedance values exists, which is why replacement vertical output transformers are available in a variety of turns-ratio ratings for substantially the same plate impedance and d-c current ratings. In this way they accomodate the variety of vertical deflection windings. But it must be realized that, in order to achieve an acceptable kind of picture so that call-backs are minimized and the set owner is kept happy, the selection of a replacement vertical output transformer cannot be haphazard.

Equally important are the hidden effects the increase in plate current and current load on the B+ supply, as well as the increased current flow through the transformer primary. While it is not as bad in vertical output systems as it is in horizontal output systems which are operating incorrectly, any increase in plate current shortens the operating life of the tube. In every test which was made so far, the plate current in the vertical output tube increased by at least 30 percent when the wrong vertical output transformer was used.



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RADIO & TELEVISION NEWS

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January-February, 1953, says: "We could make this just about the shortest book review ever written by saying only: 'This book fulfills its title'... this is a good book

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Attention Service Technicians

in the Metropolitan Area

Effective April 24, 1953, John F. Rider Publisher, Inc., discontinued over-the-counter sales of the Individual Diagram Service.

For an indefinite period of time, service technicians requiring servicing information on individual receiver models may mail their requests to 480 Canal Street, New York 13, N. Y.

TEK-FILE, Rider's monthly service data on TV receivers, may be purchased from any Rider distributor in the area. This is the ideal method of securing the latest in complete TV servicing information. Free TEK-FILE indexes may be obtained from Rider distributors or directly from the publisher. This issue of SUCCESSFUL SERVICING contains the current TEK-FILE index. New indexes are published every other month. See your Rider jobber for future editions of the TEK-FILE index, or write to us.

We regret the necessity of discontinuing the over-the-counter-sales division of the Rider Individual Diagram Service.

RCA Alumni Association Holds Philco TV Service Lecture

A TV Service Lecture-Demonstration conducted by Philco Distributors, Inc., New York Division, was given at the April 16th meeting of the Alumni Association of RCA Institutes. The speaker of the evening was Bob Dargan, Chief Instructor in charge of Training & Technical Information of Philco Distributors, Inc., N.Y. Division. Mr. Dargan, speaking to an enthusiastic group of independent servicemen, lectured and demonstrated the identification and service techniques used on Philco tv receivers.

Many guests were on hand to witness the meeting. Among these were Ed Harrje, Gen'l. Mgr. of Philco Dist. N.Y. Div.; Harold Bernstein, Nat'l. Service Mgr. of Emerson Radio & Phono Inc.; Fred Tiederman, Service Mgr. of DuMont-N.Y.; Joe Durant, Service Mgr. of G.E. Supply N.Y.; Ike Borashafsky, Technical Publications Editor of Newark Regional Office, Eastern Air Procurement District; Chuck Tepfer, Service Editor of Radio & TV News; and Milt Snitzer, Hal Alsberg and Stan Schiffman, of John F. Rider Publisher, Inc.

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Successful Servicing, May, 1953



A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

Showing only a slight decrease in the number of manufacturers reporting changes since last month, over-all product activity continues to be heavy. While tube, antenna, and sound man-ufacturers once again dominate this "change activity" scene, we note that several capacitor and wire manufactu-rers have made considerable revisions in their lines. COMMENT:

- New Items AEROVOX CORP.—Added a number of new ceramic
- Capacitors. ALLIANCE MFG.—Added Model BB2 cascamatic TV booster at \$17.97 dealer net. AMERICAN TELEVISION & RADIO—Added Model 11012T inverter replacement vibrator at \$8.10
- dealer net. BROWNING LABS.—Added Model RJ-42 FM-AM miner at \$166.50 dealer net. CORNELL-DUBILIER—Added a number of new

- bit owner at \$166.50 dealer net.
 CORNELL-DUBILIER-Added net.
 CORNELL-DUBILIER-Added a number of new vibrators.
 EBY SALES-Added terminal lug strips: T21A at \$2.10 dealer net; T22 at \$3.00 dealer net; T25 at \$2.10 dealer net; T26 at \$2.10 dealer net; T26 at \$2.10 dealer net; T26 at \$2.10 dealer net; T29 at \$2.10 dealer net.
 ETEL-McCULLOUGH-Added new series of Klystron rubes: 3K20,000LA at \$2975.00 dealer net; 3K20,000LK at \$2975.00 dealer net; 3K20,000LK at \$2975.00 dealer net; 3K20,000LK at \$2975.00 dealer net.
 FRETCO-Added Model MR-S two stack mi-tee-ray screen at \$4.35 dealer net; Model MR-C mi-tee-ray corner reflector at \$8.97 dealer net.
 GENERAL ELECTRIC-Added reving tube 1AX2, a half wave high-voltage rectifier used in TV sets, at \$2.55 list. Also added industrial and transmiting types GL-6146 at 4.90 dealer net; GL-6159 at \$4.90 dealer net; Model 29 isolation unit at \$3.55 dealer net; Model PB410 at \$5.97 dealer net.
 HALDORSON TRANSFORMER Added: Model FB409 at \$5.97 dealer net; Model FB410 at \$5.97 dealer net.
 HYTRON--Added No. T-2 special glass-filled-plastic socket at \$0.30 dealer net, fitting both PT-2A and \$7.95 amateur net.
 HYTRON--Added No. T-2 special glass-filled-plastic socket at \$0.30 dealer net, \$7.95 dealer net; UHF strip for Model TI-105RB at \$8.37 dealer net; with sets at \$0.30 dealer net; \$7.95 dealer net; UHF strip for Model an number of new items to their television chercis act act of an number of new items to their television chercis act act act act act act act at \$3.75 dealer net;

- UHF strip for Model IT-103RB at \$8.5/ dealer net.
 LOUIS BROS.—Added a number of new items to their television chassis and remote control series.
 NATIONAL UNION RADIO CORP.—Added new series of germanium diodes and transistors.
 OAK ELECTRONICS Added 4-way auxiliary speaker switch at \$0.90 dealer net.
 OHMITE MFG.—Added Type AB (Stock No. CCU) 2-watt molded potentiometer at \$4.20 dealer net.
 OHMITE MFG.—Added Model VT-3A indoor antenna at \$2.25 dealer net.
 R.C.A.—Added No. 4-1000A power tetrode rube, forced air-cooled type, at \$132.00 dealer net. (21" all-glass, rectangular picture tube of the magnetic-focus and magnetic-deflection type.)
 RADIO RECEPTOR CO.—Added germanium diodes: 1N82 at \$1.15 dealer net. 1N110 at \$1.15 dealer net.
- RAULAND-Added: two 17"; two 20"; two 21"
- net.
 RAULAND-Added: two 17"; two 20"; two 21" TV picture tubes.
 RAYTHEON-Added: TV picture tubes 10FP4 at \$26.00 dealer net; 21AP4 at \$41.25 dealer net; 21MP4 at \$43.00 dealer net; receiving tubes 6AJ4 at \$6.00 list, a 9 pin miniature triode designed for use as a grounded-grid amplifier in UHF TV receivers; 6SN7GTA at \$2.20 list, a dual triode designed for use as a combined vertical oscillator and vertical deflection amplifier in TV receivers.
 SCALA RADIO-Added Model SMI-53 oscillograph probe at \$67.50 dealer net.
 SERVICE INSTRUMENT-Added Up-Down voltage booster at \$5.97 dealer net.
 SOUTH RIVER METAL PRODUCTS-Added: UHF amenna mast adaptors Model UHM-1 at \$1.80 dealer net; Model UHM-2 at \$1.80 dealer net; chimney corner guard at \$0.30 dealer net.
 SYLVANIA-Added: hydrogen thyratrons HT-415 at \$101.15 dealer net; HT-457 at \$21.55 dealer net;

HT-458 at \$28.75 dealer net; rocket tube RT-434, planar triode, at \$35.95 dealer net; microwave crystal diode 1N21BM at \$14.40 dealer net; spec-ial purpose tube 6145 at \$8.60 dealer net; re-ceiving tube 6048 at \$3.55 list. TELREX---Added Model DFBT-1 dual channel "fish-bone" jr., channels 4 and 5 at \$20.10 dealer net. TERADO CO.---Added new portable converter, Trav-Electric Master, 6 volt model at \$24.95 list and 12 volt model at \$29.95 list. TRICRAFT PRODUCTS---Added Model 200 outdoor UHF antenna at \$5.97 dealer net; Model 210 in-door UHF antenna at \$7.77 dealer net. VIDAIRE ELECTRONICS---Added Model A-2 TV signal attenuator at \$3.30 dealer net; Model F1 high pass TV filter at \$3.15 dealer net.

- Discontinued Items AEROVOX CORP. Discontinued a number of

- AEROVOX CORP. Discontinued a number of ceramic capacitors.
 AMERICAN PHENOLIC—Discontinued No. 14-318 twin-lead transmission wire; No. 14-317 remote control wire.
 EITEL-McCULLOUGH—Discontinued: No. 6C21 vacuum tube; Model HV-1 vacuum pump; Pump Oil for Model HV-1; Vacuum switch coils 12V and 24V.
 JACKSON ELECTRICAL INSTRUMENT—Discontinued: Model 106 challenger test oscillator; Model 112 challenger condenser tester; Model 648C dynamic tube tester with counter-base.

- 112 challenger condenser tester; Model 648C dynamic tube tester with counter-base.
 JOHNSON CO., E.F. Discontinued copperweld wire No. 144-348, No. 144-350, No. 144-352.
 McINTOSH ENGINEERING LABORATORY—Discontinued Model 20W-2 20 watt amplifier.
 NATIONAL CO. Discontinued: Model MB-40-L low-power multi-band tank; crystal mounting sockets for crystal holders Model SC-1; Model SC-2; Model SC-3.
 OXFORD ELECTRIC Discontinued weatherproof speakers Model 4CMWS; Model 6CMWS.
 RADIO CRAFTSMAN Discontinued Model C300 equalizer-preamplifier.
- equalizer-preamplifier. RAYTHEON-Discontinued No. 310A special pur-
- pose tube. REK-O-KUT CO.—Discontinued Model TR-12 dual-
- REK-O-KUT CO.—Discontinued Model TR-12 dual-speed recording turntable. SIMPSON MFG. CO.—Discontinued super sky-chief (two-stage) TV booster. STEELMAN PHONOGRAPH & RADIO—Discontin-ued: Model 3D4 three-speed portable phonograph; Model 3ET2 transcription record player; Model 3K1 three-speed portable electric phonograph; Model 3RP2 radio-phonograph. SUPREME INC.—Discontinued Model 574 (VTVM) set rester; Model 616 tube and set tester.

- TELREX-Discontinued: Model DOX Duo-Orienting; Model TVB-1 Telrex V-Beam; Model TVB-2 Tel-rex V-Beam. WIRT PRODUCTS-Discontinued Model S-991 auto
- radio ignition suppressor

Price Decreases

- Price Decreases GENERAL ELECTRIC—Decreased prices: receiving tubes 35B5 to \$1.95 list; 50B5 to \$1.95 list; germanium diodes 1N64 to \$0.57 dealer net; G7B to \$0.90 dealer net; G7C to \$0.90 dealer net; industrial and transmitting tubes GL-1B35A to \$11.50 dealer net; GL-1B37A(1B37) to \$15.00 dealer net; GL-1B63A to \$56.00 dealer net. HALLDORSON TRANSFORMER—Decreased prices on several yokes and flybacks. RADIO RECEPTOR—Decreased price on 1N72 germanium diode to 1.10 dealer net. RAYTHEON—Decreased price on teceiving tube 12AZ7 to \$2.50 list.

- Increased Prices
 BRADLEY LABS.—Increased prices on their line of selenium rectifiers.
 JACKSON ELECTRICAL INSTRUMENT Increased prices: Model 648-B bench type dynamic tube tester to \$104.50 dealer net; Model CB18 counter-base for dynamic tube tester to \$8.50 dealer net; Model 648-P portable tester in wooden case to \$109.50 dealer net.
 PACIFIC TRANSDUCER—Increased price on Model 231 microscope groove analyzer to \$24.50 dealer net.
 R.C.A.—Increased price on 5ABP1 C-R oscillograph type tube to \$34.50 dealer net.
 R.Y.THEON—Increased prices on receiving tubes: 12AV6 to \$1.60 list; 12F5GT to \$1.90 list; 12K7GT to 2.20 list; 6AU5GT to \$2.75 list.
 REK-O-KUT Increased prices: Model LP-743 three-speed transcription turnable to \$59.50 dealer net; Model P-43-M three-speed record player to \$104.50 dealer net; Challenger Deluxe disc recorder to \$459.95 dealer net.
- Challenger Deluxe disc recorder to \$459.95 dealer net. SIMPSON ELECTRIC—Increased prices: Model 303 vacuum tube volt-ohmmeter to \$68.00 dealer net: Model 479 FM-TV signal generator to \$325.00 dealer net; Model 488 field strength meter to \$115.00 dealer net. SYLVANIA—Increased price on special purpose tube 7AK7 to \$10.00 dealer net. WEBSTER ELECTRIC—Increased prices on public address amplifiers: Model 81-15 to \$74.25 dealer net; Model 82-25 to \$89.25 dealer net.

Laughs in the Life of a TV Serviceman



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One reason is that you are sure of a steady flow of replacement parts and tubes from your Raytheon distributor. The factory usually ships distributor orders in 24 hours;

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RIDER TELEVISION MANUAL VOLUME 11 introduces the sectionalized Manual. This volume is divided into four parts. Each section is indicated by a full length separator page.

The purpose of this sectionalization is to enable Rider to release to the servicing industry up-to-the-minute servicing data. Whereas formerly, if one of the receiver manufacturers submitted new data when a volume was about to go to press, it was impossible to include this data in its proper alphabetical sequence. The new sectionalized plan allows for increased flexibility inasmuch as data may be included in the last section of the volume without regard to the alphabetical sequence of the previous sections. However, each section runs alphabetically by manufacturer.

It's just as easy to locate a model with this improved system as it was with the old. The Rider index lists the section number and pages in which the servicing data will be found. Knowing the section and the manufacturer, you merely turn the pages until you come to the specific model. This is another Rider aid to give the servicing industry the most up-to-date servicing information possible.

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The No. 9 Index replaces all preceding indexes. DON'T USE EARLIER TEK-FILE INDEXES!

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JUNE 1953

in this issue . . .

A	SIGNAL	TRACIN	IG	DEM	ODU-	
	LATOR	PROB	E F	OR	THE	
	OSCILLO	SCOPE				

- A MANUFACTURER LOOKS AT THE SERVICEMAN'S REPLACE-MENT PROBLEM
- BASIC PRINCIPLES OF AIR CONDITIONING
- REPLACEMENT PARTS IN TV RECEIVERS
- MISMATCHED TV COMPONENTS

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THE SERVICE TECHNICIAN AND HIGH FIDELITY 26

One Hand Washes The Other

This issue initiates a program of parts distributor advertising in alternate issues of SUCCESSFUL SERVICING in the local trading areas of the United States. It is an effort to enable the parts distributor to get his message across to the service technician. Time alone prevented the inclusion of more parts distributors' advertising than appears in this issue.

The welfare of the electronic service technician and the parts distributor is bound in the operations of each other. The parts distributor needs the buying power of the service facilities and the service facilities in turn require the financial backing which credit furnishes — as well as the convenience of on-the-spot supply. This is a broad base for mutual understanding and there are no problems between service technician and parts distributor which cannot be resolved to the fullest satisfaction of both.

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More extensive application of this system is prevented by the lack of proper equipment. The oscilloscope (preferably a sensitive one, though not always necessarily so) must be used with a sensitive crystal-diode probe designed as a demodulator for an oscilloscope. In many cases, a crystal-diode probe designed for a vacuum-tube voltmeter is used for demodulation purposes. Many home-built varieties are taken from circuits intended for applications other than signal tracing.

The modern tv service shop can usually fill the oscilloscope requirements. What is

A Signal Tracing Demodulator Probe For the Oscilloscope

by George Fleishman, TV Instructor Eastern School of Radio and Television

G ignal tracing was a well established system of troubleshooting in the pre-television days. Television servicing has elevated this system to a fine art with a fancy name—"waveform analysis." One reason for this is the increased complexity of tv receivers, especially in the circuits following the video detector. For example, many of the more obscure troubles occur in the sync and horizontal circuits.

The endeavors of technicians to master the post-detector circuits have unfortunately led, in part, to a neglect of the pre-detector circuits. Contributing to this situation is the relative simplicity of the r-f and i-f circuits. Most troubles are relatively minor, involving merely a defective tube or a shorted capacitor sometimes accompanied by a tell-tale burnt resistor. A signal disturbance test and perhaps voltage and resistance measurements suffice for most of these problems.

Importance of Signal Tracing

Ever so often (increasingly so, as receivers get older), a "dog" comes into the shop. Its trouble may be, among others, a case of picture flicker which cannot be ascribed to a defective antenna system, or perhaps an intermittent, especially in the front end. On such occasions, the signal tracer, which is reliable in troubleshooting radios, is not as effective in dealing with tv signals. Some signal tracers cannot operate on high-frequency signals. The basic objection, however, to the ordinary signal tracer, is that it gives its indications in terms of an audio indication from a speaker. Tv technicians have come to realize that signal tracing in ty receivers is best accomplished in terms of a visual representation of the signal on the face of an oscilloscope screen, hence the term "waveform analysis." It is apparent, therefore, that the serious technician is in need of a signaltracing instrument for visually investigating tv circuits carrying r-f signals in much the same manner as he does in troubleshooting aurally in radio circuits.

Unfortunately, the service oscilloscope cannot usually be used directly for probing in high-frequency circuits, since it is essentially a low-frequency instrument. It is possible, however, to demodulate the r-f signal before applying it to the input terminal of the oscilloscope. A practical solution to this problem is the use of an oscilloscope preceded by a demodulator detector probe as shown in Fig. 1. The demodulator can then be removed when the oscilloscope is employed in circuits following the video detector. obviously needed is a sensitive demodulator probe for signal-tracing purposes. This article gives a brief survey of crystal-detector probes in general and suggests a probe admirably suited for troubleshooting in the early stages of the tv receiver.

Basic Shunt Diode Peak Rectifier

Figure 2(A) shows the circuit of the shunt diode peak rectifier which is basic to almost all types of crystal probes. Capacitor C1 charges rapidly during the positive alter-



Fig. 1. Using a demodulator probe with a service scope for signal tracing.

Many technicians will recognize this version of a tv signal tracer. It is really a variation of the untuned type of signal tracer where the oscilloscope has replaced the audio amplifier. Some technicians have actually used this set-up with varying degrees of success. Its utility, in most cases, is confined to the video i-f amplifier, particularly the later stages.

nation of the input a-c signal, through the low forward resistance of diode D. During the nonconducting period of D, C1 discharges slowly through the high load resistance of R_L developing a d-c voltage drop that is negative with respect to ground. At signal frequencies above 10/ R_L C1, the discharge of C1 between successive cycles is so small that

(Continued on page 10)



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A Manufacturer Looks at the Serviceman's Replacement Problem

by Grant Graham, Engineer

Triad Transformer Corporation

About a year ago our firm started listing their products in Rider Manuals and Tek-File. The task of compiling the most effective replacement in the Triad line of transformers was assigned to me.

The original set manufacturers furnish the individual specifications of the various components used in their circuits. By comparing the specifications of the originals, a duplicate for replacement use can be suggested.

With an air of assurance I looked forward to receiving the initial package of data sheets. Little did I realize the task and its obstacles that lay before me.

With my varied background in radio servicing, selling parts to servicemen, and design engineering, I felt it should be pretty easy to make these simple recommendations. After all, matching voltage, current, resistance, inductance, etc., was all that needed to be accomplished.

Slowly, however, I began to get a feeling of doubt. I was getting a few rejections because I had overlooked a detail or two. It didn't seem too serious. After all the serviceman could drill a few holes or move components around a bit! Even after assuring myself this could be done. I was still not "sold". Perhaps if I could get a little closer to the problem at hand, the actual requirements would become clearer.

In talking this problem over with my boss, Mr. Lew Howard, we decided that there were two ways to approach this problem, and probably both ways should be followed. (a) We could drop in on technicians and discuss the problem. (b) We could actually acquire some first-hand experience on the television bench. It was decided to adopt system (b) as the most direct approach.

Not wishing to be treated as "an honored guest", it was decided that my Triad plant affiliation would not be mentioned in applying for this job. I found, due to the shortage of service personnel in Southern California, that it was really quite easy to obtain even a part-time job. I had had some television service experience, but it was limited to working on my own set and those of my friends.

The shop in which I was employed was a combination sales and service organization. They held franchises on six major television lines. The shop was quite modern with very good equipment and manned, at that time, by four men. It was probably as near to an average Southern California television service shop as could be found.

How well I remember that first job-a four year old set! Four regular technicians were employed at this shop, each quite busy on his own job, but I felt like a prima donna on her debut. They were watching me out of the corners of their eyes, this I felt was certain. I flipped the chassis over and propped the tube up on a roll of paper. With my first inspection I spotted a resistor burned to a crisp, with a nice big crack in it. "What luck, an easy one", I thought! That was my first mistake. I had drawn a real "sick dog", whether by accident or as a qualifying test I'll never know. Anyway, about three hours later and after tying up a large percentage of the shop's equipment, I got it cured, but was still a bit worried about the time I had spent on it. However, after the foreman assured me this was not excessive I felt considerably relieved about my first "professional" television repair job.

I won't go into a "blow-by-blow" description of my "professional" career as a television technician; of the sets I repaired, and a few I called for help on. But believe me, I certainly have developed a high respect for the television serviceman and his problems. No more of this "let the guy move something" or "its pretty close" attitude. True replacement parts cannot always be exact duplicates, but they should certainly be close enough so that alteration of the rest of the set is not necessary to accomodate the new part.

It might be well at this time to make a few observations on some recommendations I have made and also some made by others. At one time, I recall, I recommended a certain flyback transformer which would work, in fact it was electrically an excellent replacement. The only "fly in the ointment" was the fact that when mounted in the high-voltage cage, the corona ring arced to the cage, and if a spacer was used the transformer would stick out of the cage completely. Another case of misapplication I have noticed, is where another person has recommended one universal power transformer to replace



Grant Graham Pho

a multitude of models. It may be necessary to mount the picture tube in a separate chassis to accommodate such a transformer. This, of course, is the problem of the serviceman!

I am sure that I have learned a lot from my experience and heartily recommend furnishing the trade with the most complete data possible, both physically and electrically. In failing to do so the manufacturer is hurting himself as much or more than anyone else, because, after a sad experience or so, the serviceman is forced to go to another manufacturer for replacement parts. Parts manufacturers should not expect the serviceman to re-engineer a television chassis. Even if he is able to do so, he certainly doesn't want the extra work, nor does he want to pass such a charge on to his customer.

By careful consideration of the replacement, it should not be too difficult to recommend the proper part, or, if our part does not meet the specifications, to state that we do not make the replacement. It is certainly preferable to state "no replacement" than to give erroneous information. The ultimate user will appreciate the savings of not having to perform a major modification in order to use the part.

I know that there are bound to be errors even in the most carefully prepared data. If I live long enough to make just an occasional error, I'll be quite satisfied. However, to reiterate, the recommendations presented to the serviceman should be as carefully studied and as honestly made as is possible.

After spending some time on the service bench, I fully appreciate what the technician is up against. It is a tough job to ascertain the trouble in a set, and then to repair it, without having to reconstruct the entire chassis in the process.

We, here at Triad, are now engaged in the second phase of "Project Rider". We are talking to servicemen all over the country and getting their slant on what can be done to do a better job in the replacement field. In this way, along with the experience gained "on the bench", we hope to be able to offer much better replacements to the serviceman.



4

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MEMBER

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Color TV

The pressure for color TV is hot. Some segments of the industry want it and some don't. We think that those who do, are going to win out. But even then it looks like it will be 1955 before any substantial production takes place. From what we hear the production of tri-color tubes will be relatively low at the start, perhaps 100,000 to maybe 150,000 the first year . . . Maybe we are wrong but it looks like a 16 x 12 inch picture at the start. The tube is reputed to cost about \$175 at the beginning. The receiver will have between 35 and 40 tubes. (It looks like 1955 before anything substantial will happen but don't be surprised to see color TV in 1954.)

What interests us is that despite the greater complexities in the color TV receiver, we have every confidence in the world that the independent TV service technician will be doing the service work. Sure he'll have competition from many sources, but he'll be in there pitching his time and knowledge. In the long run the edge is with the independent because he is all over the four corners of the nation and ready to serve.

Hi-Fi

Each vear an electronic parts show is run in Chicago. This year it was a 4-day session beginning with May 19th through May 22.

The item which received great attention was high-fidelity. It appears as if all manufacturers of amplifiers and loudspeakers are aiming their sights at the high fidelity fan. At the moment there does not seem to be any definite information about how many people fall within this category, but if one is to judge by the sales of LP recordings of operas and other types of classical music, there must be great numbers of devotees of good music.

There are two points we wish to make in connection with high-fi equipment. One of these relates to the urgent need for some engineering standards concerning what is and what is not high-fidelity reproduction. Frequency range alone is not the determining factor.

The second point relates to servicing facilities. Who will service these equipments? What equipment will be used? No matter how well the equipment is made, servicing will be necessary. But in view of the attitude of the high-fi listener --- the increased order of criticalness — the technical requirements for service will be more severe than is the case with an audio amplifier in a receiver or an ordinary power amplifier. The high-fi enthusiast is a hobbyist. Hobbyists do not look at their possessions in the same light as individuals who use electronic equipment for commercial purposes or for those who use the equipment for everyday listening to radio broadcasts, plays and news. The hobbyist is much more of a perfectionist. So again we arrive at the question "who will do the service. and with what?" It stands to reason that the competent television service facility is the logical organization (or individual) to do this work. But in order to do it properly it is necessary that adequate background concerning high-fidelity reproduction exist. The average high-fi enthusiast has a much greater appreciation of musical reproduction than the average owner of a radio or television receiver. He may know very little or nothing about electronics, but he does recognize when the sound issuing from his loudspeaker indicates proper or improper performance of the units he owns --- this begins with the turntable through the pick-up, all the way to the speaker. The background necessary in the servicing facility can be no less.

As to the equipment with which service can be rendered, all of it is available but not necessarily in possession of those who might do the work. A possible exception is the scope. Square wave generators, intermodulation-distortion checkers, test recordings, a-m sweep generators are on the market but limited generally to laboratory use.

Admittedly there isn't enough high-fi service work to justify all present television service organizations entering this field, but it is almost a certainty that enough equipment of this kind will eventually be sold to justify organizations in every large center of population looking into this source of income.

The cost of a good high-fi system oftentimes is much more than even a fancy television receiver and it is a fairly safe bet that the highfi fan is willing to pay a fair price for good services rendered. Considering the nature of the installation and the attitude of the owner it is not unreasonable to assume that he will not shop for the lowest price when service is needed. Will the wide awake TV service facility miss the growing high-fi market as a source of income?

Home Air Conditioning

The home air conditioning business is growing by leaps and bounds. More and more manufacturers of home electronic products are entering this field. While it is true that heavy-duty air conditioning service activities have been in the hands of a relatively few organizations, it is not inconceivable that individual room air conditioning equipment service be done by present day TV service facilities. Investigation among organizations producing such equipments discloses that they can see the television service technician doing this work. As a matter of fact, it would be a very good idea to take up the normal slack which occurs each summer in the servicing of radio and television receivers, by servicing home air conditioning equipment.

John F. Rider

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Basic Principles of Air Conditioning

Prepared by the Commercial Service Section

of the RCA Service Co., Inc.

The following article and its illustrations are reprinted through the courtesy of the RCA Service Co. from their brochure entitled "Introduction to Room Air Conditioning."

Introduction

Air Conditioning is the art of controlling the temperature, humidity and cleanliness of the air as well as air movement and ventilation in the places where we live or work. The control of these conditions may require either the addition or the removal of heat and moisture to the air surrounding us in order to provide comfort. Addition of heat and moisture may be accomplished either by a furnace in the basement or by a room heater. Similarly removal of heat and moisture may be accomplished by either a central cooling unit or by a cooling unit designed for use in one room only.

In general usage, the term "room air conditioner" is applied to an appliance designed to *remove* heat, moisture, and foreign particles from the air and to provide air movement with ventilation as desired in a single room. Heating provisions may be added to some room air conditioners.

"Dehumidifier" is the term applied to a unit designed primarily for the removal of moisture from the air without cooling of the air in the room.

This article will describe the basic principles upon which air conditioners work.

Objective

The objective of air conditioning is to maintain a desirable level of heat losses from the human body in order that a feeling of comfort will be provided. Individuals have different reactions to the temperature and moisture conditions of the air which surround them; consequently, no one set of conditions will satisfy everyone.

A range of conditions, known as the "summer comfort zone," has been established within which most people will be comfortable. Air conditioning should maintain the temperature and humidity conditions of the air within this zone. These temperatures and humidity conditions may be represented on what is technically known as a psychrometric chart, the use of which will be described later.



Fig. 1-RCA Window Model Room Air Conditioner

Air Conditioning Requirements

Air conditioning must deal with four basic factors in order to meet the cooling requirements for health and comfort. These factors are: air temperature, humidity, air movement and the temperature of surrounding surfaces.

The human body is constantly creating heat as the result of the body process. The body must give off excess heat to maintain its normal temperature of 98.6° Fahrenheit. The surrounding air will absorb this excess heat at a rate proportional to the difference in temperature between it and the human body. The body is also giving off moisture through the pores of the skin. This is known as perspiration. When perspiration evaporates, it absorbs heat and thereby helps to keep the body cool. If the air is nearly saturated with moisture, it will absorb very little body perspiration. The degree of moisture saturation is called relative humidity.



Fig. 2-Heat Transfer by Radiation

To absorb heat and moisture from the body and thereby keep it cool, the air must come in contact with it. The air, after absorbing heat and moisture, must be taken away and the heat and moisture removed from it. To move this air, a fan is used. The temperature of surrounding objects must be considered because of two reasons. First, because heat will be exchanged directly between them and the human body. Second, because they affect the temperature of the air in contact with them.

Two requirements other than cooling must be taken into consideration. Ventilation must be provided in occupied rooms to freshen the air. For this purpose, outside air is mixed with recirculated room air.

Minute particles of dust and other undesirable substances are suspended in the air and must be removed for greatest health and comfort. These particles are removed by causing the circulated room air to pass through a filter before being returned to the room.

Meeting Air Conditioning Requirements

There are several ways in which some degree of comfort can be obtained. We can use a fan but this does not remove heat, moisture or impurities from the air. Another method would be to use ice and natural circulation.

The most satisfactory way is to use an electric refrigerating unit to cool, dehumidify, and circulate the air in the room. Fresh air can be added as desired or (in most conditioners) stale air can be exhausted from the room.

As mentioned before, an air conditioner can be a central unit to condition the air of an entire house or may be a unit to condition the air of only one room. Central unit systems, as yet, are not in common use for the home; however, room air conditioners have become very popular.

Most room air conditioners are of the type in which the heat which has been removed from the room is dissipated directly into the outside air. They are easily installed without plumbing or duct work. Some larger size room air conditioners and central unit systems use water to carry off the excess heat. They do require plumbing and an adequate supply of water.

Heat Transfer

Heat flows from warmer bodies to colder bodies. The higher the temperature difference between the bodies, the faster the heat flow. This heat flow continues until the bodies reach the same temperature or equilibrium. Heat transfer is the movement of heat from one place to another and is accomplished by any one or any combination of three methods.

1. RADIATION—Passage of heat from one object to another without warming the space between. The heat is transmitted by wave motion similar to light, as illustrated in Fig. 2.

2. CONDUCTION—Passage of heat from one point to another by transmission of molecular energy through a conductor from particle to

(continued on page 16)

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Replacement Parts In TV Receivers

Part 2 - Transformers

by John F. Rider

This is the seventh in a series of articles "Replacement Parts in TV Receivers."

By definition a transformer is an electrical device whereby electrical energy of alternating character can be transferred from a high voltage and low current, to a low voltage and high current.

The phenomenon employed to accomplish the transformation of electrical energy in a transformer is the induction of a voltage in a coil by cutting the turns of the coil by varying lines of flux which issue from another coil that is carrying a changing current. This is symbolized in Fig. 1. One winding is the primary winding P. The primary voltage is applied across this winding and the resultant current creates varying flux lines which link with the turns of the secondary winding S.



Fig. 1-Simple Transformer

The use of an iron core enables closer coupling between the two windings by providing an easy path for the flux lines. The electrical relations between the primary and the secondary coils, or any number of secondaries is fixed. The voltage induced in the secondary winding is proportionate to the turns-ratio between the primary and secondary coils, or

$$\underline{\underline{Ep}}_{Np} = \underline{\underline{Es}}_{Ns}$$

- Where Ep is the voltage across the primary Es is the voltage across the secondary Np is the number of turns in the primary
 - Ns is the number of turns in the secondary.

If the number of turns in the secondary winding is greater than the number of turns in the primary winding, the secondary voltage will be higher than the primary voltage; if the reverse is true, the secondary voltage will be lower than the primary voltage. The above applies to any number of secondary windings, for example to the three secondaries shown in Fig. 2. If the number of turns in the secondary winding exceeds the number of turns in the primary winding a voltage *step-up* occurs; if the reverse turns relationship prevails in the two windings, a voltage *step-down* occurs. The relationship between the secondary voltage and the primary voltage can be expressd:

$$Es = \frac{Ep \ x \ Ns}{Np}$$

As to the current transformation which occurs in a transformer it varies in a direction opposite to the voltage, namely if a step-up in voltage occurs, a step-down in current occurs; if the voltage is stepped-down the current is stepped-up. In both instances we are speaking about the current available from the secondary winding, which will be seen later, to be related to still another detail, namely the wire used for the secondary winding. But regardless of whether voltage or current are stepped-up or stepped-down, the total power output from the secondary (or secondaries) of a transformer never can exceed never can exceed the power input of the primary. As a matter of fact it always is less by some small amount because of losses which take place in the transformer.

The above are fundamental conditions that have a great bearing on the suitability of transformers as replacements in television receivers. This point is so important relative to one particular type of transformer that we emphasize the fact that the voltage output from any one winding is subject to definite limitations as set by the number of turns. Even if a secondary winding is visualized with taps, the number of turns between any one end of that winding and any one of the taps, is definitely fixed. The reason for stressing this limitation will be made clear later.

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For the individual models included in these Packs, refer to the TEK-FILE INDEX that will appear in the July 1953 issue. Consult your Rider distributor or write to us directly.

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Fig. 2—Transformer with more than one Secondary

A television receiver makes use of a variety of transformers. The vast majority of them, however, contain a device which, in function, parallels the transformer used in power distribution systems. Its function is to furnish electrical energy required for the operation of the receiver at different values of alternating voltage and current, and which energy is distributed to different parts of the receiver. It is appropriately named the power transformer. It transfers the primary source of electrical power available from the local a-c power line to a high voltage (and relatively low current) required by the power rectifying system for conversion to d.c. which then is applied as the operating voltages to the control grids, plates and screens of the vacuum tubes in the receiver. Simultaneously it provides a variety of low a-c voltages (and relatively high currents) required by the heaters of the same vacuum tubes.

Varieties of Transformers in TV Receivers

But as we said earlier a number of types of transformers are used in television receivers. All are not power transformers. Some are related to the generation of alternating current in association with vacuum tubes. While they are of various kinds they go by the general name of oscillation transformers, although in some instances they may bear names which more closely identify the device with a particular section of the receiver. Such are, for example, the vertical blocking transformer, the horizontal oscillator transformer, etc.

Another type of transformer is a frequency selective device wherein the transformation of electrical energy occurs at a slected frequency or over a band of selected frequencies. Ex-

(continued on page 27)

A Signal Tracing Demodulator Probe, etc.

(Continued from page 1)

the conductive period of the diode is limited to an almost infinitesimal period at the positive peaks when the input-signal amplitude exceeds the opposing voltage across C1. The negative voltage across R_L is substantially constant and is approximately equal to the voltage at the peaks of the positive alternations as shown in part (B) of the figure. Reversing the leads to the diode brings about a positive d-c voltage across R_L approximately equal to the negative peaks of the input signal.

diode has a finite back resistance which varies with the value of the back voltage. Then the load resistance, R_L, is the back resistance of the diode paralleled by the series resistance $R_{\rm s}$ and $R_{\rm M}.$ The back resistance of a 1N34 or similar type crystal and, for all practical purposes, the total load resistance shunting the diode, may only amount to a few hundred thousand ohms, varying slightly with signal amplitude. Using a value for C1 of 500 µµf, measurements with this probe can begin with the higher audio frequencies and extend to

Fig. 2, Left. Circuit of



Where the input signal is amplitude modulated, the voltage across R_L follows the modulation envelope at positive peaks of the r-f signal when the modulation frequencies are less than 1/10R_LC1. The voltage across R_L will follow the modulation envelope at the negative peaks of the r-f signal if the diode were reversed. This is the principle of most video detectors as well as the detector found in demodulator probes.

Peak Rectifier Probes for VTVM's

The shunt diode peak rectifier is shown in Fig. 3(A) modified for use as an a-c signal rectifier in a vacuum-tube voltmeter. It is usually built into the VTVM and becomes active when the function switch is set to the a-c position. It should be noted that R_L, in this case, is the series resistance of R_s and R_M, the d-c range selector.

At the higher signal frequencies, the test leads from the VTVM cause circuit disturbances. The remedy for that is the crystaldiode probe of Fig. 3(B), which brings the rectifier to the circuit under test, when its cable is connected to the d-c input of the VTVM. In this case, it should be understood that unlike a thermionic diode, a crystal

about 250 mc, but the maximum input signal must not exceed 28 volts peak because of the low inverse rating of the crystal diode.

The reader's attention is directed in particular to resistor R_s. The presence of R_s is necessitated by the use of a peak detector with an instrument having an rms calibration for a-c readings. The d-c voltage across R_s and R_M is just about equal to the peak value of the measured a-c signal. Rs produces a voltage drop which leaves, at the input to the VTVM, a voltage 70 percent of the maximum. In practice, the voltage across R_M is slightly less than 65 percent of the maximum, since the value of R_s includes also the value of the isolating resistor (usually 1 meg) in the d-c probe.

Another purpose of R_s is to isolate the cable and instrument capacitance from the

circuit under test. As seen in Fig. 4(A), if R₈ were not in the probe, a capacitance C2 of from 100 to 250 µµf would appear in series with C1 across the circuit under test causing undesirable disturbances. Additional filtering, too, is seen in the low-pass filter formed by Rs and the cable capacitance C2 (see part B of the figure) which smooths the ripple developed during the conducting period of the diode.

VTVM Probes for the Oscilloscope

A mistaken practice among technicians mentioned heretofore, is that of using the VTVM crystal-diode probe as a demodulator for an oscilloscope. Figure 5(A) shows schematically the crystal probe connected to the oscilloscope input. The effect of C3 can be disregarded in this analysis since its reactance at 60 cycles is quite low.

The demodulated component then appearing across the series resistance of R₈ and R₀. is mainly that of the vertical sync signal and part of the horizontal sync signal in their negative phase. For signal-tracing purposes, the signal in this polarity suffices. Resistor R₈ presents the real problem. The propor-



tion of the resistance of Ro to the resistance of R_o in series with R_s (R_o/R_o+R_s) is such that only about 15 percent of the total demodulated output appears at the input to the oscilloscope (see part B of the figure). The signal attenuation is even greater for the horizontal sync pulses when the low-pass filter formed by R₈ and the cable capacitance is considered.

It is obvious then, that much of the signal gain contributed by the vertical-deflection amplifier of the oscilloscope is negated by the losses in this crystal probe.

This probe has its place with the instrument for which it was designed. In the absence of an oscilloscope, the crystal probe-VTVM combination can perform many signal-tracing tests in the high-level stages of

(Continued on page 15)



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12

Mismatched Television Components Part 2 - The Deflection Yoke (Horizontal Windings)

This is the second in a series of articles on Mismatched TV Components. Deflection yokes will be continued next month.

In last month's article bearing the same general heading, the first in this series, consideration was given to the overall effects of replacing a defective vertical-output transformer with one that introduced some mismatch. One conclusion seemed clear at the time: apparently slight changes in the turns ratio or primary impendance produced serious symptoms, evident or concealed, that seemed entirely out of proportion to the actual changesuntil consideration was given to the factors involved. These results raised a question. Was the conclusion a fair one to draw, for inductive replacements in general, on the basis of a single type of component? After all, chance could have led us to the one circuit where the problem was most complicated.

For that reason, although the first line of inquiry is far from being fully explored, it was decided to abandon the vertical-output system for the time being, and to seek elsewhere for confirmation or altration of the early assumption. To this end, attention was directed to the horizontal windings of the deflection yoke. The results obtained from using mismatched yokes were so dramatic as to turn the first conclusion into an understatement of classic dimensions.

The Yoke and the Output System

. .

It is not a good idea to plunge into the maze of widespread results without at least some anticipation of what is involved. To begin, the yoke's horizontal windings do not lie, as first thought would seem to indicate, on some isolated tap of the flyback transformer's secondary, loftily unconcerned with the rest of the receiver. Figure 1 is a conventionalized and simplified representation of what a horizontal output circuit looks like from the plate of the output tube to the yoke. Closely allied to it, by direct or indirect connection or by inductive coupling, are the high-voltage, width, linearity, damper, boosted B-plus, and normal B-plus circuits---not to mention the yoke itself. This list is by no means definitive. In most receivers, other circuits are supplied by the boosted B-plus; in many, the flyback transformer is tapped at one point or another for a control pulse which is fed back to the horizontal oscillator and oscillator control circuit; in receivers using keyed agc, the keying pulse is almost always extracted from some point in the output stage.

The horizontal coils, which always appear across a part of the output transformer in one way or another, are therefore associated with all of these circuits. A poor match with respect

by Sidney C. Silver

to the coils can produce secondary effects in any or all of the systems mentioned, and in others.

What Factors Were Checked

A thorough run-down of all possible varieties of mismatch with all possible effects cannot be encompassed in a single article. Three representative exampls are presented here. In each of these instances, a replacement yoke whose vertical coils met the requirements of the original circuit was put into the receiver. the current-sawtooth waveform in the yoke, and second-anode voltage.

The First Case: Yoke Inductance Reduced

With the original yoke still in the circuit, the receiver was adjusted for optimum perperformance and reference measurements were taken. At this time, the picture-tube pattern appeared as shown in Fig. 2. The first vagrant yoke was identical to the original in all respects but one: inductance of the horizontal windings, required to be 12.8 millihenrys, was





Fig. 2—Normal pattern produced by the original deflection yoke.

In each case, however, a single specification for the horizontal coils was changed. A mere halfdozen items—in addition to the obvious effects on the picture-tube screen—were checked for effects. These were: output from the lowvoltage power supply, boosted B-plus (which is also the plate voltage for the horizontaloutput tube), plate current at the output tube, the voltage waveform at the plate of this stage,



Fig. 3—Effects on pattern when yoke induction is reduced.

measured at 9 millhentrys. This represents a reduction of about 30 percent. For the rest, the yoke was a 70-degree, cosine-wound device, as required, whose vertical windings corresponded to those of the original part.

When it was first put into the circuit, no readjustment of preset controls was attempted. Effects on the picture are shown in Fig. 3. De-

(continued on page 21)

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A Signal Tracing Demodulator Probe, etc.

(Continued from page 10)

the i-f amplifiers, especially where f-m signals are involved. With a signal generator used for signal injection, these tests can be extended to cover the entire r-f and i-f section of the receiver.



Fig. 4. Resistor R₅ serves as an isolating device and forms a low pass filter with the cable capacitance.



Crystal Probe for the Oscilloscope

A crystal demodulation probe for oscilloscope use is shown in Fig. 6. A comparison with Fig. 3(B) shows that the essential difference between the two is the value of the components employed. The crystal diode is shown reversed, in this instance, only to provide a composite video signal in its positivepulse phase as shown in Fig. 1. The value of resistance for R₈ for example, is such that 80 percent of the diode output is at the oscilloscope input, a far more satisfactory situation. For signal-tracing purposes, an even lower value of resistance for R₈ might be preferable except that less isolation is provided. Also notice the reduced value of the R_LC1 and R_sC2 time constants resulting in more faithful reproduction of the horizontal sync pulses. R_L, in this case, is the paralleled resistance of R1 with the back resistance of the diode. The similarity of the two circuits points to a simple way of converting from one to another. Where a VTVM crystaldiode probe is to be used as a demodulator

for an oscilloscope, it is a simple matter to bridge R_s, (usually about 5.4 megohms) with a 50k-ohm resistor. R1 may be omitted, and capacitor C1 need not be changed. This procedure avoids dismantling the probe completely, yet it displays the essential demodulation characteristics for signal tracing. A converted probe can still be used with a VTVM. The calibration will no longer hold since the meter readings will be considerably higher. The increased sensitivity, however, to r-f signals renders the instrument more effective for signal-tracing purposes.

The demodulator probe, when used with a high-gain oscilloscope, gives reasonable performance in the early stages of tv receivers. Many instrument manufacturers provide such a probe as an accessory for their oscilloscopes. In weak-signal areas, however, where only a low-gain oscilloscope is available, a more sensitive demodulator probe based on the peak-to-peak rectifier is indicated. Also, the voltage-doubler probe suggested itself at the

Fig. 5. Using a VTVM crystal probe as a demodulator for an oscilloscope.

time transformerless receivers incorporating selenium rectifiers in voltage-multiplier circuits appeared on the market.

Voltage-Doubler Crystal Probe for the Scope

Figure 7 shows the schematic of one such voltage doubler. Capacitor C1 charges to the positive peak voltage of the input signal through shunt diode D1 while series diode D2 is nonconducting. During the peak of the next alternation, while D1 is nonconducting. C1 discharges in series with the input signal through series diode D2. This serves to charge capacitor C2 to the peak-to-peak value of the a-c signal.

Actually this circuit is that of the a-c signal rectifier of the peak-to-peak type of vacuumtube voltmeter. In this instance the value of resistance for R₈ to give an rms calibration on an 11 megohm input-impedance VTVM is about 22 megohms.

There is no need for peak-to-peak r-f measurements in service work where the r-f signal is essentially symmetrical. Therefore, a peak-to-peak crystal-diode probe for the VTVM is unnecessary in this instance. Experience, however, has proven the value of the peak-to-peak, or voltage-doubler crystaldiode demodulator, for the oscilloscope.

Figure 8 shows the circuit of a voltagedoubler crystal demodulator probe which the author has used successfully for several years. Note that the crystal diodes have been reversed in order to produce positive-going sync pulses at the oscilloscope input. A comparison of Fig. 8 with the circuits in Figs. 3 and 7 provides several significant points of interest:

1. The demodulated waveform is approximately twice that obtained from the singlediode peak detector.

2. The low internal capacitance of D2 (approximately 1 $\mu\mu f$) appears in series with the cable capacitance, and thus isolates C2 from the circuit under test. This eliminates the necessity of an isolating resistor such as R_s, making for slightly higher signal input to the scope and permitting the use of cable capacitance for C2. This allows for more compact probe construction.

(Continued on page 22)



Where Z_m is the input impedance of the VTVM, R_m is the internal resistance of the VTVM (Z_m - resistance in the d-c probe), and f is the lowest frequency expected in the signals to be measured.

Basic Principles of Air Conditioning

(continued from page 7)

particle of the conductor material. This is illustrated in Fig. 3.



Fig. 3-Heat Transfer by Conduction

3. CONVECTION—Passage of heat from one point to another by means of circulation of a fluid. Either air or water may be considered as a fluid. Gravity circulation results from a change in density caused by the addition or loss of heat in the fluid, as illustrated in Fig. 4. Forced circulation by means of a fan or pump hastens heat transfer.



Fig. 4-Heat Transfer by Convection

Change of State

"Change of State" is also a very important factor when considering transfer of heat. When a substance changes from a solid to a liquid or from a liquid to a gas, heat is transmitted into the substance. The heat is transmitted out of the substance when changing from a gas to a liquid or from a liquid to a solid. This is illustrated in Fig. 5.



Fig. 5-Change of State

Ice is a familiar substance, so let us consider one pound of ice at 0°F. As heat is added the ice will increase in temperature until it reaches 32°F, at which point it starts to melt.

As more heat is added, the temperature remains at 32°F until all the ice is melted into water. Continuing to add heat will raise the temperature of water until the boiling point (212°F) is reached. Here again the temperature remains constant until all of the water is converted to steam or water vapor.

Converting the ice to steam involves a considerable quantity of heat. A comparison of the heat quantities required for the various steps is illustrated in Fig. 5.

A British Thermal Unit (BTU) is defined as the measure of heat required to raise one pound of water one degree F (Fahrenheit) at sea level. Addition or removal of 1000 BTU of heat in a period of one hour is stated as 1000 BTU/hr.

Specific Heat

We have been dealing with water but frequently such substances as air, Freon or a metal may be concerned and a correction factor is necessary in heat calculations for the substance involved. This correction factor is called "Specific Heat" and it is the ratio of the quantity of heat required to raise the temperature of one pound of a substance one degree to that required to raise one pound of water one degree.

In heating one pound of air one degree F, the quantity of heat required is only 24/100as much as that required for raising the temperature of one pound of water one degree F (BTU). This means that the specific heat of air is .24.

Fig. 6 illustrates the concept of specific heat, using water and lead as an example. Heating one pound of water from $32^{\circ}F$ to $42^{\circ}F$ (10°) requires 10 BTU of heat as the specific heat of water is 1. Adding the same amount of heat to one pound of lead at $32^{\circ}F$ will raise its temperature to approximately 355° .

The reason for this large difference in final temperature of the lead is due to the differences of specific heat, that of lead being .031 as compared to 1 for water.

Latent Neat, Sensible Heat, Superheat

Referring again to the "Change of State" illustration, Fig. 5, the heat required to raise the temperature of one pound of ice from 0°F is 32 times its specific heat (.5 for ice) or 16 BTU. An additional 144 BTU is required to melt the ice without raising the temperature above 32°F. This adding of heat without a temperature change is called latent heat, and the heat required to bring about this melting is called latent heat of fusion. Raising the temperature of water from 32°F to 212°F requires 180 BTU per pound (212°F-32°F times 1 (Sp. heat of water) = 180 BTU per pound.). This adding of heat with subsequent temperature change is known as sensible heat. Changing water to steam at 212°F requires 970 BTU. The heat required to bring about this change is termed latent heat of vaporization. Steam may be heated above 212°F, if confined. by applying .45 BTU per pound for each degree over 212°F temperature. This is called superheat.

Humidity

The air we breathe is actually a mixture of various gases (nitrogen, oxygen, carbon dioxide, etc.) and water vapor. Humidity is the term used to indicate water vapor which is contained in the air and is one of the variables we must deal with in air conditioning. Relative humidity, which we hear so much about, is the ratio of the amount of moisture in the air to the amount of moisture that is required to saturate the air at any given temperature.

Reducing the humidity by condensing the water vapor from the air requires an appreciable amount of air conditioner capacity. This is usually referred to as the *latent cooling load*. The temperature of the room air in passing over the cold fins and tubes of the evaporator is reduced below the dew point (the temperature at which the water begins to condense out of the air as it is cooled), and drops of water form on the fins and tubes. This condensate gathers in the bottom of the unit and is conducted to the condenser fan where means are provided to remove it by blowing it onto the hot condenser.



INCREASE OF TEMPERATURE DEPENDS UPON CAPACITY OF A SUBSTANCE TO ABSORD HEAT. THIS CAPACITY IN RELATION TO WATER IS KNOWN AS SPECIFIC HEAT.

Fig. 6-Specific Heat

The evaporator coil and fins, which are wet with condensate, are also effective in removing minute particles of dust and pollen which may pass through the filter.

Measurement of Humidity

The amount of water vapor in the air is measured by an instrument called a psychrometer. This instrument is composed of two thermometers, one of which has a cloth wick on the bulb. When taking a reading the wick is dipped in water and the psychrometer placed in an air stream or moved through the air at a rapid rate.

The "Wet Bulb" remperature is read on the thermometer having the wetted wick covering the bulb. The reading of the other thermometer is termed a "Dry Bulb" reading.

The water on the wet bulb evaporates at a rate dependent on the moisture content of the air passing over the wet bulb which is cooled by evaporation. At saturated conditions, where the relative humidity is 100% and no cooling takes place, both thermometers would read the same. Conversely, if the air is very dry (low

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humidity) an appreciably lower temperature will be obtained on the wet bulb thermometer. The higher the wet bulb temperature, the greater the heat content of the air and corresponding load imposed on the air conditioner.

The reason for using "Wet Bulb" (WB) and "Dry Bulb" (DB) temperature readings in air conditioning is that from these readings it is possible to determine the quantity of water vapor in the air and also to determine the cooling capacity required to cool the air and reduce the humidity to a desired condition.

Vapor Pressure

The water vapor in the air exerts a vapor pressure dependent on temperature and humidity. There is always a tendency for the water vapor in the air to go from a high vapor pressure area to a lower vapor pressure area. The air conditioner produces a low vapor pressure condition by removing moisture from the room air. The water vapor in the outside air passes through openings and cracks as well as building material by diffusion. A building may be well constructed and insulated, but will nor be able to prevent water vapor from passing through the walls unless it is vapor-sealed.

Figure 7 shows a section of a room maintained at a standard condition $(80^{\circ}DB - 67^{\circ}WB)$ and an outdoor condition of 95°DB 

Fig. 7-Vapor Pressure Difference

It can readily be understood that a tightly sealed air conditioner installation is required to obtain maximum satisfaction from the unit. It is much easier to condition space in a well constructed building than in a building which is poorly constructed or in a poor state of repair.

Psychrometric Chart

The most common way of representing the relationship between the various properties of air is by the psychrometric chart. The psychrometric chart illustrated in Fig. 8 is simple to use in spite of the imposing number of lines and curves that criss-cross its face. Primarily the psychrometric chart shows the relationship between the following factors:

- 1. Dry bulb temperature
- 2. Wet bulb temperature
- 3. Dew point temperature
- 4. Relative humidity
- 5. Moisture content
- 6. Vapor pressure.

If any two of these factors are known, the remaining factors may be determined from the chart. The chart has a large field of usefulness beyond the presentation of these elementary relationships.

The skeleton chart (Fig. 9) illustrates the construction of the psychrometric chart. Lines of dry bulb temperature are vertical and lines of dew point temperature are horizontal. The lines of wet bulb temperature slope downwards and to the right. The curved lines on the chart represent the different percentages of relative humidity. Grains (weight) of moisture per pound of dry air are shown on the ver-

(continued on page 30)



Fig. 8-Comfort and Psychrometric Chart



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Antenna and Transmission Line Length Formulas

In answer to requests for information regarding the lengths of antennas and transmissionline matching sections for specific frequencies, the following table of formulas is given. In all cases, L is the total length of the antenna or line section in *inches*, and F is the center frequency of operation in *megacycles*.

The formulas for antenna length take into account a 5 percent reduction of length due to end effect. Although this percentage is not absolutely exact (the effect depends on the length-to-diameter ratio of the antenna), the figure obtained is a good approximation. The formulas given for 300-ohm line include a correction of 83 percent to take into account the reduction in velocity of wave travel in the ordinary 2-wire polyethylene-insulated transmission line. This percentage represents an average of flat and oval lines made by several manufacturers. The formulas given for coaxial line include a correction of 66 percent, which applies to flexible polyethylene-insulated coaxial lines with impedances from 50 to 75 ohms.

Half wave	Quarter wave
L = 5904/F	L = 2952/F
L = 5609/F	L = 2805/F
L = 4900/F	L = 2450/F
L = 3897/F	L = 1949/F
	Half wave L = 5904/F L = 5609/F L = 4900/F L = 3897/F

M. Snitzer

TVI BOOK

Remington Rand's Laboratory of Advanced Research announces the availability of the new Third Edition of its popular booklet entitled "Television Interference" about August 1, 1953. This new edition, distinguished by its red cover, is almost completely new. It now contains 30 articles dealing with all phases of TVI of which 24 articles are new. Six of the more basic original articles have been retained to make this new edition complete in itself.

The material in "Television Interference" has been reprinted from such leading technical magazines as Electronics, Electrical World, Modern Plastics, Successful Servicing, Service, Popular Science, QST and CQ. Eight of the articles were published in 1953 and 13 in 1952. They are arranged chronologically in the Table of Contents beginning with May, 1953 and ending with December, 1948. In the back of the book there is a three-page bibliography of material on TVI appearing in QST arranged by subject.

The Preface suggests certain articles for study by the TV viewer, TV serviceman, TV engineer, radio amateur, power company engineer, as well as the industrial engineer.

The supply of the First and Second Editions of "Television Interference" has been exhausted since June 1st and therefore, those requesting either of these editions will be sent the new edition.

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Juestions About the Hi-Voltage Section

and

of a JV Receiver!

by John D. Burke

3. Remove a pre-amplifier sub-chassis from Let the chips fall where they may, I feel the back of bracket supporting the yoke. impelled to chop away a bit on some aspects of television hitherto undiscussed. Consider

4. Remove an enclosure surrounding the horizontal amplifier and high voltage rectifier.

5. Completely disassemble high-voltage socket mounting to unsolder filament leads.

6. Move the vertical amplifier output transformer so as to get at some other screws holding down the bracket which enclosed the sponge rubber covered high-voltage transformer.

7. Having unsoldered all connections above chassis, I now had four more wires to unsolder and remove from the clutter under the chassis.

8. Reverse the process - put in now transformer and reassemble the set.

Now - lest you take the above for a joke on the British let me assure you there are almost such awkward assemblies in some American TV sets. Incidentally, after doing all the above, I took the high-voltage transformer out of its sponge-rubber case, and discovered that the whole trouble was just an unsoldered connection on one solder lug. (Note: the reason for the sponge rubber used on some British sets is that the horizontal frequency of 10,125 cps is more audible than the American 15,750 cps and more likely to disturb viewers.)

Discussing this experience with my mates, they showed me how that manufacturer had learned his lesson. In recent models he has the high-voltage transformer so mounted that a new one can be put in - in little more than a few minutes.

High Voltage Rectifier Tubes

Turning to another aspect of the problem, consider high-voltage rectifiers. As we know, the plug-in tube types, such as the 1B3 and the 1X2, are quite convenient for high-speed repair. Quite often the job is done simply by such a replacement.

But, there are disadvantages. Let me call your attention to some of them. For example, when would-be home fixers discover that their high-voltage rectifier is (1) cold, (2) a tube they can pull out and take to a shop to be tested, and (3) a tube they insist on buying and trying even when you advise them their trouble is elsewhere, we are caught between two fires. On the one hand, the more often TV sets break down, the more work we have. On the other hand, when they do break down, it is not good to have to sell people a lot of tubes all at once.

Until I came to England, one of my pet peeves was the introduction by a couple of American manufacturers of the soldered-in type of high-voltage rectifiers. I never had had occasion to change one, but I was sure that such an arrangement was a silly idea, and of no help to the repairman. However, now I have seen the light! These little soldered-in rectifiers are OK. They last a long time. They work very well. And when they need changing, the soldering job is not too bad, provided you are working under favorable conditions.

The English trust these "valves" so much they even bury them in wax in some sets, and drown them in oil in other sets. That is going too far, say I! But, on the whole, they appear to be better performers than the plug-in tubes.

In any case, no English set owner is in a position to carry such a "valve" into a shop to be tested!

Same General Proposals

To wind up, I should like to make some proposals to the set manufacturers.

How about striking a happy medium?

We have learned to work around fly-back generated high-voltage. True, the power-line systems are still lethal, and no relaxation should be made in their safety factors.

But, let us have some protection on flyback sets. No mechanic should be unable to reach freely around inside a cabinet and tap

(continued on page 30)

the high-voltage section in a TV receiver. The Safety Factor

What about the safety factor? Is it possible to get killed by contact with 10,000 to 20,000 volts - developed, it is true, by a relatively low-powered device, the flyback transformer?

If the answer is yes, then why do some TV sets have the high-voltage transformer and rectifier sitting right on top of the chassis, fully exposed? No protective cover, no box, no screws.

If yes, why are some metal picture tubes not provided with plastic shields?

On the other hand, why, if some sets have no safety provisions, do others still have elaborate box arrangements? They drive us nuts with all the screws to remove before we can reach that which other manufacturers place out in the open.

Then again, what about the location of high-voltage assemblies. On the left, on the right, under the chassis, on a separate chassis, etc.

Replacing a High-Voltage Transformer

These thoughts were inspired by a recent experience with an English TV set. A few tests indicated at once that the high-voltage transformer was defective. Quite unaware of what I was getting into, I asked the stockroom man if he had a replacement.

Then it came out. Grins from my shopmates, and the remark of the shop boss, "Oh, I see you are getting into one of those. Sort of an initiation!"

Advice from all sides. The fact dawned on me that this set had been avoided by my buddies for good reasons.

To replace that transformer I had to:

1. Remove chassis from cabinet.

2. Remove picture tube. (The high-voltage transformer was mounted on the chassis directly below the yoke.)

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Mismatched Television Components

(continued from page 13)

The Second Case: Inductance Too High

focusing was marked, brightness dropped considerably, height increased, but width decreased, and horizontal linearity was poor. In addition, neck shadow became somewhat more evident than was normal and the raster tended to pull toward the left. Restoration of the picture to normal appearance was achieved without excessive readjustment of any one control, but consider the number of these that had to be reset in combination: horizontal linearity, width, focus, horizontal centering, horizontal drive, brightness, height, vertical centering, and vertical linearity. In addition, the ion trap had to be repositioned.



(B)

Fig. 4—A,B. Current waveforms in deflection yoke.

Some significant changes were shown by measurements. Those noted here are attributed exclusively to the change in the yoke, since readings taken before and after readjustment of the controls showed little variation. The second-anode voltage went from 15 kv normal to 12.8 kv. Plate current for the output tube rose from 93 to 110 ma. Plate voltage (boosted B-plus) dropped from 360 volts to 310. D-c output from the power supply fell from 300 to 270 volts. All of these represent changes of 10 percent or more. No significant alteration in peak-to-peak value or shape occurred with respect to the voltage waveform at the output-tube plate or the current sawtooth in the yoke's horizontal coils.

It would seem to some servicemen that the above effects are not too serious, particularly since readjustments can be made and changes of only 10 percent occur. It would also seem to some that tolerances for yoke specifications are rather broad, allowing considerable mismatch with little effect on the circuit. Neither of these assumptions are true. Justification for this belief is reserved for the conclusion of this article, but a sweeping statement, to be supported later, is in order here: a replacement of the kind made here is distinctly dangerous. With the original yoke returned to the circuit, the receiver was restored to normal performance. A substitute was then chosen which, again, showed a single deviation from the original. This time inductance of the horizontal windings was too high, being about twice that of the original. When the receiver was put into operation, no raster could be obtained at all. Furthermore, no combination of adjustments of the ion trap and the associated controls could produce any sign of a raster.

A check showed second-anode voltage to have fallen from 15 ky to a few hundred volts. Boosted B-plus (normally 360 volts) and regular B-plus (normally 300 volts) had dropped to the same fractional figure, 140 volts. Evidently boost voltage was no longer being developed. Plate current at the output tube increased from 93 to 120 ma. Waveforms had altered radically in shape, amplitude, and frequency. The normal current sawtooth in the voke and the one noted in the mismatched voke are shown respectively in A and B of Fig. 4. B had less than half the amplitude of A. In addition, it had increased in frequency from the normal 15,750 cps to more than 20 kc. Waveforms at the plate of the output tube are shown in Fig. 5. A was seen when the original yoke was in use; B occurred during the mismatch. B was less than one-fourth the amplitude of A. The increase in frequency, already noted in the yoke, was evident here too.





Fig. 5—A,B. Voltage waveforms at the plate of the output tube.

Generally speaking, symptoms like these have less serious consequences than those noted for the first case. A substitution of this kind, since it obviously cannot be made to work, is not likely to be left in the receiver for any appreciable time. The risk of damage is thereby reduced. These considerations will be evaluated later.



A Signal Tracing Demodulator Probe, etc.

(Continued from page 15)

3. The series connection of the low internal capacitance of D2 with the relatively larger value of C2, places the internal capacitances of D1 and D2 effectively in parallel. This results in more disturbances to the circuits under test than with the demodulator circuit of Fig. 3. In broad-band circuits this does not ordinarly present a problem, especially with the signals found in the i-f amplifier, and in the front end when tuned to the low-band channels.





Fig. 9. Constructional details of the voltage-doubler crystal-demodulator probe

The physical layout of this probe is shown in Fig. 9(A). Constructional details are best left to the devices of the builder. The builder's attention, however, is directed to the detachable arrangement of the probe and cable which is favored by the author. This permits a rapid changing of various probes besides the demodulator probe as the occasion arises. The plug arrangement at the prod end, instead of the usual phone tip, is suggested in order to accommodate the lowimpedance attachment shown in Fig. 9(B). This attachment reduces the input impedance of the demodulator circuit to a value necessary to load down the tuned circuits at the test point during the alignment of a single i-f amplifier stage. In effect, it makes this probe comparable to the ones suggested by DuMont and other manufacturers for the single-stage alignment of their overcoupled i-f amplifiers.

Applications of the Scope Probe

It is customary with most technicians to "play" with newly acquired instruments. The "toy" period in the life of test equipment lasts until the features and characteristics are

fully understood. Demodulator probes are no exception.

A suggested procedure is to make a "pass" with the demodulator probe and scope through the i-f and tuner circuits of the different types of television receivers that pass through the shop until the characteristics of the probe in connection with the various circuits are fully understood. The author's experience can be briefly summarized as follows:

1. The demodulator-probe output is the waveform viewed on the oscilloscope shown

> Fig. 8. Voltage-doubler demodulator probe for the oscilloscope.



(B)

in Fig. 1. This is the composite video signal in its positive pulse phase. Horizontal pulses are attenuated somewhat, as the demodulator probe does not have the frequency characteristics of a video detector. Furthermore, in the early stages of stagger-tuner circuits, the demodulator probe does not "see" the full video i-f bandpass which appears at the videodetector input,

2. A video-signal waveform can be obtained at the input of any stage between the second-detector input and the transmission line at the antenna terminals. Waveforms obtained from unterminated transmission lines may lead to unwarranted conclusions however.

3. Signal amplitudes at the antenna terminals in some local areas may cause the scope pattern to deflect off the screen of a 5-inch tube in a 20 mv/in oscilloscope with the vertical-gain controls wide open. Other areas may not fare as well.

4. Waveforms obtained in the tuner, and even in the 1st i-f stage may have less amplitude than those obtained at the antenna. This is due in part to the detuning effect of the probe, and to the agc action in the preceding

and respective stages under strong signal conditions

5. To obtain a satisfactory waveform at the mixer grid, the r-f oscillator should be disabled without effecting mixer operation.

6. It is imperative when probing in lowlevel stages, to connect the ground lead on the demodulator probe to a ground point at the stage under test. Do not rely on a common ground lead from the oscilloscope to the receiver chassis.

During the initial period of familiarization, it may be well if the probe were to be used in connection with some of the more obvious troubles in the video strip. In many cases, as long as the chassis is up-ended on the bench, a pass through the video strip with the probe will localize the defective stage in faster time than could be accomplished by the usual tube substitution and circuit disturbance tests.

As the technician becomes more familiar with the use of the demodulator probe and oscilloscope combination, he will find it of inestimable value in tracking down intermittents, or obscure sync troubles which have their origins in i-f and agc circuits.

Finally, he may devise special troubleshooting techniques of his own. Consider the audio i-f amplifier of an intercarrier receiver. Unlike the situation in a dual-channel receiver, this circuit amplifies a signal with considerable a-m component. The presence of the vertical sync pulse in the ratio-detector circuit will suggest to the progressive technician not only a means of signal tracing intercarrier sound i-f circuits, but a way of coping with excessive intercarrier buzz.

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Rider Manual pages and TEK-FILE pack The which include the original data and shematics to which the following production changes apply, appear in the index on page 32 of this issue.

MODEL 116 STROMBERG-CARLSON

Tube substitution.

Chassis of later production have been fitted with octal sockets to employ 6SN7GT tubes in the three positions where 12AU7 tubes were used previously. These three positions are (1) V7, the d-c restorer and sync-clipper stages, (2) V1, the vertical-sweep output stage and (3) V22, the sync clipper and vertical sweep-oscillator stage.

· No circuit modifications are required to accommodate the 6SN7GT tubes in these positions except the necessary wiring revisions to the correct terminals of the octal sockets.

STROMBERG-CARLSON

MODEL 317 series

Tube location revision.

On the tube location diagram and voltage chart for the above series of models, the positions of V12 (the 6AU6 ratio detector drive) and V16 (the 6AU6 keyed agc tube) are shown interchanged. The position of V12, its function and description, should be in the V16 position and vice versa.

Also, on the tube location diagram, the functional description of V15 (a 12AU7) should be labeled "Noise Reference and Retrace Horizontal Blanking." STROMBERG-CARLSON

MODELS TC10, TC125

Horizontal-output transformer substitution.

The horizontal-output transformer (part No. 161028) used in TC125 series "O" models, can be used in TC10 and TC125 receivers where part No. 161016 was originally used. When substituting part No. 161028 for part No. 161016, the following wiring changes must be made:

1. Connect terminals No. 5 and No. 7 together, with a piece of insulated hook-up wire, in the No. 161028 transformer.

2. Dress this connection so that there is at least one-fourth of an inch of spacing for intervening terminals.

3. Make all other connections as if wiring in a No. 16101 transformer.

STROMBERG-CARLSON MODEL TC125

Focus coil changes.

In the L31 position, focus coil assembly part No. 114660 is used when a 12LP4 picture tube is employed; and focus coil assembly part No. 114661 is used when a 12KP4 or 12QP4

(continued on page 26)





and High Fidelity

Television has become the darling of more than 23.000.000 TV set owners. But it's a bugaboo to the motion picture industry, which thinks they have the antidote in 3-D, three dimensional pictures.

While television and motion pictures both have their millions of devotees, there's a new group growing, not quite so numerous, but equally as enthusiastic. These are the audiophiles or high fidelity fans.

And you can't blame them either because high fidelity in the home is doing for sound reproduction what 3-D is doing for motion pictures. Hi-fi is opening the door to a new concept of music in the home.

And it's going to get tremendous support in the near future-almost immediately-the biggest names in receiver production soon will be waving hi-fi banners.

From all indications, the enthusiastic turnouts for audio fairs in New York, Chicago, and Los Angeles show that high fidelity is here to stay. More and more, quality component manufacturers are rushing into production units for high fidelity systems. More and more, electronics parts distributors and music dealers are installing audio salons so that the public can sit and listen to good music and decide for themselves the difference between ordinary and high fidelity reproduction.

Anyone can make his own test in his own home with his own equipment and determine if he is receiving the full measure of reproduc tion he is seeking. There's a big difference between ordinary and high fidelity reproduction. The hi-fi fan can detect it on his own equipment if he listens selectively.

Owners of the book HIGH FIDELITY SIM-PLIFIED are told to listen with discrimination when they test their present equipment, or

PILOT

equipment they intend to buy. In fact, a special record is furnished each purchaser of the book so they may make the test. Here are the questions the book asks the reader.

'Do you hear cymbals as a crashing sound followed by a sustained shimmering? Do you hear the triangle as a clear-ringing sound? Can you actually feel the vibration of the tom-tom, the bass drum, or the lowest note of the organ? A staccato passage in a piano solo should be crisp and clear, each note standing out by itself. Do you hear it that way? Does your system sound well at low volume or is it necessary to increase the level before the reproduction is fairly good? Although they are near the opposite ends of the range of strings, can you always differentiate between the violin and the violoncello? Can you tell the difference between string bass and brass bass?"

. . .

Yes, high fidelity is coming into its own. Sales for the various units that compose a home high fidelity system are increasing daily. While there are many sources for selling these units to the public, there are a limited number of establishments for servicing this equipment.

The radio and TV service technician is the ideal individual to logically step in and repair high fidelity equipment. However, he must have some background if he is to successfully compete. HIGH FIDELITY SIMPLIFIED, by Harold D. Weiler enables the service technician to become fully acquainted with high fidelity in that it explains all hi-fi terminology, basic units of a high-fidelity system, and how high fidelity may be used in the home. The best way to learn about this fast growing public activity is to read this best-selling book. Buy HIGH FIDELITY SIMPLIFIED and pave the way for a profitable "extra" to your TV and radio servicing income.

Television Changes

(continued from page 25) MODELS TV271U, TV273U, TV275, TV291U, TV293U, and TV295

Pack 53 Vol. 9 - 1-14 The basic chassis used in the above models is the same as that used in Models TV271 and TV273. For complete service information on this chassis see Tek-File pack 53 and TV Manual, Volume 9, pages 1-14

MODEL 317 series Pack 15 Vol. 8 - 1-8

STROMBERG-CARLSON

Removal of horizontal-size potentiometer.

On all the above receivers date coded 51-32 and later, the horizontal-size potentiometer has been repositioned to the rear chassis flange so as to be accessible for adjustment from the rear of the receiver.

A SMASH SUCCESS with the reviewers

HIGH FIDELITY SIMPLIFIED "....fulfills its title"

RADIO & TELEVISION NEWS

February, 1953, says:

... those planning high-fidelity music systems for their homes will save themselves time, money and trauble by reading this book first then making their purchases."



bia Records, inc., each purchaser of this book can procure for only 25 cents a 7-inch long playing test record recorded on two sides.

Excerpts by the Philadelphia Orchestra, the Orchestra of the Metropolitan Opera Association and Andre Koste-Upera Association and Andre Kosie-lanetz and his orchestra. Also ex-cerpts from selections of prominent soloists. Offer expires September 1, 1953.

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REPLACEMENT PARTS, Etc.

(continued from page 9)

amples of these are i-f, r-f and a-f transformers. Finally other transformers function simply as links between a vacuum tube and the device which is the load of the vacuum tube, and so enable the most effective transfer of energy between the vacuum and the load. When identified, such transformers are generally called output transformers, which function embraces the action of impendance matching. Each of these types establishes a category which will be dealt with individually in this series.

Power Transformers

The general category of power transformers can be sub-divided into three groups, although only two of these find application in television receivers. The three groups are:

- A-Plate and filament transformers
- B—Filament transformers C—Plate transformers

These names are completely functional and identify the device in two ways. One is in terms of the use to which the voltage and current available from the transformer is put; and the second gives some, but not complete, indication of the number of secondary windings which are to be found on the transformer. Every transformer has a primary winding, which in almost all instances is singular in



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number. The rare exception has two primary windings. For the moment we shall neglect this special variety. On the other hand multiple secondary windings are common.

For example the name filament and plate transformer immediately indicates that the device is related to two functions and apparently is capable of furnishing at least two different values of voltage. The plate reference implies high voltage for application to the plate or plates of the rectifier tubes in a power rectifying system, and the filament reference implies a low voltage for application to the filament or heaters and one or more vacuum tubes. This form of identification is, of course, very limited. While it has a functional meaning it does not in any way indicate the value of the high voltage available from the plate winding, or the amount of current which can be supplied by that winding at whatever may be its voltage rating. Neither does it state whether the transformer has one or more plate windings, or if the plate winding has a center tap. In similar fashion the reference to the filament in the identifying name of the device does not state the electrical contants of the winding relative to voltage or current, nor does it state whether one or more such filament windings are in part of the transformer. Hence, the full identification of a transformer which is capable of furnishing plate voltages to a rectifier system and filament voltages, requires specific details concerning the current and

voltage output of each and the number of windings.

The name filament transformer as another variety of transformer is a form of identification but once more it has a limited use, serving simply to stipulate that the transformer furnishes *only* filament voltages and does not afford a high voltage for application to a power rectifying system.

The plate transformer on the other hand is one which affords a high voltage for application to a rectifying system, but does not furnish any low voltages to serve the heaters of the vacuum tubes. We shall refrain from further reference to the plate transformer because seldom, if ever, is it used in a television receiver. Our discussion of power transformers will therefore be limited to the combination filament and plate variety, and to the filament voltage source device.



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- SYLVANIA—Added Receiving Tubes 1AX2 at \$2.55 list; 6CL6 at \$3.15 list; 6CM6 at \$2.20 list; TV Picture Tubes 24CP4 at \$71.00 dealer net; 24VP4 at \$71.00 dealer net; 27EP4 at \$118.00 dealer net; 27LP4 at \$118.00 dealer net. TELREX-Added several new UHF Antennas. TRANSVISION-Added several new television as-
- sembly kits. TRIO MFG.—Added several new UHF Antennas.

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- RADIO APPARATUS CORP.—Discontinued Model M-51 FM Receiver.
- RECORDISC CORP.—Discontinued Record Preserver; Turntable Lubricant; 1 Hour Recording Wire Spool.
- SIMPSON ELECTRIC-Model 266 Vacuum Tube Voltmeter has been discontinued.
- SOUTH RIVER METAL PRODUCTS-Discontinued Model WB-6 SPEC Wall Bracket.
- TRANSFORMER-Discontinued Model UNITED TRANSFORMER-V-4 Varitran Control Unit.
- VARI CORP.-Discontinued Model R-115-A Vari-Hot Electric Soldering Iron.

Price Decreases

- CORNELL-DUBILIER—Decreased prices on several vibrators. Also decreased prices on Model U-4 UHF TV Antenna to \$4.77 dealer net; Model LDX-1 Indoor Antenna to \$3.57 dealer net.
- FRETCO—Decreased price on Model MR-C Corner Reflector to \$7.50 dealer net. GENERAL ELECTRIC—Decreased prices on TV Picture Tubes 10BP4A to \$20.50 dealer net; 20DP4A to \$38.50 dealer net; 24AP4 to \$83.00 dealer net.
- NATIONAL UNION RADIO—Decreased prices on one 16"; five 17"; two 20"; five 21" TV Picmre mbes.
- PACIFIC TRANSDUCER—Decreased price on Mo-del 221 Four-Position Equalizer to \$8.64 dealer net.
- RCA—Decreased the dealer return allowance on TV Picture Tubes 16AP4-A; 16GP4; 16GP4-B; 19AP4-A; 19AP4-B; 20CP4; 20MP4; 21AP4: 21MP4.
- SYLVANIA—Decreased price on Special Purpose Tube 7AK7 to \$7.25 dealer net. TELEMATIC INDUSTRIES—Model AM-44 TV Re-ceiver Coupler decreased to \$2.14 dealer net.
- TUNG-SOL ELECTRIC—Decreased prices on Re-ceiving Tubes 6SA7GT to \$1.80 list; 12SF7GT to \$1.90 list; Special Purpose Tube 5654 to \$4.75 list.
- VIDEO INDUSTRIES—Decreased price on Model 103 Fan Antenna to \$3.38 dealer net.

Price Increases

- CHICAGO INDUSTRIAL INSTRUMENT-Increas-ed prices on Simplex Volt-Ohm Milliammeters Model 312 to \$9.00 dealer net; Model 371 to \$7.00 dealer net.
- CORNELL-DUBILIER-Increased prices on several vibrators.
- GENERAL ELECTRIC—Increased prices on Indus-trial and Transmitting Type Tubes GL-5674 to \$100.00 dealer net; GL-5740/FP-54 to \$88.00 dealer net; GL-6044 to \$56.00 dealer net.
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- safety case to \$/0.00 dealer net. SOUTH RIVER METAL PRODUCTS Increased prices; Model ZM Chimney Mount with 12 foot galvanized strap to \$1.45 dealer net; Model DM-LKK Duo-Mount Antenna Base to \$2.25 dealer net; Model SN-50 Chimney Mount to \$2.25 net; Mode dealer net.
- SYLVANIA—Increased price on Receiving Tube 6BK5 to \$2.55 list; TV Picture Tube 7JP4 to \$21.50 dealer net.
- VIDEO INDUSTRIES-Increased price on Model 105 Inline "V" Antenna to \$3.32 dealer net.

Correction Notice

EITEL-McCULLOUGH—has not discontinued but withdrawn the following: No. 6C21 vacuum tube; Model HV-1 vacuum pump; Pump Oil for Model HV-1; Vacuum switch coils 12V and 24V.



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Some Thoughts and Questions, etc.

(continued from page 19)

tubes, pull tubes, make adjustments, etc. with the set turned on.

Therefore, all exposed sources of shock should be covered in some simple and easily removable fashion.

This includes metal picture tubes. Cover them with plastic.

It includes the top caps of horizontal-amplifier tubes, and fuse holders as well.

It includes all solder lugs liable to be touched accidentally while reaching around inside the cabinet.

Certainly any manufacturing design engineer can easily apply the above common-sense tests to any chassis, and solve the problem.

If the manufacturers' main concern is the prevention of radiation from the horizontal amplifier, with some using boxes and others using shielding inside the cabinets, they ought not forget us repairmen. Make the chassis safe and easy to work around without worrying about shock, but at the same time, make the shielding arrangement easily removable so that we can get inside if we have to

We have come a long way since the introduction of the relatively safe fly-back system. All of us recognize the big advances which have been made in getting higher and higher voltages, better sweep and linearity, greater reliability. All I ask is that the repairman not be forgotten.

Basic Principles, etc.

(continued from page 17) tical axis on the left side of the chart. (7000 grains is equal to one pound)

The wet and dry bulb temperatures can be measured with a psychrometer (wet and dry bulb thermometer). Knowing or assuming the following two conditions, all others may be found by use of the chart as described below.

DRY BULB TEMPERATURE-Follow vertically up from "Dry Bulb (DB) Temperature -Degrees F"

WET BULB TEMPERATURE - Follow wet bulb line-sloping downward to the right from "Wet Bulb and Dew Point Temperatures." (Refer to Fig. 10.)



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The point of intersection will indicate the RELATIVE HUMIDITY (curved line).

Following horizontally to the left from the point of intersection to the "100% Relative Humidity" curve will indicate the DEW POINT TEMPERATURE. (Refer to Fig. 11).

Following horizontally to the right from the intersection to "Weight of Water Vapor in One Pound of Dry Air" will indicate MOIST-URE CONTENT and VAPOR PRESSURE. (Refer to Fig. 12.)



Fig. 9.-Skeleton Psychrometric Chart



Fig. 10-Dry and Wet Bulb Temperatures



Fig. 11-Dew Point Temperature



ELL-A-FAULT Symptom Sheet

LOSS OF HORIZONTAL SYNC



FIG. 1

(NOTE: Refer to CIRCUIT GUIDE IV-1 for identification of components.)

Fig. 1 shows an unstable picture-tube pattern indicating loss of horizontal sync. In this case, it was possible to obtain the normal pattern shown in Fig. 2 by adjusting the horizontal-hold control (R2) to its extreme counterclockwise position.



FIG. 3

ABNORMAL





NORMAL

FIG. 4

NORMAL











The waveform at the horizontal-sync take-off point was normal. An oscilloscope was connected to the plate of the horizontal-oscillator tube (V2) with its internal sweep adjusted for ½ the horizontal scanning rate. The abnormal waveform shown in Fig 3. occurred. Compare this with the normal waveform which appears in Fig. 4. Note that the thin, horizontal pulses in the abnormal waveform have a greater relative amplitude than in the normal waveform and that the high-frequency damped oscillations continue for a somewhat longer period of time in the abnormal waveform. The peak-to-peak amplitude of the abnormal voltage was about 1.5 times that of the normal voltage at the same point, and the d-c voltage was constant.

A scope connected to the center-tap of *L1* and adjusted as above displayed the abnormal waveform shown in Fig. 5. The normal waveform is shown in Fig. 6 for comparison. Note the high-frequency oscillations that are superimposed on the waveform which seem to give the abnormal waveform a ragged appearance. The peak-to-peak voltage of the abnormal waveform was about 30% higher than the normal value, while the d-c voltage was constant at this point.

The receiver fault responsible for the above effects was an increase in the value of R13. As a result, less damping of the shock-excited oscillations in the blocking oscillator occurred.

Summunumunumunum

Comments on Rider's Sectionalized TV Manuals

We have received numerous communications since the publication of the sectionalized Rider TV Manual, Volume 11. Many owners of this volume have expressed unhappiness over the sectionalization of the receiver manufacturers. Please believe us when we say that we would have preferred it otherwise. It was a sincere attempt to incorporate the maximum amount of service information in one volume.

All receiver manufacturers do not release their service manuals at the same time. Sectionalizing the volume enabled us to include manufacturers whose names begin with letters in the front of the alphabet after previously received data had already been sent to the printer. Witness the Admiral service data in section IV. This was received approximately two weeks before we went to press. Had the manual not been sectionalized it would have been impossible to incorporate it. The same applies to RCA, Raytheon, and other manufacturers included in section IV. However, our primary concern is to please our service technician customers. If it is the opinion of Rider TV Manual buyers that we should not sectionalize the manual, the forthcoming Volume 12 will be organized in the fashion that we have been using for years. Please let us know your comments. Thank you.

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The individual who has had factory training in the servicing of a particular brand of television receiver is acknowledged to be able to demonstrate superior skill in the diagnosis and correction of faults in that receiver. Many such men are functioning in the servicing industry; some of them in receiver distributors' service activities. It is the problem of the independent service technician handling all brands of TV receivers and who has not had such specialized training, to compete with the individual brand specialist.

The independent must deliver comparable service. He must display equal familiarity with the contents of each of these particular brands of products even though he sees the receiver for the first time when it appears on his bench.

How can this be done most easily? ... By the simplest of means ... By working with the same information which is available to the set distributor — to the factory controlled service facility ... This is the information in Rider TV Manuals ... Anything less places the independent service facility at a competitive disadvantage.

The whole thing is as simple as 2 plus 2 equals 4. The TV receiver manufacturer is not keen on being in the TV servicing business. He feels he must do certain things to protect his reputation and the hundreds of millions of dollars worth of receiver sales. Given adequate independent servicing facilities (which incidentally is on the upgrade,) set distributor and other factory participation in public TV servicing will decline . . . The independent servicing facility is in a position to dominate the servicing effort if it founds its capability on accurate-complete knowledge. This it can do if it uses the same information as the receiver manufacturers - as the receiver distributors - as the factory-controlled service facilities.

Two avenues of securing this information exist... One is the receiver manufacturer the other is Rider TV Manuals. The latter is the same as the former — except that it is a complete service with the data filed and indexed and easy to use. In this respect it is more economical to procure and use than if the information is obtained gratis from the different receiver manufacturers. The point we wish to make is that the welfare of the nation's independent TV servicing rests on its ability to do a competent, rapid and efficient servicing job, one which will stand up in comparison with those rendered by organizations which have affiliations with the receiver manufacturers . . This can't be done by working with limited or abridged servicing information . . . Everything known by a set distributor about a TV receiver should be known to the independent service technician. Everything known to a factory controlled service facility —or a set dealer's service facility, should be known to an independent service facility. . Rider TV Manuals furnish this background.

Attention Service Technicians

in the Metropolitan Area

Effective April 24, 1953 John F. Rider Publisher Inc., discontinued over-the-counter sales of the Individual Diagram Service.

For an indefinite period of time, service technicians requiring servicing information on individual receiver models may *mail* their requests to 480 Canal Street New York 13, N. Y.

TEK-FILE, Rider's monthly service data on TV receivers may be purchased from any Rider distributor in the area. This is the ideal method of securing the latest in complete TV servicing information. Free TEK-FILE indexes may be obtained from Rider distributors or directly from the publisher. New indexes are published every other month. See your Rider jobber for future editions of the TEK-FILE index, or write to us.

We regret the necessity of discontinuing the over-the-counter sales division of the Rider Individual Diagram Service.

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Rider Tell-Fill gives you Complete parts lists and values

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Servicing with Tex-File MOEK **CROSS-BAR** TV TEST PATTERN GENERATOR

by M. E. Blaisdell

(This article may not be reprinted without written permission of the author.)

SUCCESSFUL

Every radio and ty technician knows the value of a signal generator. Here is a generator (see Fig. 1), constructed by the writer, that provides several signals, one at a time or both together for the proper adjustment of linearity controls and for localizing common trouble in sweep circuits of television receivers. These signals produce a series of horizontal and vertical lines or bars that are equally spaced when the linearity controls are properly adjusted. Signalinjection tracing may also be accomplished from antenna to picture tube or speaker. This instrument is especially useful because of the lack of a station test pattern at many times. The use of people or objects that are televised as a reference for the adjustment of linearity controls is not satisfactory, as these objects are in motion and of irregular shapes. Servicemen may put their own test pattern on the screen with this unit, whether or not a tv station is on the air. The gener-



Fig. 1. Photograph of cross-bar TV test pattern generator.

ator contains a master carrier oscillator which is variable and may be set to any desired low-band channel (2 to 6). The harmonics may be picked up from channels 7 to 13. A quick and accurate adjustment of television receiver controls can now be made when the cross bars are evenly spaced. The instrument also provides for the injection of horizontal and vertical sweep signals into the sweep circuits of the receivers.

Some features of the cross-bar generator, whose schematic diagram is shown in Fig. 2 are as follows:

1. Horizontal lines - 6 to 14 (variable) 2. Vertical bars - 9 to 10 (fixed-trimmer adjusted)

3. Carrier oscillator - (variable channels 2 to 6, 7 to 13 by harmonics)

4. Vertical sweep output (60-cycle output) 5. Horizontal sweep output (approximately 15,750-cycle output)

Construction Details

The cross-bar generator can be built inexpensively from junk-box parts or parts may be purchased at reasonable cost. Any metal cabinet and chassis can be used, provided sufficient shielding is utilized both above and below the chassis. A handle may be attached to the top of the cabinet for ease in carrying. The entire unit constructed by the writer and shown in Fig. 1 measures 101/2" x 51/2" x 5".

Shielded wires are as shown in the schematic diagram, and all other wires are kept short and are dressed close to chassis.

The heater choke coils (RFC1, 2, 3) are wound on 5-meg, 1/2-watt resistors. The carrier oscillator plate choke (RFC4) is wound on a 3/8" polystyrene coil form which is placed directly over the 6T8 tube socket. Care must be taken that the coil does not touch the underside of the chassis. A 2.5millihenry, 4-pi r-f choke is used as the vertical bar oscillator coil (#1) in a Hartley circuit with 10 feet of wire removed from the high end and tapped between the first and second pi's from the ground end, The horizontal line oscillator uses an interstage plate to push-pull grid audio transformer in a variable feedback circuit. The carrier oscillator is also a Hartley circuit. The oscillator coil (#2), is space-wound on a 1/2-inch ceramic or polystyrene coil form with 16 turns of #20 enameled wire, tapped at the 4th turn from the ground end. This coil is placed on top of the chassis.

A 2-pole, 4-position switch (S3), gives the technician his choice of horizontal lines,

(continued on Page 8)



Fig. 2. Schematic diagram of cross-bar TV test pattern generator.

We BELIEVE Norman Foster's recent advertisement in the Chicago "TV Guide" is of interest to the entire television and radio industry. Consequently, with Mr. Foster's permission, we are reprinting it here as a public service for every television and radio service technician in America.



2

UNFORTUNATELY

Because of the Greed of a Few.

NORMAN FOSTER

THE ENTIRE TV SERVICE INDUSTRY MUST SUFFER

HERE IS WHAT I HAVE DONE TO GUARANTEE YOU HONEST TV SERVICE

1. The name, Foster Television is not taken from a street, a deck of cards, or a country, and it is not an adjective. It comes from the name of its sole owner, Norman Foster. I have spent 22 years in the Radio, Electronics and Television service business, and in these years I have worked for just about every type of Operator, good, bad and indifferent. When the time came that I could open my own business, I decided that because of the reputation that the Radio and Television repair business has always had, a company operating so honestly that they could invite their customers into the shop to watch their work being done could be a success. The volume of business we did last year proves I was right.

2. The reason that a service man would attempt to sell you something you do not need is because he had something to gain personally. Many Television service operators hire men, driving their own cars, on a percentage basis. This is advantageous because the service company can be in business with practically no investment. Under these conditions if this man needs money, it's only human nature that he is going to want to do the thing to your television set that will make him the most money whether it be 5 tubes or haul it to the shop.

3. Every man that I have, works by the hour and punches a time clock. He drives a company owned new truck bearing my name and his equipment and uniforms are furnished to him without charge. He has orders to repair your set in your home whenever possible. He receives the same amount of money whether he repairs 1 set or 10, and whether he charges \$1 or \$10. His rate of pay and his advancement are based on the number of sets he can repair in the home.

4. Our service call price is a flat \$3 and covers all labor necessary to make any repair possible in your home except cleaning a screen, for which we charge \$1 extra. It is evident that on this basis we do not make money on every job, but with the large volume of business we do, it has averaged out to a modest profit at the end of the year. You can bring your set into our shop and not only save this service charge, but also see it repaired while you wait. There is no minimum charge on this service. You pay only for the actual time spent on your set. 5. How fast can service be? I have a large fleet of trucks operating throughout Chicago from 9:30 A.M. to 11:00 P.M. I do not advertise one hour service and I do not believe that anything but a coincidence could give such fast service. Because it is impossible to predict in advance how long each job will take a man, the best we can do is to offer same day service. Occasionally at this time of the year, bad weather causing slow driving, makes it necessary to postpone calls received late, until the next day.

SPRAGUE PRODUCTS COMPANY (Distributors' Division of the Sprague Electric Company) Narth Adams, Massachusetts

6. Quality of parts. I use only nationally advertised tubes and parts. Every tube I sell is new, fresh and cartoned, bearing a name and a date, and is coded by the manufacturer to indicate that it is a tube manufactured and guaranteed for replacement use. I do not use bulk or surplus tubes. Every picture tube I sell bears a serial number and has a factory registration certificate to guarantee that it is a new first quality tube. I do not sell rebuilt or rejuvenated picture tubes. I use only Sprague plastic sealed condensers, which are far superior to the parts used in many TV sets.

7. I guarantee every part I replace for 90 days. If a part or tube I have replaced fails, it is replaced at absolutely no charge to you. Our guarantee is further underwritten by the American Mutual Liability Insurance Co. by arrangement with the Raytheon Manufacturing Co.

8. I have not satisfied everybody and I do not claim to. I cannot repair a set that needs a new picture tube for \$3 and I cannot give a \$60 service contract with each call. Nothing less would satisfy certain people. However, if you hear a complaint against Foster Television, that same person will generally have one against the plumber, the auto mechanic, the dentist and nearly everyone else who is unfortunate enough to do business with him. I need and value your patronage and I will sincerely respect it.

Roman Faster



Please mention Successful Servicing when answering advertising.

The apparent simplicity of the average 1.4-volt battery radio can be deceiving to the uninitiated. In servicing them a somewhat different approach is required and the following factors should be considered:

1. For battery economy very light drain tubes are used. These are necessarily lowgain types compared to ordinary a-c filament tubes.

2. The number of tubes is limited so that the radio must be operating at peak efficiency.

3. Battery sets are used in areas not serviced by a-c power, which usually means they are remote from broadcast stations.

4. Many are used in rough and rocky country where daytime reception falls off rapidly with distance.

5. Most important of all, battery voltage drops gradually with use. The radio must operate efficiently throughout the usual life of the battery.

This brings up a point which has not been sufficiently stressed. Battery-type tubes will test OK in a tube tester and operate satisfactorily in a receiver at full filament voltage but weak tubes will not when the Avoltage is reduced to 1.25 volts and below.



Fig. 2. Schematic diagram of B-battery eliminator.

a four-tube set with a 100-ma output tube filament requirement should draw 250 ma at 1.4 volts. A tube with an open filament makes no change in drain (as indicated by milliammeter) when the tube is removed. The voltmeter is useful in measuring the A-voltage applied.

Another useful device in servicing battery sets is the B-battery eliminator whose schematic diagram is shown in Fig. 2. A photograph of this unit as constructed by the writer is shown in Fig. 3. The eliminator not

Servicing Hints For

FARM BATTERY RADIOS

by John A. Dewar

The following effects are noted with weak tubes:

1. Converter tubes (1R5, 1A7, 1LC6, etc.) stop oscillating.

2. Output tube emission drops resulting in distortion and poor tone,

3. R-f and i-f tubes lose gain; the reception is poor. Therefore, all battery radios should be checked at low A-voltage, say down to 1.1 or 1.2 volts. Otherwise the customer will be throwing away batteries which have months of useful life when he really needs new tubes. Figure 1 shows a useful setup for reducing A-voltage. The milliammeter indicates immediately if any tubes are burned out. By simple mental arithmetic



only shows at a glance the plate current drawn but, most important, if the B-supply is accidentally shorted to the filaments in testing, all the tubes are not blown out.

Alignment. I have found that country people are notorious tinkers and cannot resist a twiddle at the aligning screws. If the set will not operate for any obvious reason, check the alignment with the signal generator. It may be so far out that a station will not come through.

Aside from weak tubes probably the most common fault is an electrolytic capacitor which has lost its capacitance. All sets have an electrolytic, usually about 10 μ f at 150 volts, bypassing B+ to the chassis. A dried-





out capacitor has two effects depending on the circuit — the i.f.'s oscillate, or degeneration takes place, leading to weak signals and distortion. It is surprising the number of sets I have found where the i.f.'s were thrown out of alignment by some screwdriver mechanic to stop the i-f oscillation.

Lightning. Since aerials in the country pick up large electrostatic charges due to lack of lightning arrestors, burned out or scorched antenna coil primaries are fairly common. Frequently scorched insulation cannot be detected visually but a loss of Q results in poor performance. A new antenna coil will have to be substituted to check.

Antennas. In low signal strength areas a good aerial and ground are essential. In many sets with loops the addition of an aerial throws the antenna stage out of align-



Fig. 3. Photograph of B-eliminator constructed by author.

ment so that it will not track with the oscillator. This results in serious image and oscillator harmonic interference with even short-wave stations riding in on the broadcast band. Replacement with an adjustable iron-core antenna coil is advisable. Since loops are low Q devices, a good antenna coil is an improvement in any low signal strength district, increasing gain and selectivity.

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300 ohm terminal impedance... measures 12 x 12 x 15 inches. Here is another ORIGINAL... entirely NEW UHF TV antenna that far excels anything yet seen! It is a completely balanced broad band antenna covering ALL channels from 14 to 82 and terminating in 300 ohms with a very low voltage standing wave ratio! Some of the features include:

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- Minimum wind resistance, (a dauble stacked UW-2 affers less wind resistance than many single bay antennas).
- The UW-2 assumes NO patential difference between itself and the mast, allawing MAXIMUM lightning pratectian when the mast is graunded.
- COMPLETELY FREE af insulatars and their affending results.
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Curtain Time

Hi-Fi and the FM Stations

The rising interest in Hi-Fi offers an opportunity for the FM stations of this nation to recover their listening audience. These stations have not done too well over the years. They have had an audience, but certainly far below that which was expected when the FM station went on the air.

What with the whole electronics industry aiming its sights at Hi-Fi, the FM station is the means for getting the kind of music that falls within this category into the homes of the Hi-Fi enthusiast. The AM station can't do it because the frequency range transmitted is too limited.

Also of interest is the opportunity being presented to local parts jobbers who are selling Hi-Fi equipment to advertise their wares on FM stations. Station rates are low and, with the pin-pointed audience covered by these stations, little of the audience coverage is wasted. Many large receiver manufacturers have declared that they will be making Hi-Fi equipments. They too could use the FM stations to good advantage.

Tailor Made

We have felt for a long time that replacement parts sold to the servicing industry through parts distributor channels should be the equivalent of the original parts put into the receiver by the receiver manufacturer. Nothing less than this equivalence is justified. There is every reason . . . moral and financial . . . why this should be so. Whatever may be the reason in back of a choice made by a receiver design engineer for the selection of a certain constant and a certain component characteristic, that same constant and characteristic should, within reasonable tolerances, be found in the part sold to the service technician as a replacement. If one component is a replacement for another, the two should be alike within reasonable bounds.

Now that almost a year has passed since we started the Rider Replacement Parts Program, it is with much pleasure that we note the adherence to original equipment tolerances in the replacement parts made by the manufacturers with whom we have been working. More and more replacement parts are being tailor made to fit all needs.

Progress is being made all along the line. The fact that replacement parts are subject to less fabrication in order to make them fit a space, and that their performance characteristics more closely satisfy the receiver's design needs, should prove a boon to the service technician. Having only time and knowledge for sale, he has no time to waste when completing a replacement.

We are indeed happy to note the appearance of much closer tolerances for fixed capacitors for replacement purposes than existed before the start of our program. The receiver manufacturer has been using them for a long time; now the capacitor manufacturers with whom we have been working not only are making them for replacement purposes, but some have actually set up a new parts number coding for accurate identification.

Inductor type components which satisfy the physical and electrical requirements of original receiver equipment designs are appearing in increasing numbers as replacement items. As might be expected, these apply more to those receivers which have been sold in greatest quantities to the nation's population; however, the receivers sold in moderate quantities are not being neglected.

So, all in all, we take this opportunity to say thanks to those parts manufacturers with whom we have been working, thanks for their cooperation in enabling us to fill spaces in the replacement parts columns, thereby enabling the nation's TV service technicians to get what they need to keep America's TV receivers in good repair.

Thanks also to all the receiver manufacturers of America for the cooperation they have, and are, extending to us in our effort to establish a parts replacement situation which will function to the best interests of the receiver owner and the TV service technician . . . thereby enabling the creation of harmony between the two which, in the long run, results in maximum benefits to the receiver manufacturer . . . the parts manufacturer . . . the parts distributor . . . and in general to the entire radio and television industry.

TV Antennas-Who Has An Idea?

It is indeed unfortunate that the television industry, especially the TV antenna manufacturer, parts distributor, and service technician, are unable to conceive a plan which will convince the public that TV antennas which have seen years of service require replacement before they fall apart.

A receiver owner gets a good deal for the money he spends for an antenna installation; but, no matter how well it is put together, the ravages of the weather during two or three years of exposure greatly decrease the overall efficiency of an antenna and transmission line system.

Admittedly the deterioration is progressive, and while reception may be getting worse each day, it passes unnoted, until one day a corroded connection opens or an element breaks off. Then and only then is the public receptive to replacement.

It's hard to say how many millions of TV antennas still in use should have been discarded a long time ago. A safe guess is several million, if not several times that amount. If only it were possible to conveniently demonstrate to the receiver owner the difference between the performance of a new antenna and transmission line and the erratic performance of one which has become corroded, is leaky to ground, has connections covered with soot and grime, or a transmission line with cracked insulation, or which is water logged . . . in every respect an inefficient signal pick-up and delivery system.

We cannot help but wonder if the increase in TVI in many parts of the country where TV has been in effect for a number of years is not due to the reduced effectiveness of the antenna system, and possibly to the rectifying effects of bad connections. Isn't it possible that some of the complaints which arise concerning the gradual increase in instability of a TV receiver with age, might be due to a gradual decrease in the signal pick-up effectiveness of the antenna, and to the harmful effects of a deteriorating metal structure? We wonder.

John F. Ridor

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Refrigeration And Service Procedure For

This is the second of three articles. The text and illustrations are reprinted through the courtesy of the RCA Service Co. from their booklet entitled "Introduction to Room Air Conditioning."

Definition of Refrigeration

Refrigeration is the process of extracting heat from a body or substance. This may be done by keeping the temperature of its surroundings below that of the body or substance itself. Heat transfer will take place thru radiation, conduction and/or convection. Another method is by lowering the temperature of the body or substance itself. This may be done by evaporative cooling (change of state).

The melting of ice was one of the first means of accomplishing refrigeration. One pound of ice at 32°F melting to one pound of water at 32°F would absorb 144 BTU (latent heat). One ton of ice (2000 pounds) at 32°F would require 288,000 BTU of heat to melt it to water at 32°F. This was designated as one ton of refrigeration when accomplished in a 24 hour period. Therefore a ton of refrigeration is the removal of 288,000 BTU in 24 hours, or 12,000 BTU per hour.

Mechanical Refrigeration

The principle upon which mechanical refrigeration is based is that a liquid may be vaporized by heating or by reducing the pressure above it. The liquid absorbs heat in the process of evaporation and dissipates heat when compressed and cooled into a liquid.

Mechanical refrigeration comprises: (a) the refrigerating fluid, (b) the heat absorber, an evaporator, (c) a refrigerant compressor, (d) the heat disposer, a condenser, and (e) a restrictor, a capillary tube or expansion valve. Oil which mixes with the refrigerating fluid provides lubrication for the motor and compressor.

In mechanical refrigeration the refrigerating fluid is evaporated in the evaporator, the vapor is compressed by the compressor, condensed to a liquid in the condenser and restricted in its return to the evaporator by a capillary tube or expansion valve. Heat is absorbed at the evaporator and dissipated at the condenser.

It is a common practice to use a liquid (known as a refrigerant) with as low a boiling point and as high a latent heat of vaporization as practicable. Several other design factors enter into the choice of liquid to be used.

The most common liquid used in present design home refrigerators and room air conditioners is Freon-12. It has a boiling point of -22° Fahrenheit at atmospheric pressure and a latent heat of vaporization of 72 BTU per pound. Freon-22, used in some larger room air conditioners, has a boiling point of -41° F and a latent heat of 100 BTU per pound:

If the refrigerant has a boiling point below room temperature and is in a container at or below atmospheric pressure it will boil or evaporate. When it boils it will absorb heat in an amount dependent upon the latent heat of vaporization of the refrigerant and the temperature difference between original and final conditions of the refrigerant.

A simple example of cooling can be illustrated by an open container of refrigerant or other liquid whose boiling point is below room temperature which is allowed to boil or evaporate freely into the air.



Fig. 1-Evaporation cooling without recovery

(See Fig. 1.) This simple device is good as long as there is liquid to evaporate; however, means must be provided to collect the refrigerant vapor and liquefy it, so that it may be evaporated or boiled again and thus produce a refrigeration cycle. (See Fig. 2.)

The refrigerant is caused to flow by a compressor driven by an electric motor. When the pressure is increased by the compressor, the volume of the vapor is decreased accordingly. The amount of heat (BTU) is thus contained in a smaller volume and the temperature of the vapor is increased accordingly.

The hot compressed vapor is conducted to the condenser where it is cooled by a stream of either air or water. This gives rise to the type designation "air cooled" or "water cooled."

When the vapor is cooled it will condense into a liquid. Much heat is given off in the process of condensation. Prepared by the of the RCA

Some means must be used to restrict the flow of the condensed refrigerant from the condenser to the evaporator. This must be done for two reasons; first, that a high pressure be maintained in the condenser to help condensation of the vapor into a liquid, and secondly, to allow the suction of the compressor to maintain a low pressure in the evaporator. This restrictor may be either an expansion valve or a length of small diameter tubing called a capillary tube.

In the early stages of development compressors were belt driven, but as design and manufacturing techniques improved, it was found practical to enclose both motor and compressor into a single unit. This led to the accessible type hermetic unit and to the completely sealed hermetic unit which are illustrated in Figs. 3 and 4.

The accessible hermetic unit provides means to remove compressor and motor parts in the field. This system generally utilizes an expansion valve and liquid receiver together with service valves on the high pressure and low pressure sides of the com-



Fig. 2-Evaporation cooling with recovery

pressor. The trend is toward the hermetic unit which is completely sealed by welding at the factory and is not accessible for servicing in the field. Due to rigid factory controlled conditions of assembly and cleanliness, it is possible to use the small capillary tube system which does away with the expansion valve and service valves. This system reduces the number of joints and sources of leaks to a minimum. It provides for an extremely dependable trouble-free system.

Recommended Service Procedure

Most room air conditioners employ a hermetically sealed compressor and refrigerant system which is not designed to be repaired in the field. The only field service

Fundamentals Air. Conditioning Units

Commercial Service Section Service Co., Inc.



required is to correct troubles in the air flow and electrical systems that prevent or impair the operation of the unit.

If thorough performance tests prove the existence of a defect in the refrigerant system, repair or replacement is generally handled through the manufacturer.

NOTE: If a room air conditioner is allowed to stand for an extended length of time without being run, it is possible for the Freon to become absorbed in the refrigerant oil. If this should happen there will be no cooling until-the necessary working pressures have been established. The process of getting Freon out of the oil may take several hours of continuous running. Therefore, before rejecting a unit on the complaint that it will not cool, this running-in time should be allowed for. Check this condition especially in the spring of the year.

To check accurately the particular model room air conditioner being serviced always refer to the service notes which have been prepared specifically for that model.

Servicing the Air Flow System

It is of the utmost importance to have clean components in the air flow system and the proper quantities of air flowing through it. Restrictions from any cause will reduce the amount of refrigeration the unit is capable of producing.

Check the following points in the order given:

Dirty filter, causing loss of air flow, ventilation and cooling effect.

Dirty evaporator coil, same effect as above.

- Frost or ice on evaporator due to above air stoppages.
- Dirty condenser coil, causing reduction in refrigerating efficiency and resulting in high wattage (power consumption).
- Fans not delivering correct air quantities, due to slow speed or dust incrustation.

The filter is usually of the expendable type and should be replaced when dirty. The encrusted metal parts should be cleaned with a bristle brush dipped in cleaning fluid. The condenser and evaporator coils should be cleaned with a brush, vacuum cleaner attachment or small air pump.

Servicing the Electrical System

Fig. 4-Welded hermetic

refrigerant system

The greatest source of trouble with the electrical system is not in the air conditioner

itself, but in the electrical power that is supplied to it. Low line voltage is the cause of most electrical troubles.

Motors have the characteristic that the current will be high if the line voltage is low. To meet the load imposed upon it, the motor must draw more current if the voltage is low.

This increased current causes greatly increased heating of the motor windings. This heat increase is directly proportional to the square of the increase in current.

THE VOLTAGE AT THE AIR CONDITIONER MUST BE CHECKED UNDER LOAD AND SHOULD BE WITHIN $\pm 10\%$ OF THE VOLTAGE RATING OF THE UNIT.

In the event of trouble in the electrical system the voltage should be checked first. Other possible causes of trouble are as follows:

- 1. SHORT CIRCUITS BETWEEN TURNS OF MO-TOR WINDINGS.
- 2. MOTOR WINDINGS GROUNDED TO FRAME.
- 3. OPEN CIRCUITS OR SHORT CIRCUITS IN WIRING
- 4. FAN MOTOR BEARINGS NOT OILED AS RE-OUIRED.

N O T E: Many air conditioners are provided with an overload protector which will reset automatically. If the unit has been running under extreme load conditions, the compressor may fail to re-start immediately when the switch control is turned to COOL after having been turned to any other position. If such condition occurs, turn the switch control to OFF, and wait at least two minutes before turning the unit to COOL again. This permits the refrigerant to equalize in the system and will allow the unit to start with less effort.



Cross-Bar Generator

(continued from page 1)

vertical bars, horizontal sweep signal, or vertical sweep signal. The sweep signals are used when tapping into the receiver circuit for injection tests.

Switch S2 connects plate voltage to both vertical and horizontal line oscillators, hence a cross-bar pattern is obtained consisting of both horizontal and vertical bars.

Adjustment of Oscillator Circuits

To adjust the horizontal line oscillator connect the output cable of approximately four feet of 300-ohm twin-lead to the antenna terminals of tv set, rotate the horizontal line control and listen for an audio tone. If no tone is heard at any setting of RI, the circuit may not be oscillating due to the interstage transformer being connected incorrectly. Try reversing either the primary or secondary winding leads. Next, observe if there are any horizontal lines on











Fig. 3. Patterns produced by cross-bar generator on a tv receiver of good vertical and horizontal linearity.

1 8 /

PARTS LIST

R1 25k	-ohm pot CRL B-26, C1 taper
R2, R7, R11 22k	ohms
R3 10k	ohms, 2 watt
R4, R8 5k	ohms, 1 watt
₹5220k	ohms
₹6 68k	ohms
R10100k	ohms
R12 50k	ohms
R13, R15 10k	ohms
R14, R18470	ohms
R16500-	ohm pot CRL B-4, C1 taper
R17 20k	ohms, 20 watt

All resistors, - 1/2 watt unless otherwise specified k = thousand ohms

C1, C22		002 ,	600 v
C2		03 ,	400 \
C3		270µµf,	500 v
C4, C6, C7, C18, C19,	C23, C24	. 0015 ,	500 v
C5, C8		47μµf,	500 v
C9	-100µµf midge	et variabi	e (air
	Hammarlund	(HF - 100)	1
C10, C13, C20		100µµf,	500 v
C11, C21		005 ,	600 v
C12		01,	600 v
C14	- 20 to 275µµ	f trimme	r
C15		5μμf ,	1 kv
C16, C17		8 x 16,	450 v

All capacitors in μf unless otherwise specified

the picture tube screen. If not, tune the carrier oscillator tuning capacitor C9 until several dark lines appear.

To adjust the vertical bar oscillator, tune carrier and adjust attenuator R16 for best definition. If no vertical bars appear, adjust and balance C14 for several bars.

Patterns Obtained. When this unit was connected to the antenna terminals of a television receiver which had good vertical and horizontal linearity, the bar patterns of Fig. 3 appeared. The pattern shown in part (A) of the figure was produced when the generator was adjusted to produce horizontal lines; that shown in part (B) was produced when the generator was adjusted to produce vertical bars; and the pattern shown at part (C) is a cross-bar pattern which results when both horizontal lines and vertical bars are used simultaneously.

When the generator was connected to a tw receiver which had poor vertical and horizontal linearity, the bar patterns of Fig. 4 appeared under the same conditions of generator adjustment as for the previous figure. Note the poor vertical linearity shown in Fig. 4(A) as evidenced by the crowding together of the horizontal lines at the top of the screen and the spreading of the lines at the bottom of the screen. Figure 4(B) shows poor horizontal linearity as evidenced by the spreading of the vertical lines at the left and the squeezing of the lines at the right. When both vertical bars and horizontal lines are used together, the pattern of Fig. 4(C) results.



(A)



(B)



(C)

Fig. 4. Patterns produced by cross-bar generator on a tv receiver of poor linearity.



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pages and TEK-FILE pack The Rider Manual which include the original data and shematics to which the following production changes apply, appear in the index on page 32 of this issue.

Page 25 of the May, 1953 issue of SUC-CESSFUL SERVICING listed a Television Change for Pilot Model TV116. No such model exists. This change, and the Index of Changes, should have referred to Pilot Model TV166. It is corrected as follows:

PILOT

MODEL TV166

The basic chassis used in the above model is the same as that used in Model TV161. For complete service information on this chassis see TV Manual, Volume 5, pages 1-12.

STROMBERG-CARLSON MODEL TC19 Service data correction.

The adjacent-channel video trap, L14 (in the plate circuit of the 2nd i-f amplifier 6BH6) should be aligned to 20.4 megacycles instead of the 21.6 megacycles originally indicated.

STROMBERG-CARLSON

MODEL 16 series Schematic diagram addition.

The peaking coil, in series with the plateload resistors to the V8 6AC7 video amplifier, should be labeled L15 (400 microhenry, part No. 114691). This symbol is missing on the original schematic diagram.

TELE KING CHASSIS TVJ Tube Change.

Beginning with serial number 343,559, the two 12AU7 tubes (in the V8 and V10 positions) appear in the parallel filament string in place of the 6CB6 (V3) and 6AU6 (V16) tubes. The 6CB6 and 6AU6 then replace the two 12AU7 tubes in the series filament string.

In essence then, V8-V10 and V3-V16 will replace each other in the respective series and parallel filament strings.

TELE KING

Fuse change.

In later production the FE-2, 3/8 amp fuse in the high-voltage circuit, has been replaced with a FE-5, 1/2 amp fuse. The fuse has also been removed from the underside of the chassis and placed in the high-voltage cage for easier accessibility.

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75 10-7	The Aris	tocrat, 3217 The			1-502-1, Ch. 1-502-2, 1-502-3, Ch.	25 76	9=31 10=1	TELE KING	G CORP.	
LABS., INC.	¹ Provence 3255 The Madison,	2, 3224 The Carolinian, Danberry, 3353 The 3356 The Roosevelt,			1-502-5, Ch. 1-507-1, Ch.	76 76	10=1 10=22	K-21, K-21B, K-22, Ch. TVJ K-71, K-72, K-72B, Ch. TVJ	41 -A 41 -A	9=1 9=1
12 8=:	1 3357 The Scarsdale	Jackson, 3642 The , 3644L The		·	1-50/-2, CII. 22B-11, Ch. 1-507-1 22M. Ch. 1-387(CO7)	76 13	10=22 8=118	KC-21, KC-21B, Ch. TVJ KC-21, KC-21B, Ch. TVJ KC-71, KC-71B, Ch. TVJ	41-A 41-A 41-A	9=1 9=1
LE)	Vorktown Yorker,	4000 Ch. L, See			22M-1, Ch. 1-387-1 22M-11, Ch. 1-507-1 22M-114 23M-115 Ch 1-	13 76 507-2 76	8=118 10=22 10=22	KD-21M, KD-22B, Ch. TVJ KD-71, KD-72B, Ch. TVJ	41-A 41-A 41-E	9≃1 9=1 7-1
75 10=1	1 VIDEO P 630-DX,	RODUCTS 630-K3C, 630-FM	69	10=1	23B, Ch. 1-387-1 23B, Ch. 1-387-1 23B-11, Ch. 1-507-1	13 13 76	8=118 10=22	TVJ, Ch. TVJ, Ch. 172LO, 172M, Ch. TVG	41 - A 41 - A 41 - B	9=1 7=1
75 10=	1	STROMBERG-CA	RLSON CO.		23M, Ch. 1-387-1 23M-11, Ch. 1-507-1	13 76	8=118 10=22	174LO, 174M, Ch. TVG	41-B 41-B	7=1
75 10=1	1 Brighton		76	10=1	24M-1, Ch. 1-387-1	13	8=118	203, 205, Ch. TVG	41-B	7=1
DUCTS CO. INC.	Cavalier, I Invader	rutura	23 76	9=1 10=8	25M, Ch. 1-387-1 71M, Ch. 1-441(CO2) 71M, 1 77B-1 Ch 1-502-1	20 13 25	8=140 8=31	916, 916CAF, Ch. TVG 919, 919CAF, Ch. TVG	41-B 41-B	7=1 7=1 7_1
12 8=1	Mandarin Pan Americ	an	76 76	10=1 10=8	72M. Ch. 1-502-3 72M. Ch. 1-502-3	76	10=1 7=1	IU14, IUI5, CA. IVG TEIF	4-1* KIT	I=J
ISION CORP.	24C, 24CM	Ch. 112126	76 23	10=8 7=1	72M-1, Ch. 1-366(CO8) 72M-1, Ch. 1-502-1	13 25	8=140 9=31	See ELECTRO-TECH	NICAL INDUSTE	IIES
75 10=1 75 10-1	24RPM, 24 1 24RPM, 24	Series, Ch. 112119 Series, Ch. 112119	23 23	1=1 7=1	72M-2, Ch. 1-437-3 72M-11, Ch. 1-502-3	69 76	10=39 10=1	TELEQUIP	RADIO CO.	
75 10=1	1 119M5A, 11	9M5D, 119M5G,	3		72M-11A, 72M-11B, Ch. 1- 73B, Ch. 1-366(CO8)	-502-5 76 13	10=1 8=140	C517, C517B, Ch. 5050, 5050A	14 14	8=1 8=1
75 10=1 75 10=1	1 119M51, 1 1 Ch. 1121	[19M5M, 119M5K, [4 00DX72 Ch 112114	23	7=9	73B-5, Ch. 1-437-3 73B-11, Ch. 1-502-3	69 76	10=39 10=1	C120, C720B, Ch. 5050, 5050A C820, C820B, Ch. 5050, 5050A	14	8=1 8=1
10=1 75 10=1	1 113RPM, C	h. 112120	15	8=1 8=1	73M, Ch. 1-366 73M, Ch. 1-366(CO8)	23 13	7=1 8=140	T417, T417B, T620, Ch 5050, 5050A	14	8=1
75 10=1	1 321CD2M, C	121CD20, 321	61 6	1-0	73M-1, 73M-2, Ch. 1-502-2 73M-3, 73M-5, 73M-6,	2 76	10=1	12TR 14T 14TB	41-B	6=1 6=1
75 10=1	Series, C 321CF, 321	C2M, Ch. 112127,	C7 52	1 = C	Ch. 1-437-3 73M-11, Ch. 1-502-3	69 76	10=39 10=1	16T, 16TR 16T 16TR	41-B	6=1 f=1
75 10=1 75 10=1	Cavaner 1 417C5M, 41 1 417C5-Dec	7C50, 417 Series 417 Series Mandarin	23 76 78	5=1 10=1 10=1	74B-1, Ch. 1-437-1 74B-2, Ch. 1-437-2	25 69	9=41 10=39	5050, 5050A, Ch.	14	8=1
10=1	417TX, 417 421CDM, 42	Series, Brighton 11 Series.	76	10=1	74M. Ch. 1-356(UO5) 74M-1, Ch. 1-437-1	13 22 22	8=10U 9=41	TELE-TONE R	ADIO CORP.	
10=1	Pan Ame 421CM, 421	rican Series, Invader	76 76	10=8 10=8	74M-2, 74M-3, CD. 1-437-2 75B, 75M, Ch. 1-437-1	25 13	LU=39 9=1 8-64	TAA, TAB, Ch. TAG, Ch.	41-A 41-A	6=9 6=18
75 10= 75 10=1	1 421TX, 421 1 112107, Ch.	Series, Panatomic	76 23	10=8 7=9	1210X, Ch. 1-381	13	8=64	TAJ, Ch.	41 - A	7=4 6=18
	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccc} - 1 \\ \hline \hline c c c c c c c c c c c c c c c c c$	SIENCE Solution <	Jank Columbia Jank Col	$ \begin{array}{c cccc} \hline \textbf{J} = 0 & \textbf{J} & \textbf{J} = 0 & \textbf{J} & \textbf{J} & \textbf{J} & \textbf{J} = 0 & \textbf{J} & $					

SPARTON STROMBERG STROMBERG TELE-TONE

UDEL.	DACK	24 C F C		WESTING	-TONE HOUSE	WESTINGHOUSE ZENITH					
MUDEL	PACK	PAGES	MODEL	PACK	PAGES	MODEL	PACK	PAGES	MODEL	PACK	PAGES
I ELE-1 ONE	RADIO CORP (C	(p.tuo)	JOHN WAN	AMAKER (Cont	(P,	WESTINGHOUSE	ELECTRIC CO	RP. (Cont'd)	WESTINGHOUSE ELE	ECTRIC CORP.	(Cont'd)
TAM, Ch. TAP-2, Ch.	41-B 14 41-B	7=7 8=4 8=1 8=1	T-1720, Series T-20E C2020T, C2020V, See TRAD Ch. T-20E C2420D, CD2020W, See	54 54	9=1 9=1	H-641KT7, Ch. V-2192, V-2192-1, V-2192-2, V-2192-3 1-641KT7A, Ch. V-2192-1	15	8=14	V-2150-197, Ch. V-2152-16, Ch. V-2171, Ch.	21 42-B 21	7=9 6=25 7=16
IH, 13, КеV., СП. ГТ, СҺ. ГV-284, СҺ. ТТ ГV-286, СҺ. ТН, ТЈ, Rev.	8-14 8-14 8-14 8-14 8-14	6=1 6=1 6≃1	TRAD Ch. T-20E WESTERN AUTO (TRUETI	54 SUPPLY CO. NE)	9≓1	H-642K20, Ch. V-2178-1, V-2178-3 1-642K204, Ch. V-2194, V-2104	1 12	9=14 8=32	V-2172, Ch. V-2173, Ch. V-2175, Ch.	21 15 21	7=34 7=16 8=4 7=16
TV-287, TV-288, Ch. TT TV300, TV301, Ch. TW, TX TV304, TV305, Ch. TW, TX	41-B 41-A 41-A	6=1 6=9 6=9	2D1091, Ch. 12AX27 2D1092	53	9=41 4-27	1-643K16, Ch. V-2179, V-2179-1	21 21	8=32 7=36	V-2175-1, V-2175-3, V-2175-4. V-2175-5. Ch	15	7=34
TV306, Ch. TZ TV307, Ch. TX TV314, Ch. TX	41-A 41-A	6=18 6=18	2D1094A 2D1095A, Ch. 16AX27	14	8=1 9=1 F	1-040KLV, H-647KLV, Ch. V-2175-3, V-2192 1-648T20, Ch. V-2201-1	15 21	8=14 0-0	V-2176, Ch. V-2177, Ch.	21 21	7=16 7=16
TV315, Ch. TAA, TAB	41-A 41-A	6=18 7=1 6=9	2D1185A 2D1190A 2D1190B	14 14 14	8=20 8=28 8=28 8=28	1-649C17, Ch. V-2200-1 1-649T17, Ch. V-2192-4 1-650T17, Ch. V-2192-4	1111	8=45 8=14	v-2178, Ch. V-2178-1, V-2178-3, Ch. V-2179, V-2179-1, Ch.	21 15 21	7=27 8=32 7=36
rv316, Ch. TZ rv317, Ch. TAG	41-A 41-A	6=18 6=18 7-1	2D-1191A, Ch. 20AY22 2D1194A	73 14 52	10=9 8=10 F	H-650T17, Ch. V-2200-1 H-651K17, Ch. V-2200-1	15	8=14 8=45	V-2192, V-2192-1, V-2192-2, V-2192-3, Ch. V-2104 V 2104 1	15	8=14
TV318, Ch. TAM TV322, TV323, Ch. TAM	41-B 41-B	1=1 1=1	2D20494, Ch. 16AY210 2D20494, Ch. 16AY210 2D20524, 2D2052B, Ch.	53	9=9 F	V-2204-1 1-652K20, Ch. V-2194-2, V-2194-3	15 15	8=45 9-22	V-2194-2, V-2194-3, Ch. V-2200-1, Ch.	15	8=32 8=45
rv324, Tv325, Tv326, Ch. TAP-2	41-B	7=1	16AY210 2D2052C, Ch. 17AY23 2D2052D 2D2052D 2L	53 53	9=9 F	1-652K20, Ch. V-2201-1 1-653K24, Ch. V-2202-2,	21	0=3.c 9=9	V-2201-1, Ch. V-2202-2, V-2202-3, Ch. V-2203-1, Ch.	21 54	9=9 9=17
TV328, TV329, Ch. TAP-2	41-B	8=1 7=1 8=1	ZDZUSZD, ZDZUSZE, Ch. 17AY28 2D2053 2D2149A Ch. 17AV212	53 73 73	9=29 10=1	V-2202-3, V-2210-1, Carlyte	54	9=17	V - 2204 - 1, Ch. V - 2204 - 1, Ch. V - 2207 - 1, Ch.	21 15	9=1 8=45
TV330, TV331, TV332, TV333, Ch. TAO	14	8=4 8	2D-2152A, Ch. 17AY26 12AX27, Ch.	73 53	10=20 10=20 9=41 H	1-654.117, СЛ. V-2175-3, V-2175-4, V-2192, V-2192-1 1-655К17. H-656К17	15	8=14	V-2210-1, Ch. V-2214-1, V-2215-1, Ch.	54 77	10=1 9=17 10=11
TV335, TV336, Ch. TAP-2	41-B	7=1 8=1	16AY210, Ch. 16AX27, Ch.	53 53	9=9 9=1 H	H-657K17, Ch. V-2200-1 I-658T17, Ch. V-2192,	15	8=45	V-2216-1, V-2216-2, Ch. V-2217-1, V-2217-2, Ch.	77	10=11 10=11
TW. Ch.	41-B 41_A	7=1 8=1 6=0	1/AY23, Ch. 17AY26, Ch. 17AV28, Ch.	53 73	9=21 10=20 F	V-2192-1 1-659717, Ch. V-2204-1	15 15	8=14 8=45	V-2218-1, Cn. V-2220-1, Ch. V-2220-2, Ch.	73	10=30 10=1
rx, ch.	A-17	6=9 6=18	17AY212, Ch. 17AY212, Ch. 20AY22, Ch.	53 73 73	9=29 F 10=21 H	1-660C17, H-661C17, Ch. V-2203-1 L663¥20, Ch. V 2201 1	21	9=1	ZENITH R4		10=1
rz, ch.	41-A	6=18	WFSTINGHOUSE EI	ECTBIC COBB	H	1-663T17, Ch. V-2192, V 2102 0	12	5 ≅	Aldrich	42-4	•
TELEVISION EQI	IPMENT CORF	e.1	Carlvle	Ed No CORF.	E E E	V-2194-2 1-664K17, Ch. V-2200-1	15 15	8=14 8=45	Barrett, Barrie Biltmore	21 21 47 B	0=1 9=1
505, Booster	14	8=1	C411915 H-606K12, H-607K12, Ch V-2150-111	40 50	1 L=6	1-667T17, H-668T17, Ch. V-2216-1	77	10=11	Broadmoor Burton, Byron	42-B 42-B	3=1 3=1
TRAD TELEVI	SION CORP.		H-609T10, Ch. V-2150-94C H-610T12, Ch. V-2150-136	42-A 42-A	6=10 6=10 6-18	1-013K2L, H-076T2L, Ch. V-2217-1	77	10=11	Carlyle, Chesterton Churchill	21 21 42-A	0=1 9≍1 8-1
2020, C-2420, CD-2020, Series T-20E -1720, Series T-20E	54 54	9=1 9=1	H-611C12, Ch. V-2152-16 H-613K16, Ch. V-2150-146 H-614T12, Ch. V-2150-136	42 - B 42 - A 42 - B	6=25 6=33 6=18 H	V-2216-1, V-2216-2 V-2216-1, V-2216-2 -681T17, Ch. V-2215-1 -689T16, Ch. V-2214-1	77 77	10≈11 10=11	Claridge Coleridge, J2051E Coleridge, H2439R	42-B 21 42-A	3=1 9=1 6=1
TRANS-VU	E CORP.		H-615C12, Ch. V-2152-16 H-617T12, Ch. V-2150-176	42-B 42-A	6=25 H. 6=41	I-690K21, H-691K21, Ch. V-2217-1		10=11	Conrad Derby Fioldian Toxoon	21 42-B	9=1 3≈1
700C, 1700CD, 1700T	14	8≑1	H-618T16, Ch. V-2150-186, V-2150-186A, V-2150-186C,			I-692T21, H-695K21, Ch. V-2217-2	77	10=11	Fielding, 42030R Fielding, H2437E Galsworthy	21 42-A	9≔1 6=1
TRAV-LER R	ADIO CORP.		V-2150-186CA H-619T12, Ch. V-2150-176	21 42-A	7=1 H 6=41 H	I-699KI7, Ch. V-2216-2 I-700T17, H-701T17,	77	10=11	Garland Cotham	21 42-A	9=1 6=1
3A2, 34A2, 35B2, Ch. 17-10. 217-11. 217-12 217-14	69	10=1	V-2150-177U	42-A	6=41 B	Ch. V-2216-2 -702K17, H-703K17,	77	10=11	Hawthorne, J2026R Hawthorne, H3267	21 21 42 5	3≈1 9=1
Ch. 33A2, 34A2, 35B2 20-9, 220-9B, Ch. 33A2 34A2	69	10=1	2150-186, V-2150-186A, 2150-186, V-2150-186A,	1	Н	Ch. V-2216-2 -704T17, H-705K17,	77	10=11	Irving, Kilmer Kinling	42-A 42-A	0=1 6=1 0-1
35B2	69	10=1	V - 2130 - 186C, V - 2150 - 186CA H - 625T12, Ch. V - 2150 - 197 H - 626T16, Ch. V - 2172	21 21 21	7=1 7=9 H 7-16 H	Ch. V-2216-2 -706T16, Ch. V-2207-1 -708T20, Ch. V-2207-1	77 73 73	10=11 10=1	Lowell Mansfield	42-A 42-A	8=1 6=1
TRUET See WESTERN AU	ONE TO SUPPLY CC	C	H-627K16, H-628K16, H-629K16, Ch. V-2171	21	7=16 H	-710T21, H-711T21, Ch. V-2217-2	21	10=11	Markham Marlborough	21 42-B	9≖1 3≑1
VIDAIRE TEL	VISION CO.		H-630T14, Ch. V-2176	21	7=34 F. 7=16	I-713K21, H-714K21, H-715K21, Ch. V-2217-2	77	10=11	Meredith, Morley Newnort	42-B 42-A	3=1 6=1
10	14	8=1	H-533C17, H-534C17, Ch. V-2173	15	H 8=4 H	-718K20, Ch. V-2220-2 -720K21, H-721K21,	73	10=1	St. Regis	42-B 42-B	3=1 3=1
VIDE	PRODUCTS C	c	H-636T17, Ch. V-2175 H-637T14 Ch. V 2177	21	7=16 7=34 H	H-722K21, Ch. V-2217-2 -724T20, H-725T20, Ch.	11	10 11	Shelley Sovereign	42-B 42-A 42-R	3=1 6=1 2-1
VIDEO PRODI	JCTS CORP.	i	H-639K20, Ch. V-2178 H-639T17, Ch. V-2192,	21	7=27 H	v -2220-2 -730C21, Ch. V-2218-1 -732C21, H-733C21.	77	10=1 10=30	Stratosphere Tennyson	42-B 42-A	3=1 6=1
30-DXC, 630-DX24, 630-K3C,	ŝ		V-2192-1 H-640T17, Ch. V-2175-3,	15	8=14 V	Ch. V-2218-1 -2150-94C, Ch.	77 42-A	10=30 A=10	Thackeray, H3477K Thackeray, J2054R	42-A 21	6=1 9=1
630-K24C 30-S, 630-SDX, 630-S24,	69	10=1	V-2175-4	15	8=14 V 8=28 V	-2150-111, Ch. -2150-136, Ch.	42-B 42-B	0−10 6≠1	Waldori Walpole	42-B 42-A	3=1 6=1
630-524DX JOHN WAI	69 JAMAKER	10=1	H-640T17, Ch. V-2192, V-2192-1 V-2192-2, V-2192-3 H-640T17A. Ch. V-2192	15	8=14 V.	-2150-146, Ch. -2150-176, Ch.	42-A 42-A	6=33 6=41	walton, H2328H Walton, J2044R Warton	42-A 21 42-A	6=1 9=1 6=1
1720T, C1720T, See			H-641K17, Ch. V-2175-1, V-2175-5	15	8=14 V.	-2150-170U, V-2150-177U, Cn. -2150-186, V-2150-186A, V-2150-186C, V-2150-	. 42-A	6=41	Warwick Wilshire Woodswitch Tonage	42-B 42-B	3=1 3=1 3=1
TRAD Ch. T-20E	54	9 =1			8=28	186CA, Ch.	21	7=1	Wordsworth, H3469E	21 42-A	9=1 6=1

																																											Т	ek	-Fi	le	Ir	ndé	×	No.	10	Ó
d CORRECTIONS		MANUAL 11		RIDER'S DEPENDABLE REMACEMENT PARTS LIST-						Add NDO-CN-1-4mmf to Aerovox column.	Add Z009 to Cornell-Dubilier column.	Add N150-HVD4-47mmf to Aerovox column.	Add N150-CN-1-30mmf to Aerovox column.	Add N750-CN-1-50mmi to Aerovox column. Add 5777-0431 to Sprague column			Add D078 to Correll-Dubiller column	Add D109 to Cornell-Dubilier column.	Add BR550 to Cornell-Dubilier column.	Add BR105 to Cornell-Dubilier column.	Add BBR2-50T to Cornell-Dubilier column.	Add TC302 to Mallory column.	Add PRS25/25 to Aerovox column.	Add BR255A to Comeli-Dubliter column. Add TC36 to Mallory column.	Add AFH4-67 to Aerovox column.	Add D052 to Cornell-Dubilier column.	Add AFH3-142* to Aerovox column and	*Parallel Sections to Remarks column.	Add FD 375 to Mallory column.	Add TVL-3722** to Sprague column and	**Omit 20mf Section to Remarks column.	Add C097 to Cornell-Dubiller column.	Add FP 366 to Mallory column.	Add TVL-3682 to Sprague column.	Add PRA25/100 to Aerovox commu. Add BRH251A to Cornell-Dubilter column.	Add TC 250 to Mallory column.	Add TVA-1207 to Sprague column.	Add AFH3-43 to Aerovox column. Add CO34 to Cornell-Dubilier column	Add FP376.8 to Mallory column.	Add AFH2-103 to Aerovox column.	Add C105 to Cornell-Dubilier column.	*CE6=Insulating Sleeve to Remarks column.	Add AFH4-13* to Aerovox column and	*Parallel 20 & 10 mf Sections to Remarks column.	Add BKD1145A & BK1045A to Cornett-Dubliter countrie. Add PRS50/50 to Aerovox column.	Add BR505 to Cornell-Dubilier column,	Add TC39 to Mallory column.	Add PRS150/4 to Aerovox column. Add TVA-1301 to Sprague column.				
TIONS an		DER'S TV		data that will keep your	N Volume 11 up to date.		Set Mfr. 's Original Part No.		m	21K38951		21K710903	21K470329	21K115041 166_0043D		APACITORS	154090	154099	154103	154104	0025	6.6	4239	# 4 s	C-5, 421-7	: :	45X395		: :			40X349		=	45X4UI	**	=	24048	:	24049	: :		30-2584-6		A20135			111093				
ADDIT		~		Here are more	ING published in I		Set Mfr.		FIXED CAPACITORS	Matarala	44 44	4.6	0- 1 0- 1	cinculas		ELECTROLYTIC CA		11	44	11 - FC	nouman		*		Majestic		Montgomery Ward			:	:		:	2 1	= =		=	Packard-Bell	=	:	: :	. *	Philco		Stromherg_Carlson		2 1					
ZENITH	PAGES	(p. µ.		9=1 9=1	9=1 8-1	9=1	9≖1 9−1	9=1 4-1	1=6	9-1	1 - 0	9=1	9~1	9=1	1=6	9=1	10-1	10=1	10=1	10-1	10=1	10=1	10=1	10=1	1=01	10=1	10=	10=1 8=1	9=1	10=1 6=1	6=1	3=1 3=1	3=1	3=1	3=1	3=1 3=1	3=1	3=1 3=1	3=1	3=1	3=1	3=1	3=1	3=1	3=1	3=1	3=1					
	PACK	ZENITH RADIO CORP. (Co	20421,	20J21, Wordsworth 21	20121 20121 Walton 21	20122, Coleridge 21	. 20122, Chesterton 21 20122, Thackeray 21	20122, Carlyle 21	27R, Ch. 21J20 21	29R, Ch. 21120 21 30B Ch 21120 21	42R, J2143R,	21	53K, JZ154K, 44R, Ch. 21J20 21	h. 21721 21	21 J 20 21 J 20 21	20J21, Barrie 21	812R, Ch. 19K22 77	815R, Ch. 19K20 77	846R, Ch. 19K20 77	850R, K1880R,	. 19 K2 3 77	230R, Ch. 21K20 77	240K, Ch. ZIKZU 11	263E, Ch. 21K20 77	268R. Ch. 21K20 77	270R, Ch. 21K20 77	291E, Ch. 21K20 77	22, 19K23, Ch. 77 15	2, 21J20, 21J21, Ch. 21	2, 23H22Z, Ch. 42-A	21, Ch. 42-A	4.2-B h. 27F20, Broadmoor 42-B	42-B	42-B	42-B	4.28F22, Biltmore 42-B	h. 28F22, Mayflower 42-B	n. 28F25, Saratoga 42-B h. 28F25, Claridge 42-B	h. 28F20, Waldorf 42-B	h. 28F21, Wilshire 42-B	h. 28F20, Warwick 42-B	h. 28F21, Newport 42-B h. 28F23.	sre 42-B	42-B Ch. 28F23.	42-B	Ch. 28F20, Gotham 42-B Ch. 28F23.	1gh 42-B					
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Replacement Parts In TV Receivers

Part 2 - Transformers (Continued)

This is the eighth in a series of articles on "Replacement Parts in TV Receivers."

Common usage has lead to the acceptance of the words "power transformer" to mean the device which is a part of the power supply of the conventional a-c receiver, and performs the function of supplying the plate voltage for the rectifiers and the filament voltage for the rectifier heater, and for the heaters (or filaments) of the tubes in the receiver. This is not a contradiction of the previous use of the name as a general category, and the plate-filament transformer as one of the types within this category. Rather it is an attempt to fall in line with practical identification instead of using the strictly technical approach.

In Fig. 1 is shown a schematic symbolization of a conventional low voltage power supply as used in a TV receiver, inclusive of three extra filament windings, F sec. 2, 3, and 4, as sources of heater voltage for the



Fig. 1-Schematic symbolization of a conventional low voltage power supply as used in a TV receiver.

tubes in the receiver. The rectifier system is full-wave, hence the high-voltage winding HVS is center-tapped. The filament windings F sec. 1, 2, 3, and 4 are without centertap because they are intended to supply heater voltages to cathode type tubes, with the exception of the power supply rectifier.

The transformer shown in Fig. 1 is a typical example. Variations from this particular organization of windings are plentiful; some transformers have fewer filament windings, but occasionally as many as five will be found. Those transformers which are intended for half-wave rectifiers use high-voltage windings without center-taps; however the presence of a center-tap is no limitation inasmuch as it does not have to be used. Hence the center-tapped transformer is suitable for use in the half-wave rectifier sys-

by John F. Rider

tem, as well as the full-wave system, bearing in mind of course that the output voltage between one extreme terminal of the highvoltage winding and the center-tap amounts to half the voltage output available between the two extreme terminals.

Still another example of winding organization on a typical power transformer which may be found in television receiver power supplies is shown in Fig. 2. The presence of only two filament windings, in addition to the supply for the power supply rectifiers, instead of the three illustrated in Fig. 1, is deliberate to show a variation. A more significant difference however is found in the high-voltage winding. In this instance the high-voltage winding has five terminals; the center-tap, CT, is common to a high-voltage winding terminating in A-B, and for the medium voltage winding terminating in D-E. These two pairs of terminals feed two separate full-wave rectifying systems, each of which has its own individual filter system, thus a single power transformer serves two separate power supplies.

The specific organization of windings on a power transformer is determined by the requirements of the system which uses it. Some receivers may be designed for the kind of transformer illustrated in Fig. 2, whereas others, which are in the majority, require units like those shown in Fig. 1. Obviously the single voltage center-tapped type is not suitable for use where the multi-voltage variety is required, whereas the latter is usable where the former is required, pro-

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For the individual models included in these Packs, refer to the TEK-FILE INDEX in this issue.

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vided that: (1) the voltage and current constants are correct, (2) the required number of filament windings are available, (3) the physical and test specification requirements are satisfied, and (4) the design of the transformer relative to electrostatic and electromagnetic shielding conforms with the need.

Obviously the suitability of a power transformer as a replacement for original receiver equipment is controlled by a number of factors. All of them influence the final selection; and, while every one may not seem





equally important, none of these factors can be disregarded if convenience of use, ease of application, and the desired electrical performance are to be achieved.

Factors That Control Power Transformer Selection

As mentioned above, there are several factors which give rise in one way or another to at least two general sub-groups of power transformers. The distinction is based on the physical features of the component. Figure 3 shows three types of power transformers that differ in physical features. Each of these may duplicate the electrical capabilities of the others, both as to electrical constants and organization of the windings, yet is not a suitable replacement for the other.

Physical Features

For example Fig. 3A shows the outline of a typical power transformer that is intended for "through-chassis" mounting. An opening is provided in the chassis, and the bottom half of the transformer extends into the underside of the receiver chassis, the transformer being fastened to the chassis by means of bolts which also hold the trans-

(continued on page 29)

TELL-A-FAULT Symptom Sheet

REDUCED PICTURE WIDTH







NORMAL







FIG. 5

(NOTE: Refer to CIRCUIT GUIDE IV-3 for identification of components.)

A faulty picture-tube pattern is shown in Fig. 1 in which the width of the pattern has been reduced. In addition, poor picture focus and decreased brightness were in evidence.



The waveform at the horizontal-sweep generator was normal. With the scope connected to the grid of the horizontal-output tube (V1), the normal waveform shown in Fig. 2 appeared with F=H/3. However, the P-P value of the voltage was about 10% below normal, while the d-c voltage was only about 2/3 of the proper negative value.

The waveform at the plate of V1, taken through a capacitive-divider probe, was also normal as shown in Fig. 3. But the P-P amplitude was about 40% below normal, while the d-c voltage at this point was only about $\frac{3}{4}$ of the normal value.

The scope was then connected to the plate of the damper tube (V2), at which point the waveform shown in Fig. 4 appeared (F=H/3). This waveform had a normal appearance but its P-P amplitude was only $\frac{1}{2}$ of the normal value.

The waveform at the junction of C6 and the bottom end of the horizontal-output transformer secondary winding also appeared normal (see Fig. 5, F=H/3). The P-P amplitude was only 1/3 of the normal value however.

The receiver fault which produced the above effects was a defective capacitor C7. This capacitor, which is shunted across the width coil (L1), was found to have high leakage.

REDU D PICTURE WIDTH

II-G-1

Mismatched Television Components Part 2 - Deflection Yoke (Horizontal Windings)

This is the third and last of a series of articles on Mismatched TV Components.

The Third Case: Deflection Angle Changed

Once again the original yoke was restored and the receiver readjusted for a normal picture and otherwise normal operation, waveforms and voltages being checked to confirm this condition. It was then decided to investigate another criterion critical in the choice of a proper replacement for a defective yoke. A yoke was accordingly sought out whose vertical and horizontal inductance ratings met the requirements of the circuit, but whose designed deflection angle differed from that of the 70-degree unit originally used. Such a one could not be found, in this case, but a 53-degree yoke was on hand

by Sidney C. Silver

trols had little effect on appearance of picture and waveforms or on voltage and current readings. The following had to be reset, and then with only partially successful restoration of acceptable operation: width, horizontal linearity, height, vertical linearity, focus, brightness, vertical centering, horizontal centering, horizontal drive, and ion trap. Under any condition of adjustment, the following symptoms were clearly evident: There was considerable ringing at the left-hand side of the raster; neck shadow was marked at more than one point; there was a substantial loss of width; vertical and horizontal nonlinearity were apparent; brightness was decreased; and acceptable focus could not be obtained under any combination of adjustments. The pat-

Fig. 1. Pattern produced by yoke with wrong deflection angle.

whose inductance ratings exactly matched those of the first substitution mentioned in this series of tests. In other words, a standard of performance was still available in that performance with the 53-degree yoke could be compared—not with the performance of the original part—but with the operation of the yoke discussed as *The First Case: Yoke Inductance Reduced* in the preceding portion of this article (see last month's issue of SUCCESSFUL SERVIC-ING).

That yoke, like this one, had a horizontal winding whose inductance was 9 millihenries. The deterioration in performance with the first replacement yoke now becomes the standard of comparison. Changes in appearance of the picture-tube pattern, in waveforms, and in voltage and current readings in this third case must be checked against changes that occurred with the first substitution.

As before, the substitute yoke was placed in operation, and conditions were observed both before and after readjustment of the preset controls. Readjustment of these con-



Fig. 2. Pattern obtained with comparison yoke (deflection angle correct).

tern in Fig. 1 illustrates the receiver's performance. Note that the symptoms are far more severe than those observed for the first substitution (see Fig. 2), where a yoke having the correct deflection angle of 70 degrees was used.

Similar changes were noted with respect to waveforms and meter readings. The voltage pulse at the plate of the horizontal output tube is shown in Fig. 3. The comparison pulse shown in Fig. 4 was taken under the same conditions when the first



Fig. 3. Voltage waveform, plate of the horizontal-output tube: incorrect deflection angle in yoke.

substitution was in place. In Fig. 3, the undamped oscillations during the horizontal portion of the trace continue over the full span of the trace, instead of dying out toward the right as occurs in Fig. 4. In addition, these oscillations are of greater relative amplitude. This corresponds to the ringing at the left-hand portion of the raster. Also observe the change in shape of the flyback portion of the pulse. P-P amplitude of the pulse is now 2,700 volts as compared to 3,500.

Although the change in the shape of the current sawtooth observed in the horizontal windings of the yoke were not as severe, they were clearly evident. There was a slight drop in amplitude, and the shape, which was still recognizable as a sawtooth, showed irregular curvature.

With the original yoke in place, secondanode voltage was at the rated value of 15 kv. With the first, 9-millihenry, 70-degree, substitution it fell to 12.8 kv. With the 9millihenry, 53-degree substitution it fell further to 10.6 kv. Current at the plate of the output tube, normally about 95 ma, had risen to 110 ma with the first replacement. In this case, it rose still further to 120 ma. Plate voltage (boosted B-plus) fell from a normal value of 360 volts to 310 volts when the first substitution was attempted. In this instance it fell to 250 volts. There was a corresponding drop in the overall d-c powersupply output.

The evidence is here. There was a considerable amount of overall effect on operation that had to be attributed exclusively to the fact that a 53-degree yoke was used in place of a 70-degree component.

Overall Considerations

What conclusions can be drawn, at this point, concerning allowable degrees and types of mismatch with respect to yokes in general? Such conclusions are studiously avoided here for the simple reason that no general statements are workable. In the la-

(continued on page 31)



Fig. 4. Voltage waveform, plate of the 'horizontal-output tube: correct deflection angle in yoke,

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REPLACEMENT PARTS, ETC.

(Continued from page 25)

former laminations in place. Bearing in mind the limited space that usually prevails, and also that the usual location of the power transformer is at one corner of the chassis, it stands to reason that with the hole already cut in the chassis, the physical dimensions of the transformer must conform pretty much to the space provided.

(B) Coursesy Triad (A) Coursesy Standard Transformer Corp. Transformer Mfg. Co. (C)

(C) Coursesy Merit Coil and Transformer Corp.

Fig. 3-Three types of power transformers that differ in physical features

A little latitude is usually available in all three dimensions, but not too much. If the shell passes through the hole provided for it very readily, there is a little play left in the event that the mounting bolts are slightly farther apart than the holes provided for them, but if the shell is too large to fit in the hole provided, making the hole larger by filing may not be the answer, because sufficient room may not be available. Moreover, this type of fabrication should not be expected of the service technician because neither he nor the public should pay for the time required to accomplish this adaptation. Where room exists and it may be necessary to drill two new holes for the mounting bolts, this labor is not too much.

Neglecting for the moment the matter of fabrication to make a power transformer fit the space, it is obvious that where a "through-chassis" type is needed no other physical variety will do. In this connection we hasten to comment on a special version of this kind of transformer; the type which already mounts the rectifier tube socket, and the connections to the plates and heater terminals are made internally inside the shell. This special kind is illustrated in Fig. 3C.

An "above-chassis" type of power transformer is illustrated in Fig. 3B. This is a typical unit, but does not necessarily reflect the multitude of shapes which are encountered. Regardless of this variable, this kind of transformer offers a little more leeway in mounting than does the "throughchassis." Since the transformer is mounted on top of the chassis, the bottom surface area is not as rigidly bounded by space limitations, though limits do exist. On occasion it will be found that very little extra room is available because other components surround the power transformer. This is especially true in the case of some rectifier sockets which are so located as to prevent locating a transformer with a larger base area than the original, without having one side of the transformer extend slightly beyond the edge of the chassis. This causes no harm, provided that the amount that protrudes does not prevent proper positioning of the chassis in the cabinet.

Recognizing the limits which exist in height, width, and depth dimensions for an "above-chassis" mounted power transformer,

conformance to shape is not the most important detail; conformance with physical space requirements set by the original component is the pertinent requirement. Of course it is assumed that all electrical details are satisfied. But even here it is necessary to pay heed to another physical feature of "above-chassis" mounted power transformers. This is the location of the opening through which the transformer leads leave the shell. Usually they are located on the bottom of the transformer case, or on the side, but wherever the opening may be for these wires, it is necessary to bear in mind that they must pass through the chassis for junction with the components located underneath.

As it happens, a certain amount of standardization does exist in the base dimensions or mounting hole dimensions for power transformers used in TV receivers. These are 3" x 33/4", but are subject to variations depending on the design of the receiver and the space provided for the power transformer.



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A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: This month has seen the largest num-ber of manufacturers reporting product changes in their lines. Over the last few months, as noted in previous col-umns, Antenna, Sound and Audio, Test Equipment and Tube Manufac-turers have been the most active of the product groups. product groups.

New Items

- AMERICAN PHENOLIC—Added Model 114-058 Corner Reflector at \$7.50 dealer net. AMPEX ELECTRIC—Added Audio Magnetic Tape Duplicator; Series 350 Audio Magnetic Tape Re-producers; Series 450 Audio Magnetic Tape Re-
- producers; Series 430 Audio Magnetic Tape Reproducers;
 BEAM INSTRUMENTS—Added Tannoy "Westminster" Wall Type Enclosure; Tannoy "Parliament" Corner Type Enclosure: (Mahogany cabinet at \$125.00 dealer net; Blonde cabinet at \$130.00 dealer net.)
 BERLANT ASSOCIATES—Added Model 1503-D Dual Track Recorder at \$345.00 professional user net; Model 1503-S Single Track Recorder at \$345.00 professional user net.
 CBS-HYTRON—Added Receiving Tubes 5AW4 at \$2.65 list; 6T4 at \$3.70 list; TV Picture Tubes 21AP4; 21MP4; 21WP4; 24TP4; 27RP4; Transmitting Tube 6216 at \$3.50 dealer net.
 CLEAR BEAM—Added Model TY-M Ty Match at \$4.95 list.

- CLEAR BEAM—Added Model TY-M Ty Match at \$4.95 list. CORNELL-DUBILIER—Added Model UW-2 UHF TV Antenna at \$3.57 dealer net; Model UAK-3 Stacking Bars at \$0.57 dealer net; Model S-6 "Superior" Conical at \$3.48 dealer net. DUMONT—Added TV Picture Tubes 17KP4 at \$28.00 dealer net; 21YP4 at \$41.00 dealer net; 21ZP4A at \$3.950 dealer net; 24CP4 at \$61.00 dealer net; 24CP4A at \$75.75 dealer net; FRETCO—Added Freatay with UHF at \$23.97 dealer net; UHF Adaptor Kit at \$2.25 dealer net; Conicals Model BXF8 at \$3.67 dealer net; Model BXFH8 at \$3.50 dealer net; Stacking Bars (pair) at \$0.66 dealer net; Elements (each) at \$0.24 dealer net.

- at \$0.66 dealer net; Elements (each) at \$0.24 dealer net. GENERAL ELECTRIC Added Receiving Tube 6BZ27 at \$3.35 list. KENWOOD ENGINEERING—Added Model 5C-SS Chimney Mount at \$2.98 dealer net. LITTELFUSE—Added No. 313.175 at \$0.25 list to their 3AG Slo-Blo Fuse Series. LOUIS BROS.—Added Model 470FM Folded Dipole FM Antenna at \$4.17 dealer net; Model 515 Slop-ing Wall Speaker Baffle for 15" Speaker at \$6.75 dealer net; Model 715 Corner Wall Speak-er Baffle for 15" Speaker at \$9.30 dealer net. OLIN INDUSTRIES—Added Model D Leakproof Battery for Portable Receivers at \$0.0975 dealer
- Battery for Portable Receivers at \$0.0975 dealer
- PERMOFLUX CORP. Added Headset Adapter
- PERMOFLUX CORP. Added Headset Adapter Model BMA-1 at \$2.25 professional net price.
 PILOT RADIO-Added TV Remote Chassis Model TV-524 at \$399.50 dealer net (less picture tube); Model TV-527 at \$399.50 dealer net (less picture tube); UHF Converter Model CV-602 at \$37.13 dealer net.
 PORCELAIN PRODUCTS-Added Guy Wire An-chor Insulators No. 1929; No. 1933.
 QUAM-NICHOLS-Added new series of Intercom Speakers and new series of Outdoor Theater Speakers.
 RCA-Added Transistors No. 2N32 at \$15.40 deal-

- Speakers. RCA—Added Transistors No. 2N32 at \$15.40 deal-er net; 2N33 at \$23.00 dealer net; No. 2N34 at \$13.40 dealer net; No. 2N35 at \$18.40 dealer net; Alignment Tool No. 7800 at \$1.50 dealer
- RADIO RECEPTOR-Added Model C1709-C UHF

- RADIO RECEPTOR—Added Model C1709-C UHF Converter at \$36.60 dealer net; No. 6QS4 Sele-nium Rectifier at \$2.38 dealer net.
 RAYTHEON—Added Receiving Tubes 1AG4 at \$2.80 list; 1AH4 at \$2.80 list; 1AJ5 at \$2.75 llst; 1V6 at \$3.15 list.
 RECOTON—Added new series of Diamond Re-placement Needles.
 SIMPSON ELECTRIC—Added Model 1000 Plate Conductance Tube Tester at \$135.00 dealer net.
 TURNER CO.—Added Model ADA-95D Dynamic Microphone at \$21.00 dealer net.

Mismatched Television Components

(continued from page 27)

boratory, some receivers have been shown to be fairly tolerant to mismatches; others appear to be more critical. Furthermore, it is impossible to say that any one type of receiver or type of circuit is generally broad or critical with respect to variations in component values. The same receiver that will tolerate some mismatch in the yoke will be highly critical with respect to a linearity coil, width coil, or transformer. No simple pattern emerges. A receiver that seems to accept a broad range of values elsewhere will suddenly become very choosy about the yoke.

Although the theoretical possibility always exists, it is not practical to go to the elaborate lengths required to predict, for each individual circuit, what the limits are that separate the allowable mismatch from the forbidden one. The integration of any horizonal-output circuit, with respect to its directly associated components as well as with respect to the rest of the receiver is far too complex.

Hidden Hazards

In the early portion of this article, which appeared last month, the statement was made that an incorrect replacement which seems to work out can be more dangerous than one which is obviously incorrect. Consider the facts. An unworkable replacement must be rejected at once. It doesn't get much of a chance to damage the set. But what happens when, through a series of adjustments—or misadjustments, a poorly chosen yoke can be made to operate with apparent success?

In any circuit, maximum efficiency and maximum transfer of energy is achieved only when all components are matched to each other. Wherever mismatch occurs, the circuit has to work more to produce less. In every case of a mismatched yoke, for example, plate current through the horizontal output tube has gone well beyond 100 ma. Yet the tube types used in this application in the large majority of receivers are rated for 100 ma maximum plate current. Because of the demands made on the horizontal output stage, it is customary to drive these tubes at or near the maximum (90-100 ma). Any change in the carefully balanced chain of components is likely to drive these tubes to the point where they will break down early and often. The flyback transformer, under these same conditions, is also likely to saturate and break down. These events are not likely to take place at once. They are more likely to occur in the form of call-backs, by which time the service technician has taken for granted the acceptability of the poor replacement and sees no connection between it and the immediate difficulty at hand.

A misadjustment of an ion trap, also done to produce apparently acceptable performance after a mismatch has been introduced, is likely to produce gradual but serious damage to the picture tube.

Secondary Effects

Innumerable troubles may arise, in the long run, which seem to have no connection with the horizontal-output circuit. The vertical-output tube in many receivers obtains its d-c voltage from the boosted B-plus supply. As has been shown in this series, this poorly regulated source can be drastically affected by a mismatched horizontal winding in the yoke. How long does a service technician sweat over an insoluble vertical-sweep trouble before it occurs to him to investigate operation of the horizontaloutput circuit?

The three output tubes in the average tv receiver (vertical, horizontal, and audio) account for more than half the drain on the regular d-c power supply. The horizontaloutput tube itself will account for half or more of this drain in a large number of sets. The series of tests shows that a mismatched yoke can be ultimately responsible for a drop of 20 percent or more in d-c supply voltage. If this fact, of itself, does not account for widespread impairment in performance, a normal slight drop in line voltage in association with it wall almost inevitably have that effect.

Suppose that the receiver's keyed-agc circuit drives its keying pulse from the horizontal-output circuit, or that the horizontaloscillator-control circuit obtains its comparison pulse from this source, as is usually the case. Poor horizontal stability or improper agc action become possibilities.

The drop in d-c supply voltage, already mentioned, can produce strange results in terms of the ensuing change in the balance of control and operating voltages. Consider the video i-f amplifiers, for example. A change in loading on these can alter i-f bandwidth. It can also influence sensitivity to signals or to noise.

What Can Be Done?

There is no intention here to give the impression that a slight mismatch in the case of replacement of any inductive component will, in all instances, result in the immediate and complete destruction of the receiver involved. Sometimes there will be serious results; sometimes there will not. However, there is no easy way of knowing in advance. The long-range solution is prevention rather than cure. The best preventive technique is the use of a replacement that is known to be acceptable.

Normally the service shop does not provide the laboratory facilities (Q meters, bridges, etc.) or allow the time required to screen out a replacement from random parts. This is so even where the critical values of

(continued on page 32)

does your troubleshooting for you!

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TELL-A-FAULT's second big year begins in August — START YOUR SUB-SCRIPTION IMMEDIATELY! (See page 26 for sample symptom sheet and circuit guide).

For full information on the most unique SERVICE ever made available to TV and radio service technicians — write to Dept, 2 TF



Radio's Master Reports

(Continued from page 30)

TV DEVELOPMENT CORP.—Added new series of TV Guy Wire; new series of UHF Tubular Twin-Lead

- UNIVERSITY LOUDSPEAKERS Added several new High-Fidelity Corner Enclosures for 12" Speakers.
- Speakers, UTAH RADIO PRODUCTS—Added a number of new Wall Baffles, VIDAIRE ELECTRONICS Added Model TM-1 UHF-VHF Tenna-Match at \$3.15 dealer net; Model FT-100 Wave Trap Meter at \$14.95 dealer
- net. VIDEO INDUSTRIES—Added UHF Antennas No. 201 at \$3.60 dealer net; No. 202 at \$5.79 dealer net; No. 103 Stacked at \$7.50 dealer net. WEBSTER ELECTRIC—Added Model FX Replace-ment Cartridge at \$5.10 dealer net; Model SS464 Portable Sound System at \$50.25 dealer net.

Discontinued Items

- Discontinued Items BAKER MFG.—Discontinued TV Towers Models 10AM, 12AM. BERLANT ASSOCIATES—Discontinued Model 503 Console Tray for mounting Basic Recorder; Model 702 Console Cabinet. DUMONT—Discontinued TV Picture Tube 30BP4. ELECTROVOX—Discontinued No. W-8A Replace-ment Needle for Webster Electric. PRECISION APPARATUS—Discontinued Model 10-15PM Deluxe Tube and Battery Merchandiset. RADIO APPARATUS CORP.—Discontinued AM Receivers Model AR-2; Model AR-3; FM Receiver Model M-101; Squelch Adapter Model MS-119. RADIO CITY PRODUCTS—Discontinued Model 453 Master Multitester; Model 448A All Coverage Deluxe Multitester.

- 453 Master Multitester; Model 448A All Coverage Deluxe Multitester.
 RCA—Discontinued Electron Tube 715-C.
 RADIO RECEPTOR—Germanium Diode No. 1N82 has been discontinued Variable Reluctance Pick-ups No. 155C, 155X, 165X, 175X; Acoustic Tone Artha No. 51, 61.
 RIDER, JOHN F.—Discontinued No. 113 "Servic-ing by Means of Resistance Measurement"; No. 117 "Servicing Superheterodynes"; No. 129 "The Business Helper".
- Business Helper". STEELMAN PHONOGRAPH & RADIO—Discon-tinued Model 3D3 Del Three-Speed Portable Pho-

unued Model 505 Ect Anne Print Strand
Price Decreases

- AKRO-MILS—Decreased prices on Jiffy Cabinets Model J-16 to \$6.95 dealer net; Model J-24 to \$9.95 dealer net. CBS-HYTRON—Decreased prices on three 21"; one 24"; one 27" TV Picture Tubes. CLEVELAND ELECTRONICS—Decreased price on Model 88 UHF Television Antenna to \$4.77 dealer net

- CLEVELAND ELECTRONICS—Decreased price on Model 88 UHF Television Antenna to \$4.77 dealer net.
 CREST LABS.—Decreased prices on Voltage Booster Model LVB "Jr" to \$4.05 dealer net; Cathode Ray Tube Rejuvenators Model 51 to \$2.17 dealer net; Model B to \$2.03 dealer net; Model C to \$1.87 dealer net; Model D to \$2.03 dealer net.
 EBY SALES—Decreased price on No. 49-9-H Yoke Extension Harness to \$1.35 dealer net.
 GENERAL ELECTRIC—Decreased price on Indus-trial and Transmitting Type Tube GL-IB35A to \$11.10 user price.
 HICKOK ELECTRICAL INSTRUMENT—Decreased price on Model PR-15 R.F. Crystal Probe to \$7.59 dealer net.
 JFD—Decreased price on TV Picture Tube 27MP4 to \$107.00 dealer net; Electron Tubes 5675 to \$15.20 user price; 5690 to \$11.25 user price.
 RAM ELECTRONICS—Decreased prices on Horizon-tal Output Transformers No. X078 to \$5.40 dealer net; No. X079 to \$5.40 dealer net.

- SPECIAL PRODUCTS—Decreased price on Model STAB Battery Operated Signal Tracer to \$10.95 dealer net.
- dealer net. SYLVANIA—Decreased prices on TV Picture Tubes 27EP4 to \$107.00 dealer net; 27LP4 to \$107.00 dealer net; Sub-Miniature Tube 5899 to \$12.30 dealer net; Microwave Crystal Diode 1N25 to \$5.75 dealer net. UNIVERSITY LOUDSPEAKERS—Decreased price on Model SA-HF Breakdown-Proof Driver Unit to \$21.00 dealer net. VIDEO INDUSTRIES—Decreased price on Five Ele-ment Yagi for Channel Six to \$5.25 dealer net.

Price Increases

- CBS-HYTRON—Increased prices on Receiving Tube 6BK5 to \$2.55 list; TV Picture Tube 7JP4 to \$21.50 dealer net. CHICAGO INDUSTRIAL INSTRUMENT—Low Re-sistance Test Lead Model 1048 increased to \$0.90 dealer net.
- sistance Test Lead Model 1048 increased to 30.90 dealer net. GENERAL ELECTRIC—Increased prices on Receiv-ing Tubes 6V3 to \$3.55 list; 6V6 to \$3.40 list; RCA—Increased prices on TV Picture Tube 3KP4 to \$17.50 dealer net; Electron Tubes 5691 to \$9.50 user price; 5692 to \$9.75 user price; 5693 to \$7.75 user price. SPECIAL PRODUCTS—Increased price on Model 309 Phonograph Amplifier-Preamplifier to \$18,90 dealer net.

- SylvAniA—Increased price on Sub-Miniature Tube S896 to \$8.25 dealer net. VIDEO INDUSTRIES—Increased price on Model 103 Fan Antenna to \$3.45 dealer net. WESTINGHOUSE—Increased prices on TV Picture Tubes 17HP4/17RP4 to \$38.25 list; 17LP4 to \$38.25 list.

VACATION NOTICE

During the two weeks from July 27 to August 9 the staff of John F. Rider will be on vacation. This will not affect our readers in any way, though we may be a little late in answering your letters. On August 10 we'll be going full blast again to give you the best service possible.



INDEX OF CHANGES

Model No.	Manual From	Page To	Tek-Fil Pack
Pilot Model TV166	5-1	5-12	
Stromberg Carlson Model TC19	5∽1	5-7	
Stromberg Carlson Model 16 Series	5-1	5-8	-
Tele King Chassis TVJ	9-1	9–16	41



Radio and TV service technicians ... fa-miliarize yourself with high fidelity com-ponents, terminology and problems. High fidelity is booming! LIFE magazine's June 15, 1953 issue told over 15,000,000 people about the amazing difference HI-Fi makes in sound reproduction ... and LIFE re-ported enthusiastically how "High Fidelity Simplified" - the only book quoted - exported enthusiastically how "High Fidelity Simplified" - the only book quoted - ex-plains the complete Hi-Fi story. "High Fidelity Simplified" gives complete an-swers to all questions about Hi-Fi record players and changers, amplifiers, loud-speakers, tuners, tape recorders, etc. The best way to learn about this fast growing field is to read this best selling book which will pave the way for a profitable "extra" to your TV and radio servicing income. Order your copy from your parts jobber or bookstore today! If unavailable from these sources send \$2.50 to:

John F. Rider, Publisher, Inc. Dep't. H.F., 480 Canal Street New York 13, N. Y.

Mismatched Components

(continued from page 31)

the original part and of its circuits are known. There is too little standardization of such components to allow guesswork. A prepared list of checked and dependable substitutions offers the needed margin of safety. Even where direct replacement recommendations cannot be made on the basis of available parts, the inclusion of critical values in the list provides a starting point. In any case where a questionable substitution is made, a careful sequence of checks for the shape and amplitude of waveforms, and for changes in voltages and current, should be conducted. These checks, with the replacement data and the manufacturer's service data for reference, will guard against the hidden hazards that are at least as important as the obvious defects.
METROPOLITAN NEW YORK – NEW JERSEY edition AUGUST 1953

in this issue...

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starts with

Your Parts Distributor

THE CRYSTAL PHONOGRAPH CARTRIDGE
SWEEP GENERATOR OPERATION 3
THE RAYTHEON SERVICE SAVER 6
REFRIGERATION FUNDAMEN- TALS AND SERVICE PROCE- DURE FOR AIR CONDITION-
ING UNITS (Cont'd)
NEW PRODUCTS 13

This Program Is Needed

The editorial in this issue of SUCCESSFUL SERVICING describes a joint effort between a parts distributor and more than 350 television service facilities in the San Francisco Bay Area. We visited San Francisco in July and found the popularity of the program to be very high. Bearing in mind the importance of the independent TV service facility to the welfare of the parts distributing industry, it seems only natural that electronic parts distributors in other localities of the United States should become interested in initiating similar means of promoting the TV servicing industry.

Not only does this plan elevate the standing of the servicing industry in the eyes of the public, but it is to be remembered that the greater the activity of the service shop, the greater the sale of merchandise by parts distributors.

Equally important is that phase of the Qualified TV Service Dealer Program which results in the education of the public to appreciate the problems of servicing. This is done by the weekly television broadcasts. It is extremely important because it effects the income of the servicing industry.

The equivalent of the Qualified TV Service Dealer plan is required in all centers of population being served by television stations. When will it start in the New York area?

JOHN F. RIDER

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Successful Servicing, August, 1953

Sweep Generator Operation

Development of sweep, phasing and blanking

J. Richard Johnson

(This material was excerpted from Chapter 4 of the forthcoming Rider book "How To Use Signal and Sweep Generators" by I. Richard Johnson)

Types of Sweep Generators

Sweep signal generators are those which provide frequency modulation of the r-f carrier signal, so that they may be used for sweep analysis of a response curve of a radio or TV receiver or other device.

Sweep signal generators can be roughly divided into three classes - (1) those with a rather limited sweep range (up to 1 mc) designed primarily for f-m receiver alignment, (2) those designed for TV receiver alignment (sweep up to 15 mc or so) and (3) special laboratory devices with greater sweep ranges.

Although some sweep generators of type (1) have been available, they are now in the minority in practical use. This is because those of type (2) nearly always have sweep-width controls which will allow adjustment of the sweep width to a low enough value to provide for f-m receiver alignment, as well as provide for the greater sweep width necessary for TV alignment. Type (3) generators are special laboratory equipment and not of as great an interest in the field as those of type (2). Accordingly, it is type (2) which we will be concerned with mainly.

Use of Reactance Tube For Frequency Sweep

The reactance tube is one of the main methods used for providing frequency modulation in sweep generators. Let us review briefly how a reactance tube works. The reactance tube produces artificially, by electronic means, the effect of capacitance or inductance. More important, it provides the means of varying the value of that capacitance or inductance by variation of a d-c control voltage applied. If the effective capacitance or inductance produced by the reactance tube is made to form an appreciable part of the capacitance or inductance of the tuned circuit of an oscillator, the frequency of that oscillator's signal can be made to vary by the variation of a d-c control voltage applied to the reactance tube. If the d-c control voltage is made to alternate (that is, become low-frequency alternating current) the oscillator frequency also alternates and thus becomes a "sweep" frequency. This is the method used in some sweep generators to provide the desired frequency sweep.



Fig. 1. Typical reactance-tube circuit as used in a sweep generator.

A typical reactance tube circuit is shown in Fig. 1. The operation is as follows:

1. R-f is coupled to the plate and cathode of the reactance tube from the oscillator tank through C2 and C3.

2. This causes the reactance tube platecathode circuit to act as a load across the oscillator tank. The current drawn through

Fig. 2. A vibrating

capacitor as used to

produce frequency

sweep.

is also nearly 90 degrees ahead of the oscillator voltage. This RI voltage is applied to the grid of the tube and there it acts to control the current in the plate circuit. The plate current variations are in phase with the grid voltage variations. Since the latter are almost 90 degrees *leading* with respect to the r-f voltage applied from the oscillator, the plate current is also almost 90 degrees leading with respect to the oscillator r-f voltage.

The result of all this is that, looking from the oscillator toward the reactance tube, the oscillator sees a load which draws current that leads the applied voltage by nearly 90 degrees. Since this is exactly what would happen if a capacitor were connected in place of a reactance tube, the oscillator does not distinguish it from a capacitor, and its frequency is controlled accordingly.

The larger the capacitance, the greater r-f current it will draw from the oscillator; in the same way, the more positive (or less negative) is the control voltage on the reactance tube, the more current the tubc draws. Thus the more positive the control voltage, the larger will be the capacitance exhibited by the reactance tube; the more negative the control voltage, the less the capacitance.

Now if the control voltage is made to vary rapidly back and forth, we produce the same effect as though we were rapidly rotating a variable capacitor across the oscillator tank circuit. This effect causes the oscillator to change frequency rapidly in accordance with the control voltage changes.



this load depends upon the value of the grid bias, which in this case is the control voltage across R1.

3. Also across the oscillator tank circuit is the series combination CI-RI. This series circuit is designed so that the reactance of CI is much greater than the resistance of RI. The current through this circuit is therefore leading the oscillator voltage applied by nearly 90 degrees. This current through RI produces a voltage drop which In other words, the oscillator frequency "sweeps" back and forth.

In sweep generators of the reactance tube type, a small voltage derived from the power line is applied as control voltage. This voltage is ordinaraily 60 cps a-c sine wave, and thus causes the oscillator frequency to vary sinusoidally.

In sweep generators, the sweep width is controlled by variation of the a-c control (continued on page 23)

Successful Servicing, August, 1953



4



VOLUME 14

AUGUST, 1953

JOHN F. RIDER, Publisher ANNETTE M. TRICARICO, Editor

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Curtain Time

There has come into being in the San Francisco area a move-ment known as the GMP Qualified TV Service Dealers program. GMP stands for the George M. Popkey Co., a parts distributor in San Francisco. This organization, which fathered the program, is guiding its efforts.

In the main it is a cooperative effort among TV service dealers who have pledged themselves to abide by a set of conditions which are aimed to satisfy the jobber's needs for TV service. But it goes far beyond just living by a code of ethics.

One of its aims is to answer a difficult question asked by the public: "How do I recognize a good service shop?" The GMP organization checks the qualifications and equipment of the organi-zation which wishes to join the group. Identification is by a distinctive label (shown in picture on page 14). It appears on the truck (s) of the service organization and identification cards carried by the technicians.

Advertising showing, the group label and the names of the participating members of the group appears in local newspapers, and in the local TV Review Magazine which circulates among the public in the San Francisco Bay area. The advertising is cooperative – the service facilities make their contributions on a monthly basis and these monies are matched by the Popkey organization.

The Popkey Co. sponsors a TV program on KPIX every Wed-nesday night. It is a news analysis by the foremost news com-mentator in that area, William Winter. The commercial on this program attempts to do two things – to make the organization's distinctive label known to the public; also to educate the public to better understand the TV receiver servicing problem – to better ter appreciate the requirements of service – to realize that it is a technical business – that failures will occur in receivers despite claims made to the contrary in receiver advertising - that repeat calls are not necessarily due to the failure of the part recently replaced.

Just a few weeks ago, a program of cooperation was completed between this qualified TV service dealer group and a nationwide credit-card service. This is aimed to make it convenient for the service dealers in the group to extend credit to the public, yet get their money immediately. The credit-card organization receives a copy of the invoice, pays the service dealer immediately and

then collects the money from the public later. The GMP qualified service dealer program is about the best thing we have yet seen for the betterment of the TV service in-dustry. This is 'proven by the fact that both large and small organizations are in it and working hand in hand. Every problem which may arise in such an effort has not yet been encountered, but it's a certainty that it will be solved. At the moment a grievance committee is in the process of formation, its purpose being to process properly any complaints if they arise from the public relative to any member of the group.

A program of this type should exist in every city and state of the nation. It is something which the TV service industry needs. It obviates the necessity for licensing. It will give the TV servicing industry stature in the eyes of the public. The unified effort of a group like this will kill off the opportunist — the fly-by-night operator - the kidnapper of a receiver who demands ransom from the public before he returns the receiver.

We must commend the George M. Popkey organization for its courage and foresight. Our sincere hope is that, somehow, the other parts distributors in the San Francisco area can see their way clear to participate in the program. If the same ideas take hold elsewhere in the nation, it would be grand if the sponsors of the program were a council of parts distributors in each locality - in this way avoiding any possibility of conflict among dis-tributors in an area. It is to be remembered that every inch of progress made by the independent servicing group is important to the continued progress of the parts distributing industry.

Color TV

Enthusiasm for color TV seems to be growing quite rapidly. We have had occasion to visit different parts of the nation during the past few months and concerns actively engaged in the television receiver manufacturing industry are leaning toward color, although they realize that its spread across the nation will take some time.

We have said it before, and we say it again - the independent TV servicing industry is capable of handling color TV if it applies itself to the job of learning how. From where we sit, the transi-tion from radio receivers to black and white TV was much more difficult than from black and white TV to color. . . . This does not make the color TV receiver a simple gadget. It is a far cry from a simple receiver, but it is not so complicated that the details concerning its operation and repair cannot be digested by servicing industry personnel. The situation which bothers us most is the ability of the ser-

vicing industry to cope with color TV when it hits the market. It must be ready to do a good job if it is going to discourage the participation in servicing by all of the other agencies which have a stake in the receivers which get into the hands of the public.

Our Slogan For the Year

Mr. TV Receiver Manufacturer - make the bottom of the chassis of table model TV receivers accessible. . . . Make the bottom of the cabinet removable. . . . You'll get better service.

Set Distributor TV Servicing

TV servicing by set distributors in centers of population in different parts of the country is severe competition for the inde-pendent TV service shop. It can be discouraged by the demon-stration of comparable skill and knowledge by the servicing industry. But to do this, the service technician must know as much about the receiver as the distributor's service personnel. . He must work with the same information which the set distributor has in his possession - the data which the receiver manufacturer prepared. Not abridged information — but the complete data . . . This is the only way in which the independent TV service shop can match the experience of the factory-trained service specialist - the accumulation of hints and kinks and cures which the set distributors have in their files. .

Some information is better than nothing — but incomplete information will never compete successfully with all the facts! Only with the complete information on hand can the TV service technician do the kind of a service job which will assure his continuance in business.

John F. Rider

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by John J. Rider

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Raytheon



Fig. 1. Sample portion of the "Owner's Guide."

service saver

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When a car owner drives his automobile into a service station for repair it is customary for him, or her, to describe to the car inspector the type of trouble which seemingly exists in the automobile. Sometimes the descriptions are very adequate and correct, and so give the inspector an excellent clue as to what corrective remedies are required. The average car owner is very far from being a car mechanic, but fortunately for the 40 odd million car owners it is not too difficult a task to describe at least some of the symptoms of what is wrong.

We present in these pages an idea conceived by Raytheon TV and, to the best of our knowledge, by Mr. Carroll Hoshour, Director of Sales Engineering. In many respects, it is not too much unlike the situation in the automobile business as described. As we see this idea, it seems to possess tremendous possibilities which may make the life of the service technician casier and which in the long run can improve the relationship between the public and the servicing industry tremendously.

All indications point to servicing TV receivers in the home as the standard procedure. Statistics covered by the writer lead to the conclusion that even at this carly date between 80 and 90% of service calls are completed in the home. Generally, upon receiving a call, the service facility attempts to establish certain facts concerning the receiver in question. The information covered may determine the data needed for reference instructions to the service technician on the probability of the trouble and possibly the replacement parts which may be needed.

Advance Diagnoses Made Possible

Unfortunately the customer, not being overly familiar with terminology which is properly descriptive, oftentimes finds it very difficult to describe the character of the (Continued on page 19)



Sync Stabilizer:

The control varies the operational characteristics of the sync clipper stage to obtain the optimum operation point for the least effect of noise interrupting synchronization. The control should be adjusted for a steady picture.

REPLACEN	IENT	PARTS
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Ref. No.	Part No.	Description
R401	10B-17318	Sync Stabilizer control—3 meg
C442	17A-22376	Printed circuit



SYNC CLIPPER AND AMPLIFIER SCHEMATIC

POOR VERTICAL SYNC

Poor vertical sync is generally caused by improper adjustment of the vertical hold control or a defect in the oscillator, sync amplifier or sync clipper circuits.

CHECK:

R437	Vertical Hold Control Adjustment
R401	Sync Stabilizer Control Adjustment
V-15 V-8	Vertical Blocking Oscillator and Sync Am- plifier (12AU7) Sync Clinner (ABEA)
C422	Intergrating network
R435-436-437-438	Vertical Hold Control Resistors
C423	Coupling Capacitor
T402	Oscillator Transformer

NOTE: A poor vertical sync condition may possibly be due to a defect in the RF, IF or video amplifier stages. This may be quickly checked by observing the blanking bar as illustrated in condition 16. If the detail in the blanking bar is not blacker than the blackest portion of the picture an overloading condition exists. Refer to overloading, condition number 33.



13

for the new 12 volt auto circuit

RADIART announces its 6300 series... an addition

to the full line of

Seal-Went RED VIBRATORS

Faster Starting

The exclusive RADIART design permits the briefest possible "Warm-up" period, thereby making the RADIART vibrators practically instantaneous starting. This added feature means greater performance.

Longer Life

There's more for your money in every RADIART vibratorthey last longer! Precision manufacture, using only the finest materials, assures long lasting, trouble-free performance.

Complete Replacement Line

RADIART has a CORRECT replacement vibrator for every original equipment vibrator. 12 Radiart vibrator types serve over 89% of all popular replacements. NOW..THE NEW 6300 SERIES IS READY FOR THE NEW '53 car MOD-ELS with radios having 12 volt circuits.

Seal-Vented

Sealed at the factory to prevent the formation of an insulating film on the points while the vibrator is on the shelf...the sealed vent automatically opens when put in use to allow the vibrator to "breathe".



preferred by Servicemen Everywhere

THE RADIART CORPORATION CLEVELAND 13, OHIO VIBRATORS • AUTO AERIALS • TV ANTENNAS • ROTORS • POWER SUPPLIES Please mention Successful Servicing when answering advertising.

Refrigeration Fundamentals And Service Procedure For Air Conditioning Units (Con,t)

This, the last of three articles, continued from last month. The text and illustrations are reprinted through the courtesy of the RCA Service Co. from their booklet entitled "Introduction to Room Air Conditioning."

Performance Tests

The amount of moisture in the air is an important factor affecting the performance of any air conditioner. Accurate checks of operating efficiency require the measurement of temperature and humidity conditions of the air and power consumption of the unit.

Prepared by the Commercial Service Section of the RCA Service Co., Inc.

the reading is taken. The bulb end of all thermometers must be in the center of the air stream in which they are suspended. Refer to Fig. 5 for thermometer placement.

Checking Evaporator Air-Inlet Temperatures. To obtain correct reading, close the damper door. Suspend a psychrometer in the evaporator air-inlet stream. The wetbulb thermometer should be placed closest to the louvers so that the cooling effect of the wick does not influence the reading of the dry-bulb thermometer.

Checking Conditioned Air From Evaporator. In checking the temperature of the conditioned air from the evaporator, a dry-bulb



Fig. 5. Thermometer placement for performance tests.

To make a performance test the following equipment is necessary:

Two dry bulb thermometers

- One psychrometer
- One wattmeter

In comparison with a dry bulb thermometer, the wet-bulb thermometer gives a lower temperature reading, the difference being in proportion to the rate at which moisture is evaporated from the wick covering the bulb. Before readings are taken, the wick must be clean and thoroughly wet with clean water.

Read the temperatures when the lowest wet-bulb temperature is obtained. The wetbulb thermometer will not maintain a minimum reading for very long, since the wick dries quickly. The wick must be wet when thermometer is suspended in front of and close to the room air discharge grille.

Checking the Air to Condenser. To read the temperature of the outside air used for cooling the condenser, place a dry-bulb thermometer outdoors near the outside air entrance (refer to air flow diagram of unit being tested). See that the thermometer is suspended securely, not in contact with any metal parts, and shielded from the direct rays of the sun.

If for any reason the thermometer cannot be located at the unit, it may be placed outside the nearest window in the same wall.

Checking Power Consumption. The wattmeter is connected in series with the power supply to the air conditioner. The power consumption is important only in those cases where the temperatures are within limits but the power consumption is suspected to be excessive.

Description of Performance Table. Performance tables have been prepared to aid in determining whether the air conditioners are producing a maximum amount of cooling with normal current consumption for the existing operating conditions.

Since different models have different performance characteristics, the performance table which has been published for the particular model under test should be used for reference. Each table contains temperature ranges and wattage readings that have been obtained from representative production models. A representative table is shown on page 11.

The first column marked "Condenser Air-Inlet D.B. (°F)" indicates the dry-bulb temperature of the outside air.

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The fourth column marked "Total Watts" indicates the normal power consumption (watts) of the unit for the existing operating conditions.

How to Use the Performance Table. To obtain test values for comparison with the data given in the table, proceed in the following manner: Support a dry-bulb thermometer in the condenser air-inlet stream. Support a psychrometer in the evaporator air-inlet stream and be sure the wet-bulb wick is wet. Support a dry-bulb thermometer in the evaporator air-discharge stream. Close the damper doors and any other doors or openings to the room so that no outside air is allowed to enter the room and no cooled room air is allowed to escape. This is necessary if correct readings are to be obtained. After the thermometer readings have become stabilized, record them. All readings should be taken as nearly simultaneously as possible. If the test and chart values are not exactly the same, use the nearest values given.

EXAMPLE: Assume that the following temperature readings have been taken: (continued on page 27)



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Here are more data that will keep your RIDER'S DEPENDABLE REPLACEMENT PARTS LISTING published in TV Volume 11 up to date.

		Add A-8137 to Stancor column. Add X050 to Ram column. Add X056 to Ram column. Add X066 to Ram column.		Add A-8126 to Stancor column. Add A-3000 to Merit column. Add V-405* to Ram column and •Drill new mtg. hole to Remarks column.		Add A-99X to Triad column.	Add A-303/ to Merit country.		Add Y-12 to Triad column. Add Y-12 to Triad column. Add MDF-70 to Merit column.								ON Part No. 390197 is now IBC #WK-5000 (instead of W-5000). e used with the following controls: 29 23		EMERSON Part No. 390197 is now IRC #WK-5000 (instead of W-5000). should be used with the following controls: # Q11-137 # Q11-129		for HATTICEAETERS Part No. 458120 should be Mallory No. TC2501		tes for DU MONT Variable Resistance Controls:			4	A A, RA-162B1, B4, B5, B6, B7, B22, B23, B24, B25, B26, Early & Late	B10, B11, B12, B13, B14	
t Mfr.'s Original Part No.	ANSFORMERS	5035 T80-263 T80-265 55C144	TRANSFORMERS	32-8431-2 55B115	NSFORMERS	32-8577-1	821Acc		30E164-7 30E176 EL-138			condation for EMFR	art No. C3 should 1 390156. IRC # Q11-	390181, IRC # 011- 390183, IRC # 011-	at the realscement	previously listed.	urification of alterna	Model RA-130. Model RA-130.	Model RA-130. Model RA-130.	Model RA-130. Model RA-130.	Model RA-130 Model RA-160	RA-162							
Set Mfr. Set	HORIZONTAL OUTPUT TF	Hoffmån Sears, Roebuck Western Auto	VERTICAL OSCILLATOR	Philco Western Auto	VERTICAL OUTPUT TRA	Philco	Western Auto	YOKES	Sentinel " Video Products		ADVISORY NOTICES	IRC now advises us that:	b) A Coupler, IRC P EMERSON # 3	***	the line and states at the	instead of TCD505 as	The following list is a cla	0100740 or 01012800 01007520 or 01029660	01009620 or 01012830 01009630 or 01012840	01026500 or 01030200 01028000 or 01029800	01028400 or 01030600 01038800 or 01044600								
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Set Mfr.'s Original Part No.		C20331 - 331 		030100010 030100030 030100060 030100060 030100070	080001020	SI	5029	RMERS	32-8242-11 V-11360-1	NSFORMERS	TVL-17	TRANSFORMERS	708151	AERS	20E785	CONTROLS	149893 154095 01035700	01026500	4866		2 ¥	 28E75							
Set Mfr.	FIXED CAPACITORS	Arvin 	6	Du Mont	E	POWER TRANSFORMER.	Hoffman	AF. OUTPUT TRANSFOI	Philco Westinghouse	RATIO DETECTOR TRA	Trav-Ler	SOUND DISCRIMINATOR	Emerson	SOUND IF. TRANSFORM	Sentinel	VARIABLE RESISTANCE	Crosley		Hoffman			 Sentinel							



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-	Set Mfr.	HORIZONTAL OUTP	Hoffman Sears, Roebuck Western Auto	VERTICAL OSCILLA Philco Western Auto	VERTICAL OUTPUT Philco Western Auto	YOKES	Sentinel " Video Products		ADVISORY NOTICES	IRC now advises us a) Their new r b) A Coupler, EMERSO	Mallory now advises instead of TCD5	The following list is 0100740 or 0101 01007520 or 010 01009220 or 010 01009820 or 010 01028500 or 010 01028800 or 010 01038800 or 010
			Change 1464-3900mmf to 1469-330mmf in Aerovox column. Change 1R5D4 to 5R5T33 in Cornell-Dubliler column. Delete MCE463 from Mallory column. No replacement. Change MS-234 to MS-333 in Sprague column.	Change 030100010 to 03100010 in Part No. column. Change 030100010 to 03100010 in Part No. column. Change 030100000 to 03100060 in Part No. column. Change 030100060 to 03100060 in Part No. column. Change 030100070 to 03100070 in Part No. column. Change 030100090 to 03100070 in Part No. column.	Add R-38BC to Trizd column.		Add A-3018 to Merit column. Add A-3825 to Stancor column.		Add TV-115 to Merit column.	Add TV-114 to Merit column.	Add TV-151 to Merit column.	Add 4WK-1500L to FRC Stock No. column. Add U65 to Mallory Stock No. column. Add G1-1 to FRC Stock No. column. Add G-1 to FRC Switch No. column. Add G4-1 to FRC Switch No. column. Add G4-1.5 to Clarostat Switch No. column. Add G5-1.1 s to Clarostat Switch No. column. Add G1-109 to FRC Stock No. column. Add G1-109 to FRC Stock No. column. Add U6 to Mallory Stock No. column. Add U6 to Mallory Stock No. column. Add U6 to Mallory Stock No. column.
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	Set Mfr.	FIXED CAPACITORS	Arvin 	Du Mont	POWER TRANSFORM Hoffman	AF. OUTPUT TRANSI	Philco Westinghouse	RATIO DETECTOR TI	Trav-Ler	SOUND DISCRIMINAT Emerson SOUND IF. TRANSFO	Sentinel VARIABLE RESISTAN	Crosley Du Mont Hoffman Sentinel

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Carry An Extra High-Voltage Supply

by Phil Weiss

The best indication of how a tv set is performing is the picture on the screen together with sound. However, when a set has insufficient high voltage to show any light on the screen, the serviceman is immediately deprived of his most important source of information.



Fig. 1. The completed accessory supply.

If he decides to pull the set into the shop, he needs more information before he can give the customer a reasonable estimate of what it will cost to repair it. And many customers demand such an estimate before they will permit their set to be removed. Much helpful information can be obtained on the spot by using an auxiliary highin the cabinet, removing only the chassis.

2. Is there some additional trouble besides the obvious one of no high voltage, for example, poor video, or poor sync? If so the customer had better be told about it before the set is removed.

The auxiliary supply is built in a 6" x 6" x 6" utility box, as shown in Fig. 1. The schematic diagram of the unit appears in Fig. 2. The ground strap is clipped to the tv chassis and the high-voltage lead is clipped to the picture tube anode (from which the receiver's high-voltage lead had previously been disconnected). The same procedure is used when the tv chassis is ungrounded since there is always enough leakage to pass the small current required by the picture tube anode., Severe shock hazard is avoided by the use of a 100,000-ohm wirewound resistor, in series with each lead, us shown in the schematic diagram.

When the tv set and the extra high-voltage supply are both turned on, the picture tube receives about 16,000 volts. Usually a raster will appear, unless the tube is bad, or is is not receiving correct voltages at its socket. It is sometimes necessary to turn down the brightness control to avoid burning the face of the tube when this is done, especially when the yoke is shorted. Sometimes the



Fig. 2. Schematic of the extra high-voltage supply.

voltage supply to produce a raster on the screen. By examining the raster so produced the technician can often answer these important duestions:

1. Is the trouble in the picture tube or deflection yoke? If not, the whole picture tube assembly can often be left raster will not focus properly, if the extra voltage supply is either too high or too low for the set. But in general, it works very well.

Nearly any flyback transformer could be used, provided it has a separate yoke winding (continued on page 30)



Positive cures for TV troubles! Gives you exact directions for correcting TV receiver performance "bugs". Each cure is official, factory-authorized, direct from the receiver's manufacturer. Listings by manufacturer and model or chassis number. Helps correct the most difficult faults—picture jitter, hum, instability, buzz, tearing, etc. Vol. 1, 115 pages (51/4 x 81/4") ...

Vol. 3, 119 pages (51/4 x 81/4").....\$1.80

Covers 16 brands, Kaye-Halbert through Philco Vol. 4, over 115 pages (51/4 x 81/4")......\$1.80 Covers 10 brands, Philharmonic through Shaw TV

TV SWEEP ALIGNMENT TECHNIQUES

by Art Liebscher, Test Equipment Specialist Never before has there been a book such as this on TV sweep alignment! An expert gives you accurate time-saving methods—and tells you how they work. Introduces the new Supermark method. Chock-full of sweep curve pictures. Valuable for servicing in UHF signal areas. 123 (5½ x 8½") pp., illus......\$2.10

TV TROUBLESHOOTING AND REPAIR GUIDE BOOK. R. G. Middleton. Finest practical book to make TV TELEVISION-HOW IT WORKS, Rider Editorial Staff. Discusses all sections of TV receivers. Excellent introduction to TV servicing, 203 (81/2 x 11") pp. illus.\$2.70

ENCYCLOPEDIA ON CATHODE-RAY OSCILLOSCOPES AND THEIR USES, by Rider & Uslan. Most complete 'scope book! Cloth cover. 992 (81/2 x 11") pp. 3,000 illus.\$9.00 TV INSTALLATION TECHNIQUES, by Marshall. "Howto-do-it" book on antennas, receiver adjustment, municipal laws on installing, etc. 336 (51/2 x 8½") pp., 270 illus.\$4.50 UNDERSTANDING VECTORS AND PHASE IN RADIO, by Rider & Uslan. A shorthand method to easier understanding of radio theory. Cloth cover. 160 (5½ x 8½") pp., illus.\$1.89 TV AND OTHER RECEIVING ANTENNAS (Theory & Practice), by Bailey. All details on more than 50 latest type receiving antennas. Cloth cover. UHF PRACTICES AND PRINCIPLES, by Lytel. Com-

TV MASTER ANTENNA SYSTEMS, by Kamen & Dorf. A practical working manual on master antennas; problems and solutions. Cloth cover. 356 (51/2 x 8½") pp., 270 illus.\$5.00

FM TRANSMISSION AND RECEPTION, by Rider & Uslan. 2nd edition covers FM from start to finish, including receiver servicing. Cloth cover. 460

Place your order with your Parts Jobber NOW or write:



480 Canal Street, New York 13, N. Y

Successful Servicing, August, 1953



Additional literature on each of the products described in these columns may be obtained from SUC-CESSFUL SERVICING. See the coupon in column three.

New Battery Eliminator and Charger

A new Battery Eliminator and Charger kit for combined 6-volt and 12-volt use has been developed and added to the EICO line by Electronic Instrument Co., Inc. This instrument, the new Model 1050, is available in kit or wired form.



Item 1.

The Model 1050 is designed for use as a Battery Eliminator in the servicing and demonstrating of both 6-volt and 12-volt operated auto radios, marine and aircraft equipment, and for charging both 6-volt and the new 12-volt storage batteries. Rated above normal needs in these applications and fully protected against overloads, the instrument incorporates such features as continuously variable output voltage, separate voltmeter and ammeter, safe and easy operation. It may be used in other applications requiring a low-voltage d-c power supply.

Snap-in Resistors for Printed Wiring

In keeping with latest printed wiring techniques, the Electronic Components Division of the Stackpole Carbon Company has announced that its standard 1/2-watt fixed composition resistors are now available with specially formed and trimmed leads. This new feature greatly facilitates the handling



of resistors when assembling components on the standard 0.062" printed wiring base. The hot tin dipped leads are cut and formed for a tight "spring fit" and extend through the printed circuit base just far enough for easy soldering. Resistors snap into place. No additional operation need be made for proper assembly.

Remote Control Unit for TV Boosters

Blonder-Tongue Laboratories announces a new 2-piece remote control unit for the operation of TV boosters, uhf converters, or distribution units from the on-off switch of the television receiver. This unit will operate with any Blonder-Tongue auxiliary equipment of this type.



Item 3.

The power control section of this device, Model RC-1, plugs into any 117-volt a-c outlet and receives the TV set line cord. It contains a thermo relay, an indicator light, and fuses. The remote portion at the unit to be controlled feeds a-c power and accepts TV signals. For outdoor installations, the remote section may be mounted in a Blonder-Tongue weatherproof housing along with the booster or other unit.

A single, heavy-duty 300-ohm line is used between the two parts to carry a-c power out and TV signals back at the same time. Both sides of this slave circuit are fuseprotected according to the Electrical Code of the National Board of Fire Underwriters.

Square-Wave Generator

The new SKL Model 504 Square-Wave Generator, manufactured by Spencer-Kennedy Laboratories, Inc., produces square-wave voltages without tilt or overshoot. The extremely short rise time (less than 30 milli-



Item 4.

microseconds) makes the generator useful for testing the response of audio, i-f, r-f, and video-amplifier circuits.

The calibrated voltage output is continuously variable from 0 to 11 volts. A synchronizing pulse output is provided on the front panel to permit triggering of an oscilloscope or similar network. Another front-panel terminal pair allows the generator to be synchronized with an external voltage source.

The Model 504 has a frequency switch with nine positions. The first step permits operation at any frequency as determined by an external capacitor. The remaining positions provide frequencies from 0.5 cycles to 500 kc in decade steps. This provides a convenient source of time bases from one second to one microsecond.

The SKL Model 504 Square-Wave Generator and its self-contained regulated power supply are mounted in a compact, lightweight aluminum cabinet suitable for bench use.



Item 5. Improved Antenna Clip

Industrial Television, Inc., announces that initial deliveries are now being made to jobber accounts of its newest Tenna Clip.

The new Tenna Clip incorporates the design improvements of the two-year period since its original development. Provision is made for either screw terminal or solder connection with strain relief.

To obtain additional literature on any of the items described in this section encircle the number of the product (number appears under picture) on the coupon below, cut the coupon out and mail it to SUCCESSFUL SERV-ICING, 480 Canal Street, New York .13, N. Y.

	- Cur he	19	
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Successful Servicing, August, 1953

RCA Announces Prefab I-F Strip

THE TELEVISION INDUSTRY'S first ready-to-use prealigned i-f amplifier—complete with electron tubes and printed circuit components—was announced recently by the Tube Department of the RCA Victor Division, Radio Corporation of America.

The unique assembly, now in mass production, is designed to help TV set manufacturers pare production time, eliminate assembly and alignment operations, and provide efficient amplifier operation, according to R. T. Orth, vice president in charge of the tube department.

Intermediate-frequency (i-f) amplifiers, essential to every home TV set, are now constructed and aligned by individual set manufacturers, he pointed out. Such operations are exacting and time-consuming because amplifier tubes, circuits, and wires must be assembled on the TV chassis, positioned to assure efficient operation, and then connected and soldered manually. The new amplifier is a finished "package," ready for attachment to the chassis.

The unit became commercially practical with the successful application of a special photo-etch "printing" process for the production of wiring patterns as well as component coils, Mr. Orth explained. Accordingly, all hand-wiring operations are eliminated. In effect, the amplifier is mass-produced from a series of film negatives covering the wiring panel and the individual printed components.

The unit is a 3-stage, 40-mc assembly, designed for intercarrier receivers having picture and sound i-f carriers at 45.75 and 41.25 mc respectively.

COMING IN OCTOBER RIDER TV 12 WITH REPLACEMENT PARTS

	with
	Replacement Parts Listings
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	at the end of August!
Po	ack 90. Sparton, Spiegel, Stewart-Wa ner, Stromberg-Carlson
Pc	ick 91. Starrett, Sylvania, Teletone, Western Auto
Po	ick 92. Aimcee, Arvin, Western Auto, Westinghouse
Pa	ick 93. Cadillac, Emerson, Fada, Gambl Skogmo
Pa	ck 94. Hallicrafters, Jewel, Magnavo Majestic, Mitchell
Pa	ck 95. Montgomery Ward, Motorola, Philco, Philhormonic
the the isso wr	For the individual models included it ase Packs, refer to the TEK-FILE INDEX it will appear in the September 1953 ue. Consult yaur RIDER distributor o ite to us directly.



a meeting of the GMP Qualified Service Dealers. (See story on page 5.)

Mr. Rider addresses





Bring back that <u>New=Set Sparkle</u> with Performance=Tested Tubes

Meet John Cunningham, a CBS-Hytron Commercial Engineer. John is beginning at the beginning for you. Socket by socket, he is analyzing the tube requirements of a brand-new TV set design.

John knows the superior performance demanded. He concentrates his know-how on insuring top tube operation within standard specification limits. He tests sample tubes . . . checks analysis data. Working hand-in-glove with the set designer . . . and with CBS-Hytron engineers . . . he assures control of the characteristics of all tubes for this new chassis. Finally he achieves . . from rectifiers to picture tube . . . the perfect performance all of this engineering team (and you) seek.

engineering team (and you) seek. Constantly CBS-Hytron carries on teamwork like this. Socket by socket analysis. Day in, day out — with 9 out of 10 leading TV set makers. Both tube and set engineers pool their specialized skills. Scores of the nation's foremost TV set engineers help make endless CBS-Hytron improvements. Help assure you of unsurpassed performance in virtually *all* leading TV sets. Small wonder that your CBS-Hytron

Small wonder that your CBS-Hytron replacement tubes recapture that new-set sparkle. Please your customers. Cut your call-backs. Profit more. Take advantage of CBS-Hytron engineering. Demand CBS-Hytron ... your logical replacement tube, because it is performance-tested all the way... from original to replacement.





27EP4 and 24TP4 . . . both mirror-backed, spherical, electromagnetic types.

Leading TV set makers demanded maximum brightness from their large-screen sets. Without strain on component parts. For them, CBS-Hytron introduced its *Mirror-Back* picture tubes. Mirror-like effect of their aluminized backing steps up light output. Adds sparkling brilliance to the picture. Gives greater contrast and freedom from screen discoloration. You, too, will want CBS-Hytron *Mirror-Back* tubes for replacement. Because your customers can see them recapture that bright, new-set sparkle. Order the performance-tested 27EP4 and 24TP4 from your CBS-Hytron distributor.

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High voltage accessory probe gives readings to 30,000 volts DC.

Dealer net price ... \$95.00

Ask your electronics distributor for information, or write us.



the crystal phonograph cartridge

(continued from page 1)

it to normalcy. It is too late to merely add moisture then, because the crystal structure itself has warped.

In climates where the temperature and relative humidity are extremely high, crystal cartridges have a tendency to take on excessive moisture. A simple *desiccator*, such as is shown in Fig. 4 may be used as an aid in controlling this hydration. The desiccant may be either calcium chloride or silicagel. If the crystal cartridge, when not in use, is stored in the desiccator, the excess moisture will be removed from the crystal element, thus helping to prolong the useful life of the cartridge.



Fig. 3. Operation of the crystal cartridge.

In this case the desiccant must be changed periodically, as it becomes saturated with moisture. To determine whether the desiccant has reached its saturation point, a piece of paper toweling may be moistened and inserted in the desiccator. This should completely dry out within approximately $1\frac{1}{2}$ hours. If it does not dry, it may be assumed that the desiccant has become saturated and should, therefore, be replaced.

Soldering to Cartridge Terminals

When leads are required to be soldered to the cartridge terminals during installation or service, the soldering iron should not be applied for a longer time than necessary to make a solid joint. Terminals are well tinned during manufacture and if leads are also well tinned before connection is made, it is only necessary that the soldering iron be applied to the joint long enough to flow the solder. Remember the metal ribbon leads to the crystal conduct heat very well, and the usual soldering iron temperature is well over 120 degrees F. Give the crystal element a chance, before it is even connected to the phonograph.

Replacement of Cartridge

To an experienced serviceman replacement of a crystal phonograph cartridge is a fairly routine procedure. Charts are available, listing replacement cartridge specifications, identifying the frequency response, output voltage, physical mounting, needle pressure—everything required to show which cartridge may be used to replace which. From stock, or if necessary from the shelves of dealers, the required replacement is obtained, connected, mounted, and the job is done. The serviceman gets his fair labor charge, and he's sold a cartridge. The customer has a speedy repair with an exact replacement.

On the other hand, lest the serviceman consider opening the crystal cartridge and attempting an internal repair of the element itself—remember the eternal soldering caution? It's even worse inside. Consider:

1. A crystal element consists of a chemical salt. (If you get the chance, give one a lick with your tongue. Salty, isn't it?) No binder but the normal crystalline structure holds the fragile element into a single piece. In handling and assembly this frail salt is easily broken. You break a crystal in assembly, and there's your profit on the floor in chips.

2. Crystals are especially treated at the factory to protect them from adverse climatic conditions, requiring specially controlled storage facilities. The crystal elements themselves are not stocked. They are assembled as received. The complete cartridge is stocked as a sealed unit. Should the service shop desire to stock crystal elements, without temperature and humidity controls, the loss from deterioration of crystals would prove prohibitive.

3. The crystal pickup cartridge assembly appears to be a simple mechanism. In



Fig. 4. Using a desiccant to dry out a crystal.

operation it is truly simple. However, fine tolerances with special instruments and individual company techniques make each cartridge a precise problem in basic construction. Even if you could match the company assembly, would it pay?

4. Finally, even if you did complete the assembly, could you tell how the repaired unit stacked up against the factory product? Few servicemen have access to the test equipment necessary to properly test pickup cartridges. And there's no dealer return of opened, "repaired" cartridge units.

(continued on page 30)

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"Part Number for Part Number"

Many different activities make up the cost of running a business. In the operations of an electronic parts distributor one of the cost items is the research which is necessary in the parts distributor's store to determine the replacement part which is needed by the service technician when he does not tell the counterman the set manufacturer's part number for the original part used in the receiver.

Every parts distributor is ready and willing to serve the television servicing industry at all times. It is a daily practice for countermen to check lists which identify suitable replacement parts. It must, however, be recognized that at best this is a time consuming operation for both the man behind the counter and for the person in front of the counter who wants the part. The parts distributor is always ready to do checking of this kind because he is selling the part and satisfying the customer.

There is, however, one point which warrants more than just casual attention in this situation. It is the possible saving of the service technician's time by a slight modification of the request that he makes to the distributor's counterman. Instead of asking for a contrast control for a TV receiver of a certain model, it would be very much better if he asked for that part by the original equipment part number.

Very few service technicians, if any, attempt to service a television receiver without having service data on hand. While this type of information is available in assorted varieties, seldom does it lack a list of the receiver manufacturers' parts numbers for the components which are used in the receiver. Therefore, the information which would save everyone time in procurement of a suitable replacement part, if it exists, is readily available. It is simply a matter of using the information. Not only does this save time but it is a much more businesslike method of procurement. It may not mean too much if just an occasional replacement part is purchased over an extended period of time, but every service shop which is worth its salt has occasion to procure many replacement parts.

As regards to transformers, chokes, and capacitors of all kinds, it is by far the best way of getting the proper part from the parts distributor. Frequently the parts list shows changes in part numbers for specific chassis and models. A request for a part by functional name may lead to the purchase of a part which is not intended for the particular chassis in question. However, if the replacement part is based on part number for part number reference, not only is time saved for everyone, but the possibility of error is minimized.

JOHN F. RIDER

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Successful Servicing, August, 1953



Rider Manual pages and TEK-FILE pack The which include the original data and shematics to which the following production changes apply, appear in the index on page 32 of this issue.

FIRESTONE

MODELS 13-G-110, -115, -116, -119, -120 Power transformers in later production.

The power transformer part No. 53X324 has been replaced in later production by part No. 53X331. This later power transformer has the rectifier tube (V20, a 5U4G) and socket mounted on the top cover. The schematic symbol remains T10.

STROMBERG-CARLSON MODEL 16 series

Service data revisions.

The following changes have been made in the 16 series receivers: Capacitor changes

1. C40 becomes part No. 110040 instead of part No. 110037 when it is mounted so as to be accessible from the rear of the chassis, as on all 16 series receivers.

2. C49 should be part No. 110286 instead of part No. 110280.

Resistor changes

1. R63 is 330,000 ohms instead of 33,000 ohms as originally indicated. The part number is correct as originally given, and is 149198.

2. R72 (from brightness control potentiometer to ground) becomes 18,000 ohms, 1/2 watt, part No. 28173 instead of 27,000 ohms, part No. 28174.

3. R85 should be 68 ohms, 2 watts, part No. 149069 instead of 220 ohms, part No. 149072

TELE KING

CHASSIS TVJ

Capacitor changes.

C217 (0.01-µf, 1000-volt capacitor, part No. CP-10-11) which originally went to pin 4 of V6 (a 25L6 GT-G, audio output) has been grounded.

C218 (a .005- μ f capacitor) is added in parallel with C217 near the audio-output transformer

STROMBERG-CARLSON

MODEL 17 series

Resistor deletions.

The following resistors have been deleted in the chassis of later production.

1. R18, the 120-ohm resistor in the grid circuit of the V8 video amplifier, has been removed

2. R37, the 4.7-megohm resistor in the V6 horizontal phase-detector circuit, has been removed.

3. R69, the 1,000-ohm resistor in series with the screen supply to the picture tube, has been removed.

TELE KING

CHASSIS TVI Starting with chassis serial number 297,925, all TVJ chassis incorporate the following changes: (These later production chassis are also stamped with the letter "D," denoting that the changes have been made.) Peaking coils:

L4 (peaking coil part No. LP11, wound on an 18k-ohm resistor and schematically located between V3 and V4) is changed to part No. LP17, wound on a 10-k resistor.

L7 (peaking coil part No. LP13, wound on an 18k-ohm resistor and schematically located between V4 and the brightness control) is changed to part No. LP-18, wound on a 12k-ohm resistor.

Resistors:

R118 (8.2-k, 1/2-w resistor, part No. RC-822-2, schematically located under L4) is changed to 6.8 k, 2 w.

R125 (5.6-k, 2-w resistor, part No. 562-8, schematically located near L7) is changed to 6.2 k, 2 w.

MECK

CHASSIS 9034

All 9034 chassis with the suffix "M" incorporate a three tube tuner, part No. TT-10002B.

(continued on page 32)

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much higher

selectivity and

greater rejection

of unwanted

signals



Clearer Reception...

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COMING TV TROUBLESHOOTING

AND REPAIR GUIDE BOOK

Volume I in this series has been a *best* seller in the TV servicing text book field almost since the day it appeared in 1952. It is with a great deal of pleasure that we announce Volume II now being typeset and to be published within two months.

"Bob" Middleton is one of those rare authors who possesses the faculty of understanding his reader and who is a firm believer in the value of practical information. He is one of those individuals who, when writing a book, feels that it is his responsibility to do the work first and then describe and illustrate his findings. Writing and illustrating a book in this fashion delivers to the reader the kind of information that he will need as the answer to the daily servicing problems he encounters.

Volume II

Volume II of the Middleton TV TROUBLESHOOTING G U I D E BOOK series is not a repetition or duplication or a revision of Volume I. It picks up where Volume I of the series left off. For example, troubleshooting in front ends of receivers was not covered in Volume I. It is Chapter 1 in Volume II and is a very substantial chapter at that. It is tremendous in its contents and discusses and illustrates a great many problems which TV service technicians have encountered and for which they never had the answers. The kinds of troubles which may be encountered in the video i-f system, video system, sound i-f system and horizontal-sweep system are myriad. Many of these were treated in Volume I, but as each day passes in the life of a TV service technician new and different kinds of difficulties appear. A great many of these which were not covered in Volume I are clearly diagnosed and illustrated in Volume II.

The many tens of thousands of purchasers and users of Volume I will find Volume II an even better book. More than 500 oscillograms were taken by the author to illustrate his points. We say without reservations that there never has been a book like this one for use by TV service technicians, students of TV servicing, and others who have an interest in the subject.

The format of Volume II will be exactly the same as Volume I and the price will be only \$3.90. The book will be 81/2 by 11 in size and will contain a cumulative index covering Volumes I and II. Watch for publication date announcement in September Successful Servicing.

Raytheon Service Saver (Continued from page 6)

image which appears on the picture tube when trouble exists. The result can easily be a wrong evaluation of the fault. This may lead to a wrong estimate of time required to correct it, the cost for the repair, the information given to the technician for guidance, etc.

This Raytheon program solves not only these problems, but very many more, among which is one that is extremely important and which we shall deal with separately later. Raytheon is placing in the hands of each buyer of one of their TV receivers a booklet titled "TV Owner's Guide" wherein are contained about 40 different picturetube patterns representative of a wide variety of troubles which may occur in the receiver. A reduced reproduction of one of these pages is shown in Fig. 1. Each picture bears a number. At the same time Raytheon releases to the servicing industry another service booklet pertaining to the same receivers. In this booklet appear the same picture-tube traces as are to be found in the "TV Owner's Guide" and they are identified by exactly the same numbers as appear in the "TV Owner's Guide."

The service technician's booklet, however, contains additional information. A sample page from this booklet appears in Fig. 2. Each of the picture-tube patterns is correlated with a sectionalized schematic of that portion of the receiver which contains the trouble responsible for the picture. In addition, a list of possible faults in that section is included in the technician's guide.

How the Plan Works

The operation of the plan is very simple. With the "TV Owner's Guide" in his possession, the receiver owner furnishes the service facility he has called with a clue to what may be wrong in the receiver by referring to that sample picture-tube illustration which most closely resembles what he sees on the picture tube itself. The only description required is the number which contains the illustration in the "TV Owner's Guide." The service facility having on hand the "Service Saver" service guide checks the reference illustration by number. He immediately sees the portion of the circuit involved, and the components which are suspect. From this point on he has the general idea of what work has to be done

TV Replacement Parts Series

The continuation of the TV Replacement Parts series of articles will be picked up in September. The space originally allotted for it has been used for this article, which is considered of greater immediate importance. when he gets to the home and what components, if any, he must carry as possible replacement requirements.

Another item of great interest in this "TV Owner's Guide" is that this is not a "fix it yourself" book. The receiver owner is not given any troubleshooting information. Moreover, he is told that no matter how well a receiver is made some troubles will eventually develop and that the repair of these troubles requires the service of a competent TV technician. In other words," the TV technician is being sold to the public.

Consumer Education and Call-Backs

The above points are important of course, but there is one point in this whole program which we consider to be of tremendous value. Heretofore, the servicing industry has faced a problem stemming from the lack of technical knowledge on the part of the TV receiver owning public. This has been the problem of convincing the public that the repair of one fault can be followed legitimately by the appearance of a new defect within a week, a day or an hour after a repair. This difficulty has plagued the servicing industry no end. For years, the servicing industry has been unable to explain this situation.

We believe that the widespread use of a plan of this type by all receiver manufac-(Continued on page 20)



- of TV troubleshooting speed-up devices. • Circuit guides showing different
- Kinds of TV receiver circuits.
 Comparison between normal and
- abnormal patterns.
 How to use test equipment for TV
- servicing—and get the maximum value from the equipment you own —and much, much, more!

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No matter what price you put on your servicing time, you can't afford to spend several hours troubleshooting a receiver and then charge for only an hour or two. TELL-A-FAULT cuts down on this profitconsuming time loss and gives you the complete answers to your TV servicing problems,

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Less than twenty-five cents a week will bring this vital TV troubleshooting information to you every other month. Just think! for only \$15.00 a year, you can save anywhere from 50 to 200 hours in servicing time. Is it worth it? You can bet your bottom dollar it is!

TELL-A-FAULT pays for itself. If you use only one or two symptom sheets dur ing the year, you've made back the cost of your subscription. And remember, you still have the servicing shortcuts and section on how to use test equipment for extra value! It all comes to you in a sturdy leatherette binder with subject separators. Whether you're a beginner or a 20-year man in the servicing industry, TELL-A-FAULT can serve you equally well.

TELL-A-FAULT's second big year begins in August — START YOUR SUB-SCRIPTION IMMEDIATELY! (See page 26 for sample symptom sheet and circuit guide).

For full information on the most unique SERVICE ever made available to TV and radio service technicians — write to Dept. 3TF



Raytheon Service Saver

(Continued from page 19)

turers will be of tremendous value in making the public recognize the difference between troubles which may develop in television receivers. Having called a service facility to correct those troubles which may be responsible for picture symptom 19, whatever they may be, and having had the fault corrected, the appearance of some other fault shortly thereafter may cause a symptom described by picture 32. Inasmuch as the public associates different faults with the different pictures contained in their "TV Owner's Guide," they will readily understand that something else has gone wrong.

Without any trouble-symptom pictures to guide them in the past, the public did find it difficult to distinguish one type of picture-tube image from another. All faulty pictures due to trouble in the receiver looked alike. Hence, the individual not versed in technical details naturally would assume that the two different bad pictures stemmed from the same fault. There is no attempt in the "TV Owner's Guide" to state what is wrong when a certain type of picture appears on the screen, but since each is distinctive from the other and since the set owner has identified two different pictures on two different occasions, it is reasonable to assume that he will recognize them as being due to different causes.

An Important Step Forward

It has always been our contention that the manufacturer of the receiver is the one who knows his product best and that information which will lead to the most effective repair and the most rapid diagnosis of troubles can be produced best by the organization that engineered and manufactured the receivers. What we show here is a vivid example of this situation. This information is not general, it relates specifically to a single Raytheon Chassis, the 21T8. We are given to understand that subsequent chassis will be treated in similar fashion. this information being complementary to the regular service manuals prepared by them.

We realize that many TV receiver manufacturers have produced creditable literature for use by the service technician and for guidance to the receiver only. Notwithstanding all of this, wedding the public to the TV service technician as Raytheon has done in this program is something which warrants serious consideration by all.

It is understandable that every problem extant in television servicing is not answered by the idea we have described. Neither is it presented as the panacea for all ills, but there is no doubt about it being an excellent idea with tremendous potential.

DUMONT UNVEILS HIGH POWER UHF TRANSMITTER

TOP QUALITY, ultra-high frequency (uhf) television pictures broadcast from Easton, Pa., 70 miles from New York City, were witnessed recently at the Empire State Building on a standard vhf/uhf television receiver using only a 2-bay bowtie antenna and reflector. This antenna was mounted inside a window of a room on the 82nd floor of the building.

The TV pictures were shown by Allen B. Du Mont Laboratories, Inc., to demonstrate the unusually wide signal coverage provided by a new Du Mont 5-kilowatt ultra-high frequency television transmitter. The new transmitter, first of its kind, is owned by WGLV, Easton TV station. It was put into regular commercial operation for the first time over Channel 57 on August 14. The 5kilowatt transmitter feeds a specially designed transmitting antenna having a power gain of 20 so that an effective radiated power of 100 kilowatts is produced.

In addition to the long-distance coverage, good local coverage is obtained by the new uhf station. Evidence of this strong local coverage was provided in a report based on engineering tests already undertaken in the Lehigh Valley over an area covering 95% of the population which WGLV will serve. The report shows that the new transmitter furnishes very good noise-free coverage in the area which includes the cities of Easton, Bethlehem and Allentown, Pa., and Philipsburg, N. J.

An interesting feature of the demonstration was that some of the uhf television pictures witnessed at the Empire State Building were originally transmitted from New York to Easton on very-high frequencies (vhf). They were originally telecast by WABD, key station of the Du Mont Television Network, from the transmitting tower on top of the building. The signals were picked up at Pattenburg, N. J. and sent by microwave relay equipment to the Easton station, where they were rebroadcast as uhf signals. These uhf signals were then picked up directly at the Empire State Building and displayed. Other portions of the programs originated in Easton.

As evidence of the high quality of the uhf signals being received, Du Mont engineers placed a monitor, showing the original picture, alongside the uhf receiver showing the picture received from WGLV. In addition, a third receiver was tuned to the local vhf channel for an off-the-air picture. Viewers watched all receivers simultaneously in order to compare the pictures. Aside from a slight loss in high-frequency detail in the uhf picture, the quality of the picture was remarkably similar to the vhf signal that was being received locally. This was so despite the fact that the signal had traveled a total of about 140 miles, one-half of which distance was being covered by uhf transmission from station WGLV.

110051	DADT #	CATALOG	FUNCTION	DESCRIPTION	LIST	MODEL &	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST
CHASSIS	PAKI *	CATALOG *			PRICE	CHASSIS				2.5 Mag. O combon	PRICE
012	M-106-A	AG-83-5 KSS-3	Height	2 Meg. Ω carbon	\$1.25		VC-12121C	AG-84-5 FKS-1/4	Height	2.5 Meg. 12 carbon	\$4.30
	M-106-A	AG-83-5 KSS-3	Vert. Hold	2 Meg. Ω corbon	\$1.25		VC-1212/8	RIV-297	Val./Sw.	Conc. Dual carbon SPST	1 .30
CHASSIS 243	M-110	AG-19-5 KSS-3	Vert. Lin.	5000 Ω carbon	\$1.25		VC-12131C	AG-44-5 KSS-3	Hor. Hold	50K Ω carbon	\$1.25
	M-116	RTV-293	Contrast/ Vol./Sw.	2000/500K Ω Conc. Dual carbonSPST	\$3.70		VC-12132C	AG-83-5 KSS-3	Vert. Hold	1,5 Meg. carbon	\$1.25
	M-120	AG-58-S KSS-3	Bright.	500K Ω carbon	\$1.25	MOTOROLA	17711412	Order From	Hor	50 0 1 W-W W	
114DX	M-106-A	AG-83-5 KSS-3	Height	2 Meg. Ω corbon	\$1.25	14920		MFR.	Cent.		
	M-106-A	AG-83-5 KSS-3	Vert. Hold	2 Meg. Ω carbon	\$1.25		18A702441	AG-85-S RS-2	Bright.	5 Meg. Ω corbon	\$1.25
CHASSIS DX253	M-110	AG-19-5	Vert.	5000 Ω corbon	\$1.25	TS-275	18A/02443	RS-2	Height	5 Meg. 12 carbon	\$1.23
	M-112	RTV-319	Focus	22.50 Ω 4W-W.W.	\$1.85		18A702444	RTV-343	Controst/ Vol./Sw.	2500 Tap 2000/ I Meg. Tap 300K Ω Conc. Dual carbonSPST	\$4.90
	M-116	RTV-293	Contrast/ Vol./Sw.	2000/500K Ω Conc. Dual carbonSPST	\$3.70		18A702468	AG-49-5	Hor.	100K Ω carbon	\$1.25
	M-120	AG-58-5 KSS-3	Bright.	500K Ω carbon	\$1.25		18A702475	AG-8-5	Vert.	750 Ω carbon	\$1.25
	M-128	A10-25K KSS-3	Hor. Drive	25KΩ 4W-W.W.	\$2.20		18A711225	AG-61-5	Focus	1 Meg. Ω carbon	• \$1.25
	M-130	A 10-400 KSS-3	Width	350 Ω 4W-W.W.	\$1.85		18A711999	AG-61-S	Tane	1 Meg. Ω carbon	\$1.25
MA JECTIC				5000 Q	£1.25		18K711278	Order From	Vert. Hold	850K Ω carbon	
20FP88	C-8.206-6	FKS-1/4	Lin.	SUOD 12 Carbon	\$1.23	21F1,B	1X711613	Order From	Hoi. Cent.	50 Ω IW-W.W.	
	C-8.219-5	AG-84-5 FKS-1/4	Height	2.5 Meg. Ω carbon	\$1.25	21K1,8 21K2,8 21T1 8	184702441	MFR.	Bright.	5 Meg. O carbon	\$1.25
	C-8.221	A43-2500 FKS-1/4	Facus	2250 Ω 2W-W.W.	\$1.25	21T2,B	184702443	RS-2	Height	5 Mag. O corber	¢1.26
	C-8.229-7	AG-46-Z RS-2	Har. Hold	50K Ω carbon	\$1.25			RS-2	. nergin	5 Meg. 17 Carbon	
	C-8.229-8	AG-63-Z RS-2	Vert. Hold	1 Meg. Ω carbon	\$1.25		18A702468	AG-49-5 RS-2	Hor. Hold	100K Ω carbon	\$1.25
-	C-8.229-9	AG-49-5 RS-2	Bright.	100K Ω carbon	\$1.25	TS-351,A	16A702475	AG-8-S RS-2	Vert Lin	750 Ω carbon	\$1.25
	C-8.230-1	RTV-323	Contrast/ Val /Sw	1500/1 Meg. Conc. Dual carbonSPST	\$4.30		18A711225	AG -61-5 KSS-3	Focus	1 Meg. Ω corbon	\$1.25
MERCURY						*RADIO CHASSIS	18A711999	AG-61-S RS-2	Tone	l Meg. Ω carbon	\$1.25
2013 2113 2115	PMA-48016	AG-19-5 FKS-1/4	Vert. Lin.	5000 Ω carbon	\$1.25	HS-316	18 K70286 4	RTV-344	Contrast/ Vol./Sw.	2500 Tap 2000/I Meg. Top 300K Ω Conc.	\$4.90
2401 4120 4220	PMB-48014-1	AG-44-S RS-2	Hor. Drive	50 K Ω carbon	\$1.25		18K711278	Order From	Vert.	850K Ω carbon	
4317 4320	PMB-48014-2	AG-49-5 FKS-1/4	Bright.	100K Ω carbon	\$1.25		18A600974	AT-115	Vol./Sw.	2 Meg. Tap 500K	\$1.85
	PMB-48014-3	AG-55-5 FKS-1/4	Noise Bol .	250K Ω carbon	\$1.25			KSS-3 SWA		Ω carbonSPST	.ó0
	PMB-48014-5	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	\$1.25		18K//399	AG-61-S KSS-3	Tone	1 Meg. Ω carbon	\$1.25
	PMB-48014-7	AG-61-5 RS-2	Vert. Hold	1 Meg. Ω carbon	\$1.25						
	PMB-48015	RTV-247	Contrast/ Val./Sw.	750/500K Ω Conc. Dual carbonSPST	\$3.70						
MIRRORTONE			<u> </u>								
20PC	VC-121208	AG-19-5 FKS-1/4	Vert. Lin.	5000 Ω carbon	\$1.25		· ·				
						•				Form No. 751838010-5	M-11/52



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- SIX SELF-CONTAINED OHMMETER-MEGOHM-* METER RANGES: 0-2000 - 200,000 ohms. 0-2-20-200-2000 Megohms.
- ★ FOUR DIRECT PEAK READING HIGH FREQ. VTVM RANGES: 0-3-12-30-120 volts. (When used with RF-10A High Frequency Vacuum Tube Probe, Net price \$14.40. No crystal rectifiers employed.)
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PRECISION

Sweep Generator Operation

(continued from page 3)

voltage applied to the reactance tube. The oscillator whose frequency is being swept is usually operated at a rather high frequency (the values in Fig. 1 are for an oscillator at 40 mc) so that a given percentage of frequency deviation can produce as high as possible a sweep in megacycles. For constant sweep width with varying output center frequency, and for reasons of stability, the oscillator which is thus frequency modulated is usually kept at a fixed center frequency, while variable output center frequencies are obtained by heterodyning with another, unmodulated, variable frequency oscillator.

comes less; as it moves into it, the capacitance becomes greater. Since the voltage applied to the moving coil is alternating rapidly, the capacitor rotor plate is moved rapidly back and forth, thus rapidly varying the capacitance. As shown, the capacitor plates are connected across the oscillator tank coil. The rapid variations in capacitance cause rapid variations in oscillator frequency, and the desired sweeping action is accomplished. Frequently the stator is made in two sections so that a split-stator capacitor is formed.

The distance the moving assembly travels back and forth depends upon how much



Use of Vibrating Capacitor for Frequency Sweep

The second method for obtaining frequency sweep is a mechanical method, usually employing a vibrating capacitor. This is a development from an older method, in which the shaft of a variable capacitor was made to rotate rapidly, causing the capacitance to change rapidly from minimum to maximum and back again in a regular periodic manner. This capacitor, connected in an oscillator tank circuit, caused the frequency of the oscillator to sweep back and forth in the desired manner.

The more modern method frequently utilizes a capacitor whose plates can move closer or further apart. The spacing between them is varied by means of an electromagnet connected to an a-c power-line voltage. The idea is shown in Fig. 2. In most cases the capacitor plates are cylindrical, as shown, with one moving inside the other. One plate is fixed in position, while the other is kept in motion by a coil-and-magnet arrangement (similar to the voice coil and magnet assembly of a loudspeaker), actuated from an a-c voltage source. A springy suspension of some kind keeps the armature in its static position. As the moveable plate moves out of the stator, the capacitance bevoltage is applied to the moving coil. The amount of capacitance variation and thus the sweep width depends upon the distance through which the assembly moves. Consequently, the sweep width depends upon the voltage applied to the moving coil. This is the principle used in controlling sweep width in generators using modulation of this type. As shown in the figure, the sweep-width control is one which varies the voltage applied to the actuating coil.

A typical vibrating capacitor is illustrated in Fig. 3. Note that, to increase the capacitance and its variation, several coaxial plates are used in the capacitor. In this case, the rotor plates are grounded through the centering spider, and the split stator plates are insulated above ground by the insulating material at the top.

(Note: The type of electromechanical driving mechanism described above is also sometimes used to move a copper or aluminum disc toward and away from a coil which forms the inductance of the swept oscillator. As the disc is moved closer to the coil, the inductance is reduced and the oscillator frequency is raised. As the disc is moved away from the coil, the inductance is increased and the oscillator frequency is lowered. When a.c. is applied to the coil in the driving mechanism, the disc moves alternately back and forth and thereby causes the oscillator frequency to vary in step.)

23

0 000000 000000 SIGNAL WINDING (CONTROLLED R'F WINDING) 000000

WINDING

Fig. 4. Schematic, controllable inductor.

for Frequency Sweep

Use of Controllable Inductors

flux produced by current flowing in another

Still another method of producing frequency sweep is by the use of a controllable

The schematic diagram of a controllable

inductor is shown in Fig. 4. Note the use

of the two windings-the control winding, to

which the changing current is applied which

produces the flux that partially saturates the core, and the signal winding, whose inductance is caused to change because of the

changing flux in the core. This flux, as it approaches core saturation, reduces the permeability of the core and thus results in a reduction of effective inductance. The two windings are separated by an electrostatic shield, and are so arranged that practically no electromagnetic coupling exists between

them. The entire unit is usually supplied

¹Trademark of C.G.S. Laboratories Inc.

DIAL 123

Fig. 5. One example of a

controllable inductor.

(continued on page 25)

winding on an iron core is caused to de-

winding.

operates at radio frequencies. In a saturable inductor, the effective inductance of a

inductor such as the Increductor¹. This is

a special type of saturable inductor which

CONTROL

crease if the core is partially saturated with



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Sweep Generator Operation

(continued from page 23)

in a hermetically scaled can, which may be mounted in any position. The appearance of one such typical unit is shown in Fig. 5.

In normal operation in a sweep generator, an alternating current at the line frequency is applied to the control winding. This causes the inductance of the signal winding to vary over a considerable range. By using the signal winding as all or part of the inductance of an L-C tuned circuit of an oscillator, the oscillator frequency is made to vary back and forth at the line-frequency rate about a center r-f frequency. In this manner, a frequency sweep is produced.

Phasing

When a sweep generator is being used to produce a response curve on an oscilloscope screen, the sweeping action of the generator frequency and the sweeping action of the oscilloscope beam horizontally should be synchronized not only in frequency but also in phase. If the phase relation is not properly adjusted, then one end of the oscilloscope horizontal trace does not correspond to the lowest frequency swept through by the generator, and the other end does not correspond to the highest frequency, as should be the case. This is illustrated in Fig. 6. In this figure, it is assumed that a sweep generator is sweeping between 20 and 30 mc, and that it is being used to depict a response curve on an oscilloscope screen. To make the explanation clearer, the forward and return traces are shown separately (return trace below the forward trace) although in practice they usually coincide.



Fig. 6. Proper and improper sweep-generator phasing.

At (A) the phasing is properly adjusted, so the response curves swept during the forward and return traces coincide. The forward trace sweeps through the frequency range from 20 to 30 mc, while the return trace sweeps in reverse order, from 30 to 20 mc. Thus when phasing is proper, each point along the horizontal axis represents the same frequency for both the forward and return traces.

At (B) is shown what happens if the phasing is not correct. The sweep generator

is starting from its low frequency extreme (20 mc) after the oscilloscope beam has started its forward sweep; by the time the sweep generator reaches 30 mc, the oscilloscope beam has completed its forward sweep and started its return sweep. The result is that the forward and return response curves do not occur at the same point along the horizontal axis and are staggered as shown at (B).

Fig. 7. A phase-adjusting circuit, schematically shown.



traces are shown separated vertically in the

figure for clarity but coincide in practice)

and the region under the traces is blank.

Sometimes it is desirable to remove the re-

turn trace of the response curve by elimi-

nating the generator r-f signal during the

return-trace period. The oscilloscope beam

The phase relation between the sweep generator signal and the oscilloscope sweep is adjusted by a circuit between the generator and the oscilloscope deflection plates. This phase adjusting circuit may be in the generator or in the oscilloscope, or sometimes there is one in each unit. A common method of obtaining sweep voltage for the oscilloscope and adjusting its phase in the



A typical blanking circuit is shown in Fig. 8. Here the blanking tube is normally held cut-off by the bias developed across the large (10 meg) bias resistor. Under these conditions the sweep oscillator operates normally. During the positive alternations of the input a.c., the blanking tube conducts.



0000000

Fig. 8. Schematic of a typical blanking circuit.

TO VIBRATING CAPACITOR OR

REACTANCE TUBE

sweep generator is shown in Fig. 7. The a-c voltage for both the vibrating capacitor in the sweep generator and the deflection circuit of the oscilloscope are obtained from a low-voltage secondary winding of the power transformer in the sweep generator. The voltage is applied directly to the vibrating capacitor, but through the network shown to the oscilloscope horizontal input circuit. The relative phase between the two outputs depends upon the adjustment of the 50k-ohm phase adjuster, which varies the amount of resistance in the circuit with the .25-µf capacitor.

Blanking

As shown in Fig. 6 there are actually two traces visible in ordinary sweep alignment or response curve observation. One is the forward trace, as the oscilloscope beam sweeps from left to right, and the other is the return trace, when the beam returns from the right to the left. If the phasing is properly adjusted, as shown at (A) of Fig. 6, the response curve traces coincide (the It therefore operates to place a high negative bias voltage on the oscillator tube so the oscillator stops oscillating and the sweep-generator signal is absent. The blanking-phase control forms a phasing circuit



Fig. 9. Response curves showing baselines produced by blanking.

with the $.02 - \mu f$ capacitor so that the phase of the blanking voltage may be adjusted to stop operation of the sweep oscillator during exactly the proper time (while the sweep generator produces the reverse sweep and the scope retrace occurs). Examples of response curves with base lines produced by the blanking facility of the sweep generator are shown in Fig. 9.

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(continued from page 9)

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Evaporator-air inlet, wet-bulb temperature 67°F.

Evaporator-air inlet, dry-bulb temperature 76°F.

Evaporator-air outlet, dry-bulb temperature 54°F.

(Evaporator dry bulb difference \pm 22°) Total power consumption of unit, 855 watts.

- 1. Referring to the table, find 95° in column headed "Condenser Inlet Temperature (D.B.)."
- 2. In column headed "Evaporator Inlet Temperature (W.B.)" and in the "95" horizontal group find 67°.
- Follow to the right from the 67° value, and find the figures 20-23 in the column marked "Evaporator Inlet and Outlet Temperature Difference (D. B.)."
- 4. The wattage reading may be found in in the fourth column and should be 810 to 900.

A REPRESENTATIVE ROOM AIR CONDITIONER

Condenser Inlet Temp. (Dry Bulb) °F	Evaporator Inlet Temp. (Wet Bulb) °F	Evap.Inlet & Outle Air Temp.Diff. (Dry Bulb)°F	t Total Watts
110	79	10 - 13	850 - 950
	75	14 - 17	880 - 980
	71	17 - 20	900 - 1000
	67	19 - 21	900 - 1000
	63	19 - 21	900 - 1000
100	79	11 - 14	795 — 875
	75	15 - 18	820 - 910
	71	18 - 21	840 - 930
	67	20 - 23	850 - 940
	63	21 - 24	840 - 930
95	79	11 - 14	755 - 845
	75	15 - 18	790 - 880
	71	18 - 21	810 - 900
	67	20 - 23	810 - 900
	63	22-25	810 - 900
	59	23 - 26	800 - 890
90	79	11 - 14	765 - 855
	75	15 - 18	760 - 850
	71	19 - 21	780 - 870
	67	21 - 24	790 - 870
	63	23 - 26	785 - 865
	59	24 - 27	770 - 860
80	71	19 - 21	720 - 800
	67	21 - 24	735 - 815
	63	24 - 27	725 - 805
	59	26 - 29	715 - 795
75	71	19 - 21	690 - 770
	67	22 - 25	700 - 780
	63	25 - 28	695 - 775
	59	27 - 30	690 - 770
70	67	22 - 25	675 - 745
	63	25 - 28	670 - 740
	59	28 - 31	665 - 735
	57	31 - 33	660 - 730

This data shows that if the evaporator is reducing the temperature of the air passing through it at least 20°, and not more than 23° the unit is operating normally for the existing conditions. The 20° dry-bulb temperature difference is the minimum value allowed for these conditions.

If the evaporator cooling is greater than the maximum temperature difference (23°) , check for the following troubles:

- 1. Clogged or dirty filter.
- 2. Evaporator fan motor turning too slowly.
- 3. Frost or ice on evaporator.

If the evaporator cooling is less than the minimum temperature difference (20°) , check for the following troubles:

- 1. Low line voltage.
- 2. Air leakage from normal path (leaking seals, damper door not tight, etc.).
- 3. Dirty condenser.



Fig. 6. Split-phase motor.

If the wattage and temperature readings are within the limits given in the table, the air conditioner may be considered to be operating normally.

Complaints of insufficient cooling may result from the use of a unit of insufficient capacity to meet the cooling load imposed upon it.

A careful performance test should always be made before considering unsatisfactory performance to be the result of a defect in the sealed refrigerant system.



Fig. 7. Capacitor-start motor.

Electric Motors

It is advisable, at this time, to describe the several types of motors used in room air conditioners and why each type is used. The common split-phase induction motor (Fig. 6), found on washing machines and

(Fig. 6), found on washing machines and large fans, is relatively efficient, has medium starting torque and the current required is not excessive in sizes under one-half horsepower.



Fig. 8. Capacitor-start-run motor.

Compressors require a motor with a greater starting torque and for this reason a capacitor-start split-phase motor is used. (Fig. 7). Being hermetically sealed and surrounded by the refrigerant, all starting switches must be outside the compressor shell. In the larger size units the running current becomes quite heavy. Underwriters Laboratories now require that the total running current be less than 15 amperes. To meet this limitation, larger size conditioners utilize what is known as a running capacitor in addition to the starting capacitor. (See Fig. 8.)



Fig. 9. Shaded-pole motors.

The so-called "shaded-pole" motors are seldom made in sizes greater than one-eighth horsepower. They do not require any starting switch but have low starting torque and are suitable for use only on small fans and other light duty applicators. (See Fig. 9.)



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A monthly summary of product developments and price changes supplied by RADIO'S MASTER, the Industry's Official Buying Guide, available through local parts distributors.

COMMENT: For the second month in succession, more manufacturers have reported product changes than for any other previous month. The most active product classification continues to be the Sound and Audio group, with a total of 44 manufacturers reporting changes.

New Items

- New Items
 ALTEC LANSING Added Model TI-401 Signal Generator at \$340.00 dealer net; Model TI-402 Intermodulation Analyzer at \$450.00 dealer net.
 CLEVELAND ELECTRONICS Added new series of Intercom Replacement Speakers.
 GATELY DEVELOPMENT LABORATORY—Added new series of 12" and 15" Purist Speaker Baffles.
 GONSET Added Model 3025 Deluxe Gonset Communicator at \$229.50 dealer net.
 HY-LITE ANTENNAE Added UHF TV Anten-nas Model UFDV "Doodle Vee" at \$6.00 dealer net; Model UF170 "Bar Gain" at \$6.00 dealer

- KWIKHEAT MFG. Added Model 200 Junior Electric Soldering Iron at \$7.75 list; No. 2001 Element at \$3.15 list; No. 2051 Tip at \$0.55
- ^{list,} NATIONAL CARBON Added Model 437 "B" Battery for Portable Receivers at \$2.06 dealer net. NATIONAL CO. Added Shaft Lock with nut Type "SL" at \$0.36 dealer net. NATIONAL ELECTRONICS Added NL-5551 Ig-inical \$80.50 dealer net.
- NATIONAL ELECTRONICS Added NL-3331 lg-nitron \$80,50 dealer net.
 OXFORD ELECTRIC Added Model 4CM-27 Re-placement Speaker for drive-in theater use at \$3,43 dealer net.
 PYRAMID ELECTRIC Added new series of "Glasseal" Capacitors.
 Q-LINE MFG. Added new series of 5 element and 10 element Yagi Antennas.
 RCA Added Electron Tube 6CF6 at \$1.25 dealer net. Also added new series of Germanium Crystal Diodes.

- Diodes. RADIO MFG. ENGINEERS Added UHF Con-verter Model UHF200 at \$39.50 dealer net. RAYTHEON Added Receiving Tube 12B4 at \$2.25 list; TV picture Tube 24DP4 at \$62.00 deal-

- §2.2) IIST, 4.9 product Added Model 850 Replacement Phoneedle Kit at \$39.98 dealer net.
 REGENCY Added Model DB-98A Booster at \$17.97 dealer net; Model NB-4 Duo-Switch at \$1.50 dealer net.
 PEKOKUT Added Model C-7B Console for
- 81.50 dealer net.
 REK-O-KUT Added Model C-7B Console for Model B-16H Three-Speed 16" Transcription Table at \$109.95 dealer net.
 ROCKBAR CORP. Added Model 3/531 Three-Speed Non-Intermix Record Changer with 2 plug-in shells and mounting hardware. less cartridges at \$40.87 dealer net; Model 3/532 Three-Speed Intermix Record Changer with 2 plug-in shells and mounting hardware. less cartridges at \$48.75 dealer net; Model 3/534 Three-Speed Record Player with 2 plug-in shells and mounting hard-ware, less cartridges at \$25.20 dealer net.
 ROYAL TELEVISION SUPPLY Added Model R105 Adjustable Peaked Roof Base at \$2.37 dealer net; Model GLW Guy Line Winch at \$1.95
- dealer net.

- SCOTT, H. H. Added Random Noise Generator Model 811-A. SERVICE INSTRUMENTS Added Model LB3 "The Up-Ten" Voltage Booster at \$4.77 dealer
- SNYDER MFG. Added new series of Directronic

- SNYDER MFG. Added new series of Directionic TV Antennas.
 SPIRLING PRODUCTS Added Indoor-Tenna Model TV8 at \$2.50 dealer net.
 SYLVANIA Added Germanium Crystal Diode IN56A at \$1.45 dealer net.
 VIDAIRE ELECTRONICS MFG. Added Model A-131 TV Amplifier at \$11.97 dealer net; Model F-5 Wave Trap at \$2.16 dealer net.
 WORKMAN TV Added Model FR2 Filament Resistor Kit at \$1.44 dealer net.

Discontinued Items

- ALPRODCO Discontinued Model ALP-68HD Heavy Duty Telescoping Tower Unit.
 FAIRCHILD RECORDING Model 201-B Three-Way Turtet Head discontinued.
 GENERAL ELECTRIC Discontinued TV Picture Tubes 17MP4, 21JP4, 21UP4.
 JACKSON ELECTRICAL Discontinued Model 115 Challenger Dynamic Tube Tester.
 ORRADIO INDUSTRIES Discontinued Model 205RKA Paper Base "Itish" Tape.
 OXFORD ELECTRIC Discontinued Model 4CM13 Replacement Speaker for drive-in theater use.
 RAULAND CORP. Discontinued TV Picture Tube 17CP4.
 RAYTHEON Discontinued Special Purpose Tube BH.

- BH.
 RECORDISC CORP. Discontinued ½ hour Recording Wire Spool.
 SYLVANIA—Discontinued TV Picture Tube 21XP4A.
 VIDAIRE ELECTRONICS Discontinued Model A-130 TV Amplifier.
 WELLER ELECTRIC Soldering Guns Models WS-100, WD-135 discontinued.
 WORKMAN TV Discontinued Model P-5 Picture Tube Booster.

Price Decreases

- HICKOK ELECTRICAL Decreased price on Model 600A Portable Dynamic Mutual Conductance to \$164.00 dealer net.
 KENWOOD ENGINEERING Decreased price on Model 5C-SS One Piece Chimney Mount to \$2.84 dealer net.
 LEWIS & KAUFMAN Decreased price on Rectifier 705A to \$17.93 dealer net.
 RADELCO MFG. Model VT-3A Indoor Antenna decreased to \$2.07 dealer net.
 RAYTHEON Decreased price on CK722 Junction Type Transistor to \$4.50 dealer net.
 SYLVANIA Decreased prices on Microwave Crystal Diodes 1N23B to \$4.30 dealer net; 1N23BM to \$12.95 dealer net.

Price Increases

- EITEL-MCCULLOUGH Increased prices on Vacuum Tubes 35TG to \$16.00 dealer net; 866A to \$2.10 dealer net.
 GONSET Model 3026 Standard Gonset Communicator increased to \$209.50 dealer net.
 SYLVANIA Increased price on Receiving Tube 6BK5 to \$2.55 list.
 TALK-A-PHONE Increased price on Model LM-5 Master Station for 5 Sub-Stations to \$34.80 dealer net.
- net. UNIVERSITY LOUDSPEAKERS Model PH Re-flex Loudspeaker Projector increased to \$18.60
- tiex Loudspeaker Projector increased to \$18.60 dealer net. NOTE: CENTRALAB: On Radio's Master page L-7, through error, Switch No. 1483 is shown as complete with mounting bracket and hardware. This is not so. Bracket and mounting hardware are furnished with kit No. P-300 listing at \$1.50.





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Successful Servicing, August, 1953

You can't pour ten gallons of water into 2 gallon jug 8

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the crystal phono, cartridae

(continued from page 16)

"Improving" the Situation

Now, for another service failing. The well-intentioned serviceman, finding it necessary to replace a bad cartridge, decides to win customer approval by improving the performance of the equipment by replacing the original faulty cartridge with a more recently developed model. The output voltage of the original cartridge was approximately 2.5 volts at 1,000 cps. The cut-off frequency of the cartridge then might have been 4,000 cps, with a husky needle pressure of 23/4 ounces. The customer had been satisfied, but now simply requested replacement and return of the apparatus.

Good-hearted-Joe thumbing through the catalogue instead picks out a cartridge with an output voltage of l volt, a needle pressure of 1 ounce, and a greatly extended frequency range, cutting off at almost 10,000 cps. The customer, impressed by the description, waits the two weeks for delivery, finally arriving to find the unit installed.

Of course, the pickup arm had to be counterbalanced for one ounce needle pressure. This caused considerable trouble with the record changer trip mechanism, since it was designed to operate at the greater needle pressure required by the original cartridge. A decided loss in output resulted, of course, since the new cartridge was designed with decreased output voltage. The audio amplifier, never designed for extra power or wide response, didn't even notice the highs, and didn't have enough gain to make up the loss of input in the first place, consequently giving very weak output. As if that weren't enough, the maximum volume setting to get even weak output accented needle scratch and increased audio distortion. P.S. The new model also cost more. (Question-how much is Joe's protit?)

Every story should have a moral. Okay, here it is: A serviceman's business is to restore the faulty unit to its original condition.

Carry an Extra-Hi Voltage etc.

(continued from page 12)

for feedback. There is nothing critical about the placement of parts, but reasonable care should be used to insulate the high-voltage. A stand-by switch is used instead of an onoff switch to facilitate testing without waiting for the filament to heat each time. No pilot light was included because the squeal of the transformer can be heard when the power is on.

ELL-A-FAULT Symptom Sheet

NEGATIVE PICTURE

Copyright 1953 John F. Rider



(NOTE: Refer to CIRCUIT GUIDE III-2 for identification of components.)

In addition to black-and-white reversal, as shown in Fig. 1, smear and marked ringing of video information were noted on the picture tube in this defective receiver. Manipulation of the brightness and contrast controls had little effect in changing this condition. Reception of audio intelligence in this splitsound receiver was unaffected by the fault.

A check at the output of the video detector disclosed a normal video-signal waveform; but at the input electrode of the picture tube (grid, in this case), this display was highly distorted and of abnormally high P-P amplitude. This is shown in Fig. 2, as observed with a direct probe at F=V/2.

Working back from the picture tube into the twostage video amplifier, similarly distorted video waveforms were noted up to and including the grid of 2ndvideo amplifier V2. At the plate of 1st-video amplifier V1, however, the normal display of Fig. 3 was noted. Except for changes in waveform polarity and P-P value, the waveform in the 2nd video amplifier and at the grid of the picture tube resembles Fig. 3 during normal operation.

A check of operating voltages and resistance-toground readings in the peaking and coupling network between the plate of video amplifier V1 and the grid of video amplifier V2 disclosed the following: There was a considerable drop from normal value of resistance from the V1 plate.

Examination of components in the plate network of 1st video amplifier V1 revealed a short in wiring. The lead going from the bottom connection of load resistor R4 to the B+ divider was making direct contact with the junction of peaking coil L3 and resistor R6. This effectively short-circuits R6.

Effects of this change in loading on video-amplifier response may be studied by a comparison of Figs. 4 and 5. The two-stage response curve, as obtained while the fault existed, is shown in Fig. 4. There is excessive response in the region of 2 mc, causing ringing and overload, but there is poor response over the remainder of the band. After repair, with the same setting of the contrast control, the normal curve of Fig. 5 was obtained. The markers appear at 2 and 4 mc.

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2-A

4-A

(Continued from page 17)

STROMBERG-CARLSON

MODEL 16 series

Chassis differences between the 16C (console) and the 16T (table) models.

The differences between the C and T models are as follows:

C62, across the audio-output transformer primary:

In 16C is .0047 μ f, 600 volts, part No. 110553

In 16T is .01 μ f, 600 volts, part No. 110555

C123, across terminals No. 1 and No. 2 of the horizontal-output transformer:

In 16C is 7,500 $\mu\mu f$, 500 volts, part No. 110287

In 16T is 3,900 $\mu\mu f$, 500 volts, part No. 110272

Picture tubes:

In the 16C is the round 16GP4, part No. 162089

In the 16T is a rectangular 16RP4, 16KP4, or 16TP4, part No. 162091

Additional réctangular tube types may also be used in some receivers so that it is advisable to replace a defective picture tube in a receiver with one of the same type wherever possible. (The 162091 part number refers to all rectangular tube types, thus the type as well as part number must be used in ordering.) However, rectangular tubes of the types listed above can be interchanged by proper choice of focus coils with no other mechanical changes required. All the above tube types take focus coil part No. 114683, except the 16KP4 which must take focus coil part No. 114687.

To obtain a satisfactory range of control on the focus potentiometer with the use of the focus coils mentioned above, the R85 resistor, in series with the focus potentiometer, should be 68 ohms, 2 watts (part No. 149069) rather than the 220-ohm, 2-watt resistor originally specified. If the 68-ohm resistor is not in a receiver being serviced, another 220-ohm resistor can be bridged across the existing 220-ohm resistor to obtain a proper focus range. Receivers are now being produced with the lower value resistance in this R85 position.

ALUMINIZED PIX THRES IN UPSWING

THE GENERAL ELECTRIC COMPANY announced today that it will increase production of its aluminized TV picture tubes by fifty percent when a retooling project, now under way at its Buffalo and Syracuse plants, is completed.

Almost three-quarters of this company's picture-tube production then will be in the aluminized type, according to J. Milton Lang, general manager of the organization's tube department.

The aluminized tubes feature a metallic reflective coating on the rear of the viewing screen. Mr. Lang states that this increases light output considerably and also improves picture contrast.

Tubes of this type are used initially in TV receivers made by GE, and by many other receiver manufacturers in addition. They are also stocked by distributors throughout the country for replacement use in receivers in which they were not originally incorporated. The increase in production was made necessary by an increase in demand, both as initial equipment and for replacement use.

The retooling project is part of an overall expansion on the part of GE in the electronic-tube field. This company is expanding warehouse facilities in Chicago, Los Angeles, and Clifton, N. J.

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Successful Servicing, August, 1953



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