SUCCESSFUL Servicing

FEBRUARY 1953

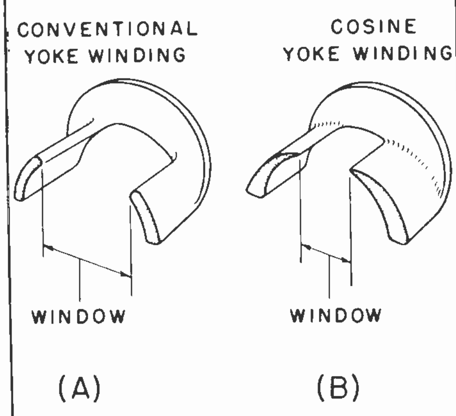

Fig. 1. Cross section of yoke winding.

the cosine yoke

by harry e. thomas

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 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-of-focus 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*)

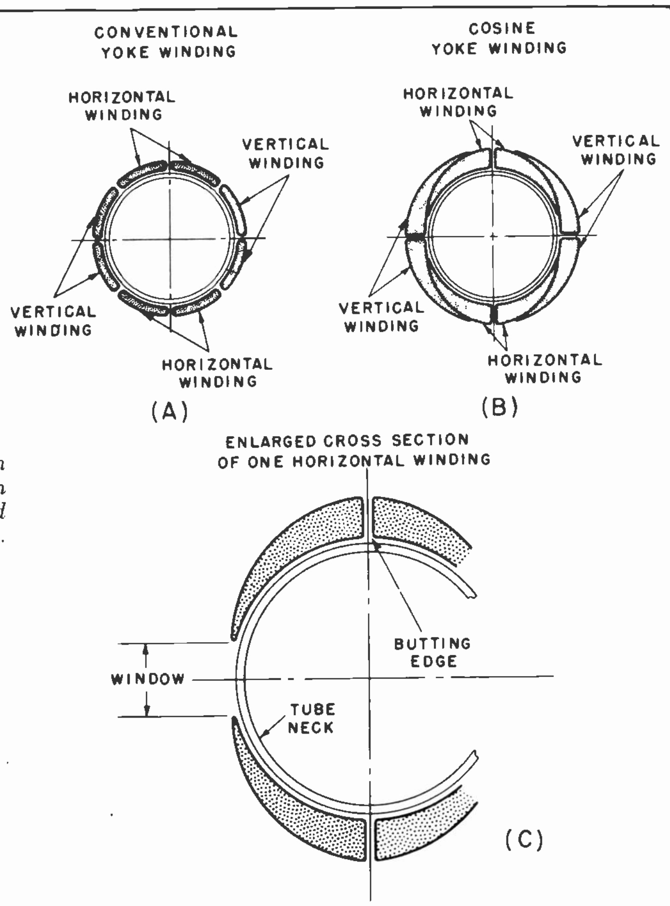

Fig. 2. Distribution of windings (shown in cross section) around neck of picture tube.

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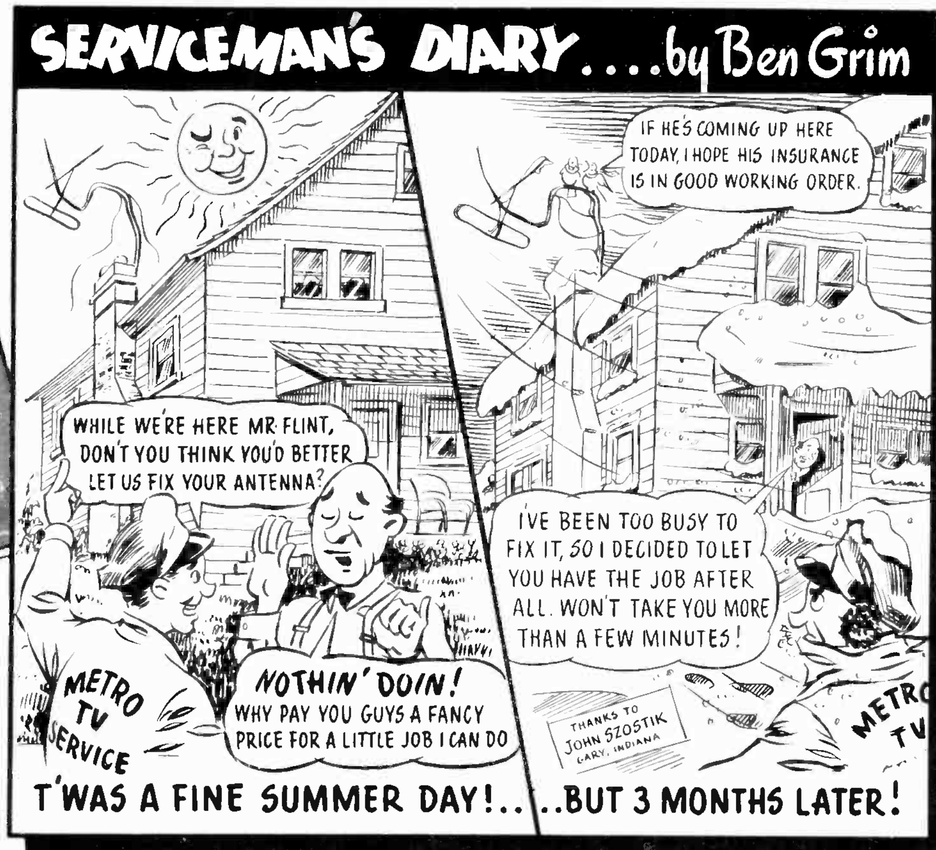

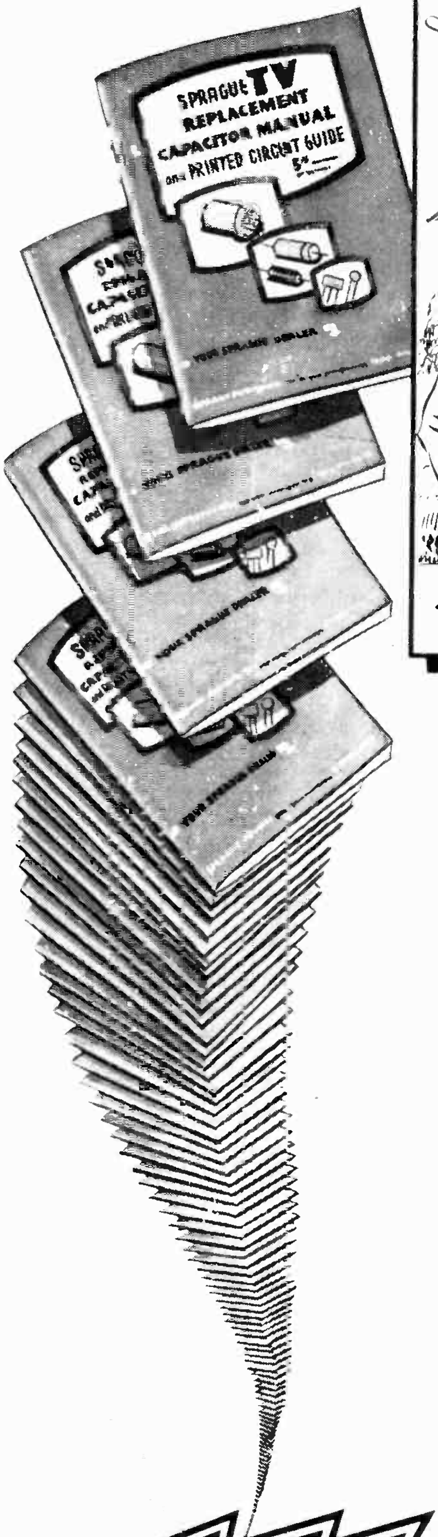

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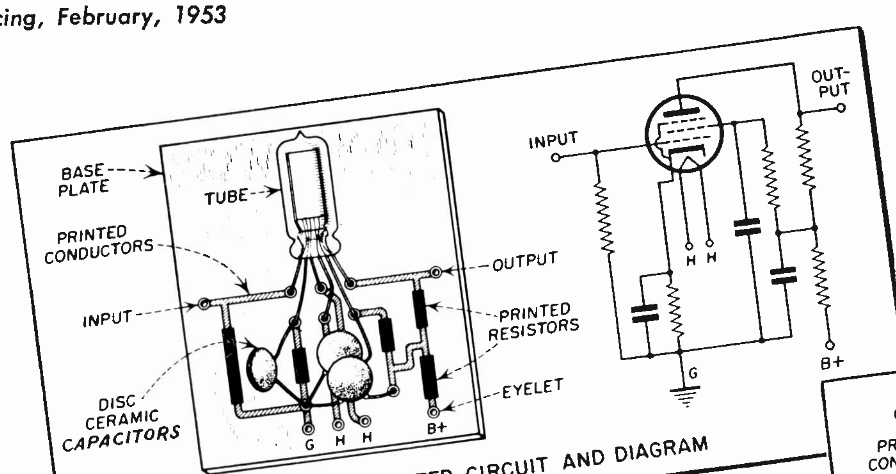
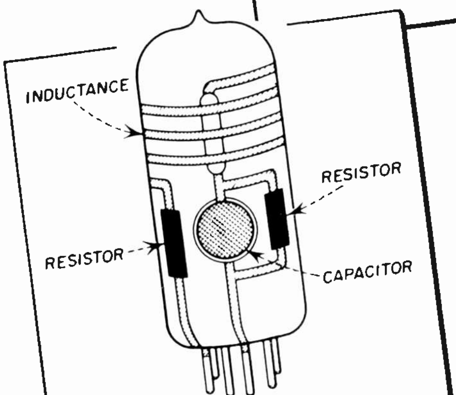
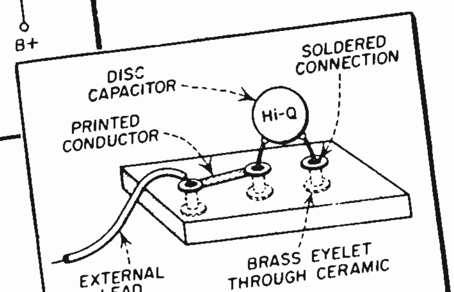


TYPICAL PRINTED CIRCUIT AND DIAGRAM
FIG. 1



PRINTED CIRCUIT ON TUBE ENVELOPE
FIG. 2



METHOD OF CONNECTING WIRE LEADS
FIG. 3

PRINTED ELECTRONIC CIRCUITS*

by the Engineering Department,
Aerovox Corporation

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

THE reproduction of electrical circuits on 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 tube has been utilized as a base for its associated printed circuit. See Fig. 2.

The paint used for electrical conductors consists of a powdered metal such as copper 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. "Cross-overs" 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.

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 space-saving 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 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
j. 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 *l*. 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, 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 μf 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 μf is the limit at 450 volts, whereas 5000 μf 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

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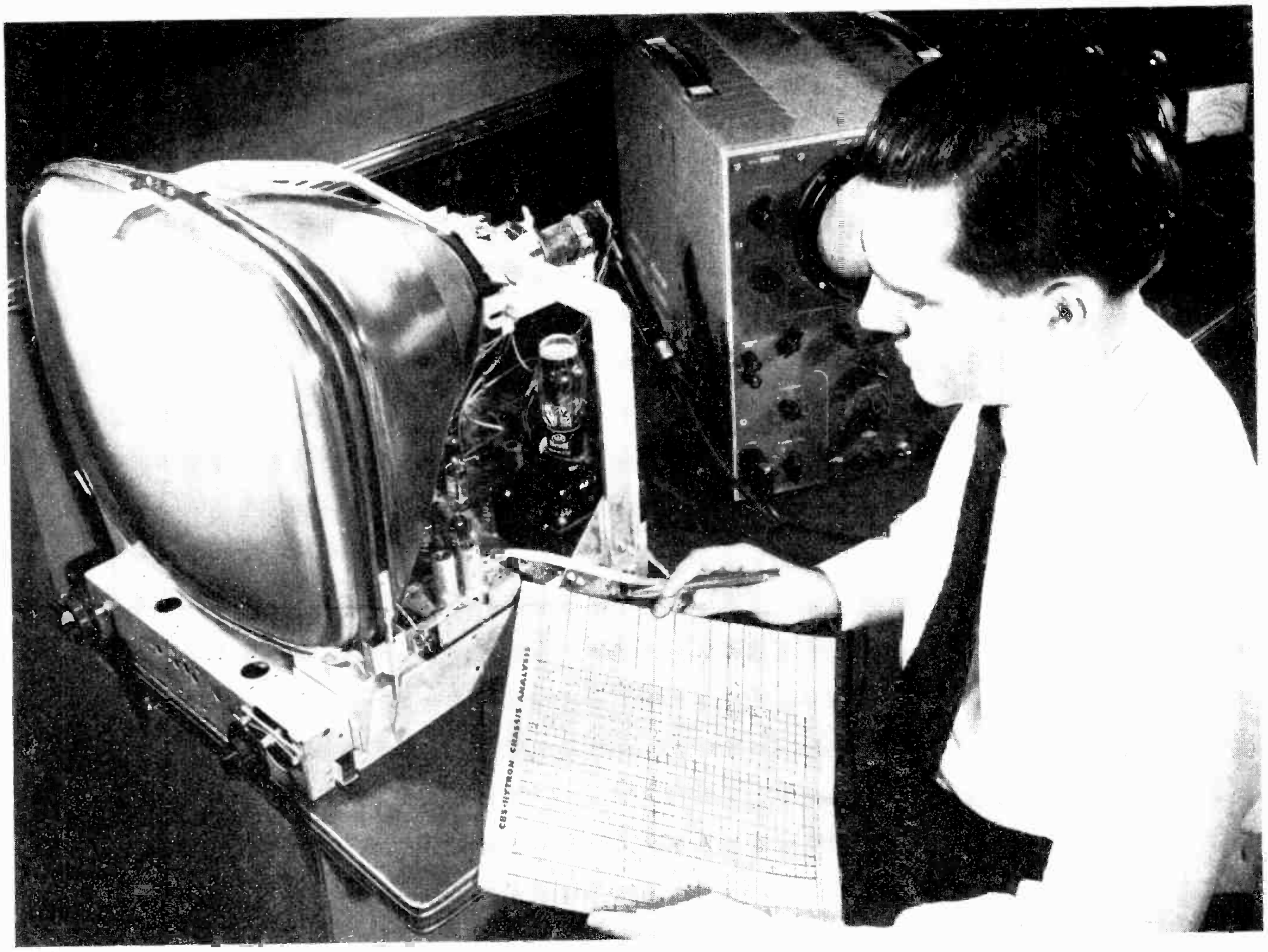

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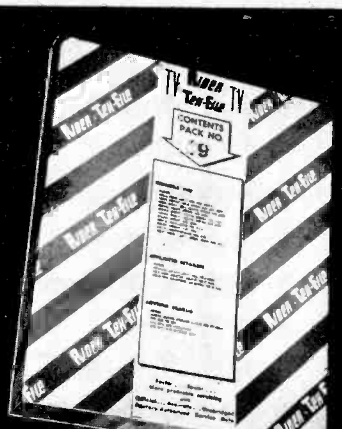


The Cosine Yoke

(Continued from page 1)

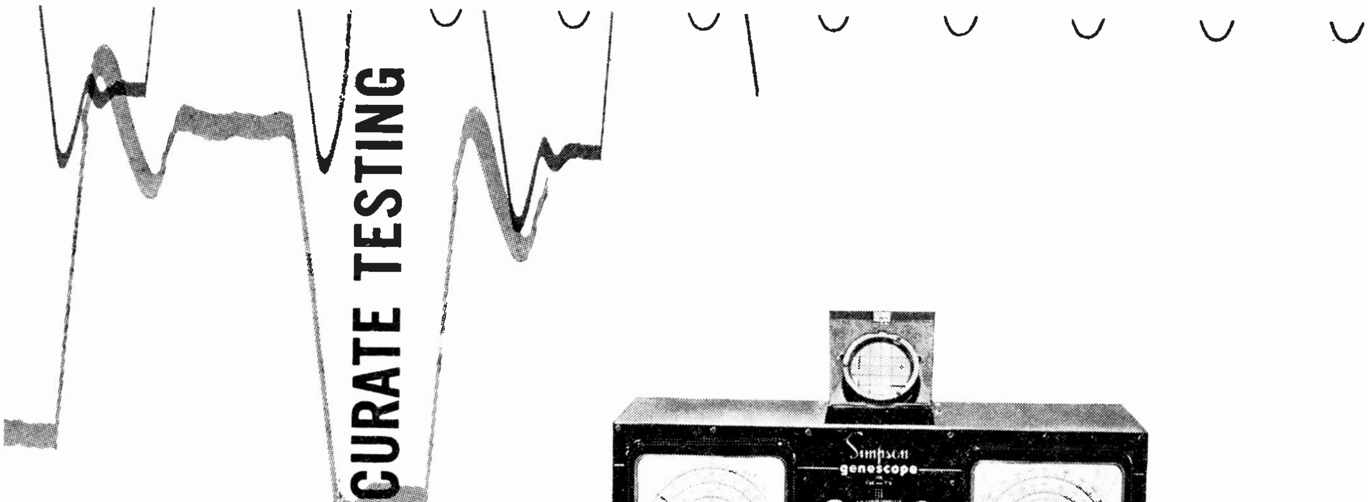
with horizontal lines of force. This magnetic field produces vertical deflection. Part B of the figure shows a cross section of the windings of the cosine yoke. Windings which produce horizontal and vertical deflections are labeled. Part C is an enlarged view of one of the horizontal windings with the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

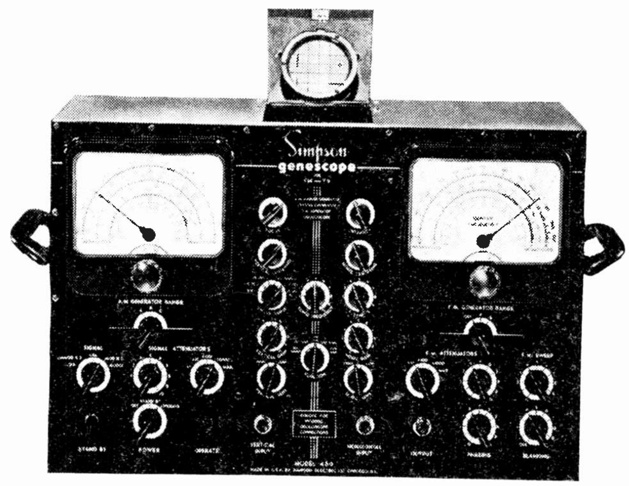
The cosine distribution curve is a design detail and has no direct significance to the serivce man. Suffice it to say that the winding thickness varies in a cosinusoidal manner. Some windings claim to be cosine squared in character, which means that the winding thickness increases faster than in a normal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



SIMPSON MODEL 480 GENESCOPE FOR ACCURATE TESTING



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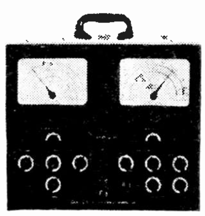
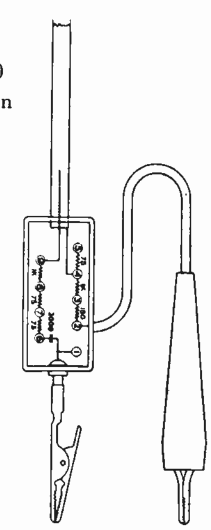
Provides all the necessary signal sources for proper alignment and servicing of FM and TV receivers • Includes the Simpson High Sensitivity Oscilloscope, complete in every detail and equipped with a high frequency crystal probe for signal tracing • Independent, continuously variable attenuators and step attenuators for both AM and FM units offer complete control of output at all times—from the high level required for front end adjustment to extremely low levels for fringe area peaking operations • Multiple shielding, generous bypassing and adequate line filtering reduces signal leakage to a negligible factor • A 0-15 megacycle sweep is provided by means of a noiseless specially designed sweep motor based on the principles of the D'Arsonval meter movement for fine control and lasting accuracy • The exclusive Simpson output cable (illustrated on the right) includes a variable termination network which is quickly adapted to provide open, 75 or 300 ohm terminations—the addition of a pad provides attenuation and isolation. The use of appropriate resistors across certain terminals will provide any other termination required. A .002 MFD blocking condensor can be added on any termination for use on circuits containing a DC component • The FM generator output voltage is constant within .2 DB per MC of sweep.
Model 480 $395.00



Also available without the oscilloscope as Simpson Model 479 TV-FM Signal Generator. Model 479 $269.00



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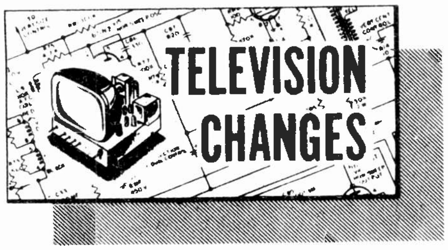


In compliance with the many requests we have received from our readers, this and future issues of SUCCESSFUL SERVICING will again contain the feature, TV PRODUCTION CHANGES.

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) **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)

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, ½w (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.

DEALERS GETTING WESTINGHOUSE TUBES PROFIT FROM HEAVY LOCAL ADVERTISING AT NO COST

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

All of it—local ads and kits—are designed to build TV-radio service business in the dealer's local area.

Best of all, none of it costs the dealer a penny!

You can get your store listed in two local newspaper ads at no charge, and get a kit to boot. If Westinghouse Tubes are now sold in your area, see your Westinghouse Distributor and take advantage of this $900-worth-of-advertising-at-no-cost offer.

NEWSPAPER ADS

COMING YOUR WAY

If Westinghouse Tubes are not yet distributed in your area, be patient. Distributors are being established in all market areas as fast as product availability and good service permit.

You'll soon have the chance to buy RELIATRON Tubes. Keep this tremendous opportunity in mind: you'll get newspaper advertising at no cost! Imprinted material for mailings! Imprinted signs for your window!

All of it is local advertising which sells your service in your own area where it counts.

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.

YOU CAN BE SURE...IF IT'S **Westinghouse**

RELIATRON™ TUBES

WESTINGHOUSE ELECTRIC CORPORATION, ELECTRONIC TUBE DIVISION, ELMIRA, N. Y.

To All Purchasers of:

RIDER'S TV 10

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 LISTING published in TV Volume 10 up to date.

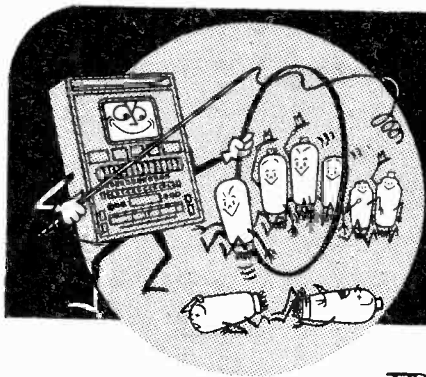
ADDITIONS TO PHILCO VARIABLE RESISTANCE CONTROLS SECTION:

PHILCO Part No.	REPLACEMENTS																		
	CLAROSTAT				IRC							MALLORY							
	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	A43-10K		FKS 1/4		WK-10000							M10MP						
33-5546-49	A10-10K		FKS 1/4		4WK-10000													
33-5563-42	RTV-345				QJ-391		W17-111	WR11-116	P3-129	R8-213								
33-5563-43	RTV-241				QJ-302	K-2	B11-125	B11-130	P1-200	R1-216	76-1							
33-5563-44	RTV-360				QJ-340	K-2	B12-141	B18-139X	P1-200	R1-216				UF54L	UR25AL			
33-5563-50	RTV-358				QJ-356	K-2	B11-123	B11-130	P1-200	R1-216				WF252	UR15L			
33-5563-51	RTV-359				QJ-357	K-3	W17-111	B11-128	P3-131	R1-216		UT451						US26
33-5564-14	AT-116		FS-3	SWA	Q18-139X							SU46						
33-5565-17	AG-55-S		FKS 1/4		Q11-130							SU35						
33-5565-30	AG-44-S		FKS 1/4		Q11-123							SU67						
33-5565-31	AG-85-S		FKS 1/4		Q11-14							SU565						
33-5565-32	AG-84-S		FKS 1/4		Q11-239													

ADDITIONS AND CORRECTIONS TO FIXED CAPACITORS SECTION:

Set Mfr.	Set Mfr.'s Original Part No.	
Belmont	8C-18487	Add AFH4-82 to Aerovox column.
Packard-Bell	23936	Change BPD-.0015 mf to SI-2-1500 mmf in Aerovox column.
"	"	Change K071 to G071 in Cornell-Dubilier column.
"	"	Change DC-5215 to UC-5212 in Mallory column.
"	"	Change 5HK-D15 to 5GA-D15 in Sprague column.
"	23955	Change K078 to KD077 in Cornell-Dubilier column.
"	"	Change UC-5240 to DCD524 in Mallory column.
"	"	Change 5DA-D4 to 5HK-2D4 in Sprague column.
"	23956	Change 1468L-HV 47 mmf to HVD30-47 mmf 10% in Aerovox column.
"	"	Delete 5P20Q47 in Cornell-Dubilier column. No replacement.
"	"	Delete MCL-447 in Mallory column. No replacement.
"	"	Change 60GAB-Q47K to 20GAB-Q47K in Sprague column.
"	23967	Change 1468L-HV-100 mmf to HVD15-470 mmf in Aerovox column.
"	"	Delete 5P10T47 in Cornell-Dubilier column. No replacement.
"	"	Delete MCK-347 in Mallory column. No replacement.
"	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.
"	"	Add TVA-1304 to Sprague column.
"	30-2417-7	Add BBR-2-50T to Cornell-Dubilier column.
"	30-2570-57	Add D111 to Cornell-Dubilier column.
"	"	Add FP476 to Mallory column.
"	30-2570-66	Add XA004 to Cornell-Dubilier column.
"	"	Add FP117 to Mallory 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.
"	"	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.
"	"	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.

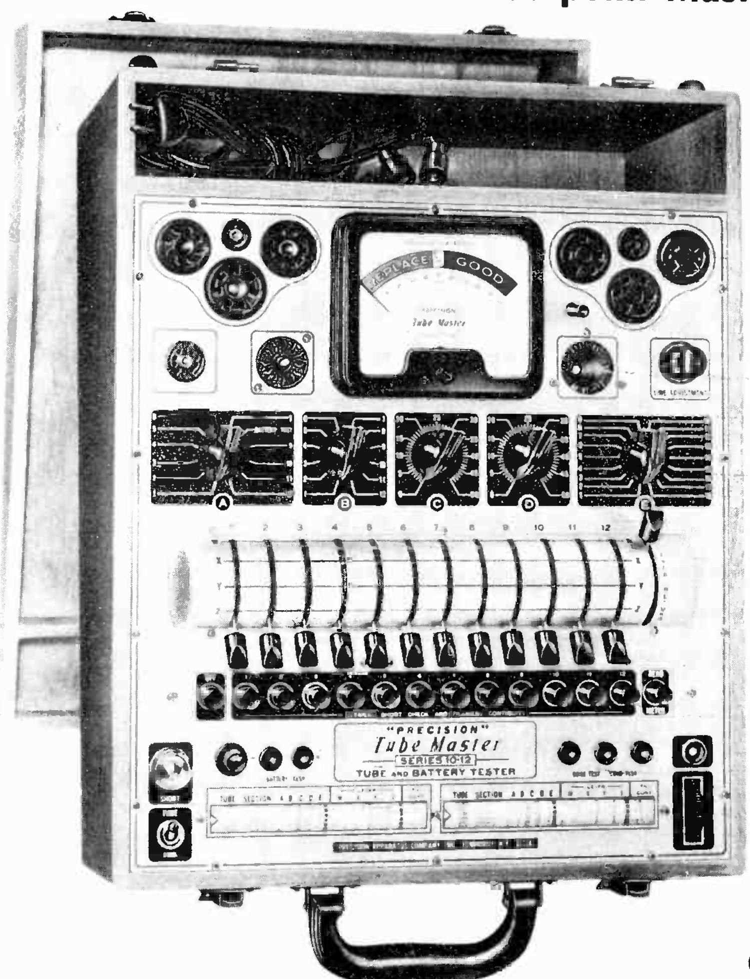


THE INSTRUMENT THAT DEMANDS OVERALL PERFORMANCE FROM THE TUBE UNDER TEST!

-PRECISION- SERIES 10-12

*Electronamic** Tube PERFORMANCE Tester

with 12 element free-point Master Lever Selector System



To test modern tubes for only one characteristic will not necessarily reveal ***OVERALL*** PERFORMANCE CAPABILITIES. Modern tube circuits look for more than just mutual conductance or other single factor.

It has been conclusively proven that even though a tube may work well in one circuit, it might fail to work in another—simply because **different circuits demand different relative performance characteristics,** such as amplification factor, plate resistance, power output, emissive capability, etc.

In the PRECISION "ELECTRONAMIC" Circuit, the tube under test is made to *perform* under appropriately phased and selected individual element potentials, encompassing a wide range of plate family characteristic curves. This COMPLETE PATH OF OPERATION is electronically integrated by the indicating meter circuit in the positive performance terms of *Replace-Weak-Good.*

The efficiency of this "Electronamic" test results from encompassing several fundamental tube characteristics, NOT JUST ONE. Accordingly, when a tube passes this demanding **OVERALL PERFORMANCE test,** it can be relied upon, to a very high degree, to work satisfactorily.

*REG. U.S. PAT. OFF. T.M. 438,006

MODEL 10-12-P (illustrated): in sloping, portable hardwood case with tool compartment and hinged removable cover. Sizes 13¾" x 17¼" x 6¾" **$104.50**
MODEL 10-12-C (Counter Type) **$109.25**
MODEL 10-12-PM (Panel Mount) **$109.25**

Compare these features

- ★ Facilities to 12 element prongs.
- ★ Filament voltages from ¾ to 117 V.
- ★ Tests Noval 9 pins; 5 and 7 pin acorns; double-capped H.F. amplifiers; low power transmitting tubes, etc., regardless of filament or any other element pin positions.
- ★ Isolates each tube element regardless of multiple pin positions.
- ★ Dual Hi-Lo short check sensitivity for special purpose tube selection.
- ★ Simplified, High Speed, 12 element Short-Check system, uses consecutive push-button switching.
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- ★ 4½" Full Vision Meter.
- ★ Built-in Dual-Window, high speed, geared roller chart.
- ★ Free Replacement Roll Charts & supplementary tube test data service.

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AM · FM · TV

PRINTED ELECTRONIC CIRCUITS

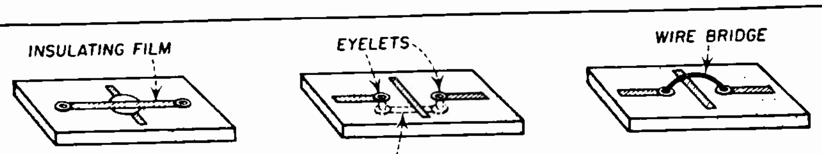
(Continued from page 3)

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,



TYPES OF CONDUCTOR "CROSS-OVERS"
FIG. 4

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 brush-applied painting technique. Kits of such paints, including both conductor and resistor mixtures, are commercially available.

(Continued on page 18)

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.

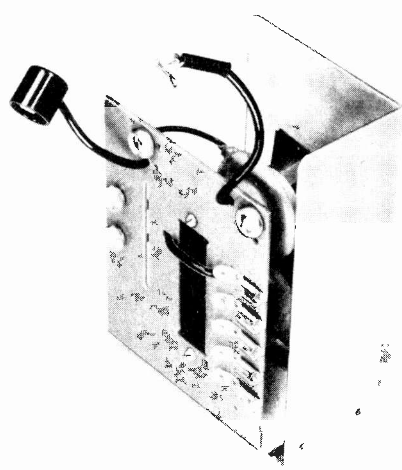
Although subminiature tube sockets are sometimes used with printed circuits, tubes are frequently connected directly to metal eyelets in the base plate, as in Fig. 1. When replacing tubes connected in this manner, care must be exercised to avoid the use of excessive heat during soldering operations. 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.

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 & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
ADMIRAL					
22A2,A 22M1 22Y1	75B1-50	AG-83-S KSS-3	Tone	2 Meg. Ω carbon	$1.25
	75B11-20	RTV-327	Contrast/ Vol./Sw.	1500/1 Meg. Tap 500K Ω Conc. Dual carbon--SPST	$4.30
	75B13-3	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	75B13-7	AG-15-S FKS-1/4	Vert. Lin.	3000 Ω carbon	$1.25
	75B13-12	AG-49-S KSS-3	Bright.	100K Ω carbon	$1.25
	75B13-13	AG-40-S KSS-3	Hor. Hold	25K Ω carbon	$1.25
	75B13-14	AG-61-S KSS-3	Vert. Hold	1 Meg. Ω carbon	$1.25
	75B13-16	A43-750 KSS-3	Focus	750 Ω 2W-W.W.	$1.25
AMBASSADOR					
C1720 C2020 C2420 CD2020 T1720 T2020	131-0001	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	131-0002	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	131-0003	RTV-1	Contrast Vol./Sw.	10K/1Meg. Tap 200K Ω Conc. Dual carbon--SPST	$3.70
	131-0012	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
	131-0012	AG-44-S KSS-3	Bright.	50K Ω carbon	$1.25
	131-0013	AG-61-S KSS-3	Vert. Hold	1 Meg. Ω carbon	$1.25
	131-0014	RTV-10	Focus	5000 Ω 4W-W.W.	$1.85
14MT,MTS 16MT,MTS 17MC,MCS, MT,MTS 20MC,MCSMT, MTS	VC-12120B	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	VC-12121C	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	VC-12127B	RTV-297	Contrast. Vol./Sw.	750 Tap 500/250K Ω Conc. Dual--SPST	$4.30
	VC-12130	AG-49-S KSS-3	Bright.	100K Ω carbon	$1.25
	VC-12131	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
	VC-12132B	AG-83-S KSS-3	Vert. Hold	1.3 Meg. Ω carbon	$1.25
AM-17C, CB,C1M ET,T1M	PT-1002	RTV-252	Contrast Vol./Sw.	750 Tap 250/250K 2W-W.W./carbon Conc. Dual--SPST	$4.30
AM-20C,T PL-17CB,CG, PG,TM 20C 23P	PT-1004	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	PT-1005	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	PT-1007	AG-49-S KSS-3	Bright	100K Ω carbon	$1.25
	PT-1008	AG-61-S KSS-3	Vert. Hold	1 Meg. Ω carbon	$1.25
	PT-1009	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
20PC 20PCS 20PCS2	VC-12120B	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
AMBASSADOR					
	VC-12121C	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.24
	VC-12127B	RTV-297	Contrast/ Vol./Sw.	750 Tap 500/250K Ω Conc. Dual carbon SPST	$4.30
	VC-12131C	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25
	VC-12132C	AG-83-S KSS-3	Vert. Hold	1.3 Meg. Ω carbon	$1.25
	VC-12135	AG-49-S FKS-1/4	Bright	100K Ω carbon	$1.25
ANDREA 2C-VL20	GRV-812-1	AG-83-S FKS-1/4	Height	2 Meg. Ω carbon	$1.25
	GRV-824	A43-2000 FKS-1/4	Vert. Lin.	2000 Ω 2W-W.W.	$1.25
CHASSIS VL-20	GRV-830	AG-60-Z FS-3/SWB	Vol./Sw.	500K Ω carbon--SPST	$1.25 .60
	GRV-831	RTV-75	Hor./Vert Hold	50K/2 Meg. Conc. Dual carbon	$3.10
	GRV-834	RTV-300	Bright./ Contrast	20K/5000Ω 4W-W.W./ carbon Conc. Dual	$4.05
ARTONE AR14L AR17L 17CD 17CRR 17ROG 20CD 203D 1000 1001 2nd Run	P-2	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	P-5	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	P-7	AG-60-Z FS-3/SWB	Vol./Sw.	500K Ω carbon SPST	$1.25 .60
	P-12	AG-8-S FKS-1/4	AM-Rejection	1000 Ω carbon	$1.25
	PD-5	RTV-146	Vert./Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	PD-6	RTV-253	Contrast/ Bright.	2000/100K Ω Conc. Dual carbon	$3.10
MST-12 MST 14 14TR 16TR 17CD 17CRR 17ROG 20CD 20TR 112X 203D 312 819 3163CR 8163CR 8193CM 1st Run	P-2	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	P-5	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	P-6	A10-1500 FKS-1/4	Focus	1500 Ω 4W-W.W.	$1.85
	P-7	AG-60-Z FS-3/SWB	Vol./Sw.	500K Ω carbon SPST	$1.25 .60
	PD-4	RTV-145	Contrast/ Bright.	750 Tap 250/100K Ω 2W-W.W./carbon Conc. Dual	$3.70
	PD-5	RTV-146	Vert./Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
ARVIN 5175 5176	E22464-17	RTV-258	Contrast/ Vol./Sw.	25K/3 Meg. Tap 1 Meg. Conc. Dual carbon--SPST	$4.30
	E22464-20	RTV-259	Vert. Lin./ Height	3000/2.5 Meg. 2W-W.W./carbon Conc. Dual	$3.10
CHASSIS TE320	E22464-34	AG-49-S KSS-3	Bright.	100K Ω carbon	$1.25
	E22464-35	Order from MFR.	Tone/ Phono Sw.		
	E22464-36	AG-83-S KSS-3	Vert. Hold	1.5 Meg. Ω carbon	$1.25
	E22464-37	AG-44-S KSS-3	Hor. Hold	50K Ω carbon	$1.25

CLAROSTAT

This supplementary sheet is for use as an up-to-the-minute 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

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 ± 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.

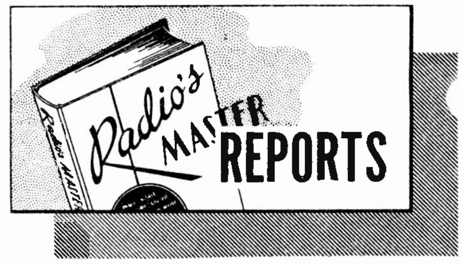
Type of Capacitor	*Standard Industry Capacitance Tolerance in Percent*	*Capacitance Tolerance Values Used in Percent*	*Letter Code*
Mica			
(Plain)	± 20	± 20	M
		± 10	K
(Silver)	± 5	± 10	K
		± 5	J
Ceramic			
(GP)#	± 20	± 20	M
		± 10	K
		± 5	J
(GMV)*	+ 100 and − 0	+ 100 − 0	
		+ 100 − 20	
(TC)**	± 10	± 10	K
		± 5	J
Paper Dielectric	± 20	± 20	M
		± 10	K
		± 5	J
		+ 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	

\# 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 ± a certain amount of capacitance. For instance the capacitance specified by a receiver manufacturer for a circuit may be 0.0022 μf ± 10 percent. Assuming all other conditions satisfied, any value of capacitance between 0.00198 μf and 0.00242 μf 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)



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 increasing 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 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 plastic spray Model 603 at $1.95 dealer net.

CLAROSTAT — Added TV replacement controls RTV 384 to 390 inclusive.

CORNELL-DUBILIER — Added Model V-8, VHF antenna at $25.50 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 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.

GENERAL ELECTRIC — Added germanium transistors 4JA1A1 at $1.95 dealer net . . . 4JA1A2 at $3.85 dealer net . . . 4JA1A3 at $4.80 dealer net and 4JA2A4 at $5.30 dealer net. Also added Model UPX-009, pickup and transcription arm at $9.33 dealer net . . . Model RPX-051, triple play variable reluctance cartridge at $5.28 dealer net and Model RPX-042, variable reluctance cartridge at $4.35 dealer net.

GON-SET — Added No. 1499, UHF line at $7.08/100 ft. dealer net . . . No. 3027, cascade pre-amplifier at $19.95 dealer net and No. 3028, signal slicer at $29.95 dealer net.

ILLINOIS RESEARCH LABS. — Added Silencer in quart size at $6.50 dealer net and introduced Sta-clear, new chemical solution for keeping static attracted dust from accumulating on picture tube at $1.00 dealer net. (4 oz. bottle).

KENWOOD ENGINEERING — Added Model 12W, 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 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 $.66 dealer net.

STANDARD TRANSFORMER CORP. — Added deflection yokes Model DY-11A at $6.00 dealer net and Model DY-12A at $6.00 dealer net.

STROMBERG-CARLSON — Added a number of new items including No. AP-51, power amplifier at $157.50 list and TR-13, line transformer at $3.50 list.

SYLVANIA — Added radio receiving tubes 6T4 at $3.55 list . . . 1XRB at $2.65 list . . . 40B2 at $2.05 list . . . 6SN76TA at $2.20 list and sub-miniature tubes 1T6 at $2.05 list . . . 6BF7 at $1.85 dealer net and 6BG7 at $1.85 dealer net.

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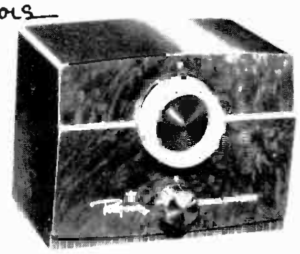
Thomas A. White
president: Jensen Manufacturing Company, Chicago, Illinois
says: "In every field there's one leader
- - - - in boosters it's Regency"
the largest selling booster at any price



Replacement Parts

(Continued from page 20)

with the standard value of say 0.002 μf (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 μf and 0.0024 μf. 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 μf was within a ± tolerance of 10 percent, what then? On the low side it would have a value of 0.0018 μf and on the high side it would be 0.0022 μf. 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 μf for the replacement. Would any normal tolerance satisfy? With a rating of ± 10 percent, the low limit would be 0.00225 μf and the high limit would be 0.00275 μf. 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 μf 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 μf. On the – side, it is 0.004 μf. 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 μμf and 100 μμf 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 μμf 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.

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.

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, separate teletalk amplifier for paging at $120.00 list and 15 pair plastic interstation cable and junction box at $.34 list (on reel).

Discontinued Items

ADVANCE ELECTRIC & RELAY — Discontinued 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.

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 — Discontinued Model 3005, tri-band amateur converter and their Gonset radarray series.

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 microphones.

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 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 — 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.

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 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 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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