MARINE ELECTRONICS
CONDENSER CHECKERS
SERVICING HI-FI
BUSINESS PROCEDURES
COLOR TV RF-IF ANALYSIS
OLDSMOBILE AUTO RADIOS
Raytheon's pioneering in the research, development and production of Transistors has resulted in many important "firsts" — firsts that give Raytheon an unchallenged lead in the field. Here are some of these firsts:

**FIRST in commercial production.** Raytheon was the first company to commercially produce and sell junction transistors. These first transistors set high performance standards as they revolutionized the hearing aid industry.

**FIRST in RF Transistors.** Raytheon scored another important first by leading the way in RF Transistors, too. The first commercially produced RF Transistors — Raytheons — are revolutionizing the portable radio industry, and are being used in computers and communication equipment. Many major manufacturers of portable radios use these Raytheon RF Transistors and all "hybrid" portables use either Raytheon Transistors, Raytheon Subminiature Tubes or a combination of both.

**FIRST in PNP Silicon Transistors.** Raytheon alone makes a line of PNP Silicon Transistors that fills the need for transistors that will operate at high temperatures.

**FIRST Major Manufacturer to Break the Dollar Barrier.** A most important first to you — Raytheon is the first major supplier to achieve such high production and product acceptance of their transistors that one of the line could be priced at less than a dollar — Raytheon quality transistors range in price from 99¢.

At Raytheon more than 100 engineers and scientists, plus nearly 1400 other employees are devoted to a single task — the design, development and production of the finest and best in transistors and diodes. To help them work more efficiently, and to meet increasing production schedules Raytheon recently added facilities totaling three acres of engineering and manufacturing space to its Semiconductor Division.

Raytheon Tube Distributors from coast to coast stock and recommend Raytheon Transistors.

**RAYTHEON TRANSISTORS**

*more in use than all other makes combined*

**RAYTHEON MANUFACTURING COMPANY**

Receiving and Cathode Ray Tube Operations


Raytheon makes all these: Receiving and Picture Tubes, Reliable Subminiature and Miniature Tubes, Semiconductor Diodes and Transistors, Nucleonic Tubes, Microwave Tubes.
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FRONT COVER

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Reminiscing—and Looking Ahead

In 1929, when I was selling advertising for "Radio Engineering" (then the "top" magazine in the field), McGraw-Hill announced they would launch a competitive publication to be named "Electronics." McGraw-Hill said that "Electronics" would cover "all kinds and types of equipment actuated by electronic tubes, even radios." In those days the staff of "Radio Engineering" considered our contemporary presumptuous for implying that the then booming radio broadcasting and receiver business would eventually be but a small segment of the overall, but then nebulous, electronics field. Time has proven that we, not McGraw-Hill, were wrong. Today the radio-TV manufacturing business, even if you add to it all the money spent by commercial sponsors for radio broadcasting and telecasting, is lower in dollar volume per annum than just one phase of electronics manufacturing and servicing, to wit; the military guided missile program. Believe it or not, one West Coast manufacturer has its own service department wherein 17 technicians are employed full time solely on the job of calibrating the firm’s test equipment. Scores of other servicemen working in that plant use the test equipment to service the electronically controlled machinery. Not all electronic service departments are as large as the one cited, but this serves to prove the point.

But today, mellowed by a quarter century of experience, I am inclined to believe that the servicing of installed electronic and commercial communications equipment is a very important business just as is the servicing of home and auto radios and TV sets. Thousands of radio-TV servicemen, although presently engaged solely in servicing radios and/or TV sets concur, and it was due to their recommendation that we have broadened the editorial scope of "Service Dealer" to include "Electronic Servicing."

We reiterate what has been said previously as a word of caution. Today the law stipulates that radio-TV servicemen cannot service certain equipment such as 2-way and ship-to-shore radio transceivers unless they hold an FCC issued radio-telephone ticket. These tickets, or
licenses, issued free by FCC to those who qualify, are 1st, 2nd and 3rd class, and the type of industrial communications servicing one intends to do determines which class ticket must be held. We’ll have articles on this subject, with complete explanations, in future issues.

Welcome Aboard!

Two new editors’ names appear on the masthead of this issue. Elbert Robberson, now our Marine Communications Editor, has for over 25 years been recognized as the authority in his field. His articles in “Yachting” on marine communications equipments are considered as “classics” by boat owners. We promise this: the articles Mr. Robberson writes for SERVICE DEALER and ELECTRONIC SERVICING will, over a period of time, cover every facet of marine communications and electronic device selling and servicing and will prove interesting to every serviceman who reads them, regardless of whether or not the serviceman does boat radio or boat electronic equipment servicing.

Likewise plaudits to Mr. Lawrence Fielding, our new Hi-Fi and PA Editor. He has been in radio for 15 years and for the past 10 years has been “top brass” with one of the foremost audio equipment manufacturers. He knows all phases of Hi-Fi and PA design and selling, both from the manufacturer’s view as well as from the seller’s. Thus, Mr. Fielding’s department in SERVICE DEALER and ELECTRONIC SERVICING will not be premised on wishful thinking. Instead it will cover practical and proven successful aspects in an effort to get “their share” of Hi-Fi or PA business for those servicemen who, heretofore, have been on the “outside looking in.”

N.Y. State Survey

A Governor’s committee is at present engaged in evaluating the TV service situation in New York State with a view to possible legislation to correct any of the evils that may exist. Wherever the fault may lie, we hope they will come up with the answer.

[Continued on next page]
AD LIBS
[from previous page]

Rider Spoke in April
You'll recall I said, when we recently arranged with John F. Rider to have his "Rider Speaks" page run as a regular feature, it was mutually agreed that he would be allowed to select his own subjects and present his views carte blanche. Because I was traveling around the country these past months, it was not until the April issue came off the press that I knew what subject matter had been covered in it by Mr. Rider. Now, having read it, I heartily concur with his views. Further, I urge all readers of this journal to re-read Mr. Rider's April page for it contains a wealth of sound reasoning and the reader's future can be affected by his subtle prognostication.

Starting A New Era
This issue starts us on our 17th year as a radio-TV serviceman's technical publication. The new title and format of the magazine may startle you. In view of this, we welcome your comments, suggestions and criticisms, so send 'em in! We want you to believe that we consider you as a part of our staff just as we consider ourselves as being a part of your enterprise.

Random Notes
The other day a serviceman sent us his subscription order and this particular one caused a mild furor in the circulation department. The order was on a subscription order form which appeared only in our May and June 1940 issues. Took the fellow quite a while to decide about subscribing! On the other hand, it's gratifying to know that there are servicemen who have kept their copies of Service Dealer for 16 years.

New York City saloon-owners are currently being told in newspaper advertisements specifically directed to them by a local TV discount house that it will rent them a Color TV receiver for $1.00 a day. That part of the advertisement does not cause us alarm, but one other part does. I refer to the paragraph which reads: "It is cheaper to

Philco breaks National Campaign to replace "Tired" Picture Tubes

Millions of TV Set owners get the call to action—to phone you immediately for a new picture tube. TV Guide, Saturday Evening Post, newspapers and TV commercials are ready to break the big replacement story and sell the Philco Star Bright 20/20 Aluminized Picture Tube for you. Be sure to have stock on hand when your phone starts ringing. Then you'll be ready to move into the homes of television owners and cash in on the greatest campaign of its kind ever to hit the public.

Invest in your future in Color TV Service and equip your shop FREE during the fabulous

PHILCO SHARE
AND PROFIT
Dividend Opportunity

That's right, you can earn FREE color and B/W Test Equipment and Parts and Accessories by concentrating your radio and TV parts on Philco. With each purchase you get SHARE and PROFIT stamps, redeemable for the dividends of your choice at your Philco Distributor. They build EXTRA 100% PROFITS because they cost you nothing. See your Philco Distributor now for full details.
Now, an Exclusive Double Edged Selling Tool...

Bond plus Warranty
ON EVERY
PHILCO®
Star Bright
20/20

SUPER ALUMINIZED! CLEAREST, MOST LIFELIKE PICTURE POSSIBLE

Regardless of the make or model of a TV set, a Philco Star Bright 20/20 Aluminized Picture Tube gives your customers a clearer, brighter, more lifelike picture than ever before... and builds confidence in you.

Yes, Philco gives you a double-edged selling exclusive to boost your replacement tube business. In addition to the one year warranty, the Philco Star Bright 20/20 Aluminized Picture Tube is BONDED to have all new picture making components. This bond protects your customers against counterfeit tubes and assures a picture tube that's built to the same rigid standards as those in original TV receiving equipment. The Philco Star Bright 20/20 is the only picture tube made that is backed by such a bond.

PHILCO CORPORATION
ACCESSORY DIVISION
PHILADELPHIA 34, PA.

Philco puts you in the color service business with this one compact instrument

PHILCO Universal COLOR BAR and DOT BAR Generator

It's new... highly efficient... designed to provide the widest possible variety of functions in the minimum amount of space. PHILCO MODEL 7100 is used to completely trouble-shoot circuits associated with color reproduction and make accurate convergence adjustments in any color television receiver on the market.

rent a Color TV set rather than buy one.” We believe that Service Dealers should rent radios and TV sets (just as they should rent PA outfits). A profit can be made on such rental transactions and frequently sales result from rentals. But to tell prospective Color TV set buyers in high-pressure advertising that they should NOT buy an item because it will cost less if rented, in our opinion, is negative and very low-grade merchandising. It creates a doubt as to the product's merit and value. Many millions of dollars have been invested in Color TV development. To have this huge investment jeopardized—to have derogatory and snide aspersions cast on Color TV by a “price butcher” of this discount house’s ilk, is in our opinion untenable. Were we the sales manager for a Color TV set manufacturer we would refuse to sell our merchandise to such a discount house because it has proven to be a mere opportunist, not a sound merchandiser.

Refuse No Jobs

Many servicemen have declined service jobs on Geiger Counters, photoflashers and other electronic devices because, not having had any experience with them, or a source from which to obtain technical guidance, they believed it wiser not to “get involved.” To prevent the bypassing of such profitable jobs SERVICE DEALER and ELECTRONIC SERVICING recently published articles on servicing Geiger Counters and radiation detectors. We now have in preparation articles on servicing electronic photo-flash units as well as a myriad of other electronic devices. The techniques, schematics and pertinent facts required by a radio-TV serviceman to enable him to do this type of extra-curricular work have never before been published by any serviceman’s magazine.

If, in future, you are ever offered a service job on any type of electronic device about which you are not already familiar, don't decline the job! Accept it and communicate with our Answer Man at once. He will get to you immediately the information you need. There is no charge for such reader service. It’s our policy to help you do every possible or potential job in every phase of electronic equipment servicing.

www.americanradiohistory.com
RIDER SPEAKS

From where we sit, and judging from what we have picked up here and there, the hi-fi component manufacturers might well give some consideration to making a few changes in the design of the components they produce.

There is a need for some form of standardization among the components offered to the hi-fi enthusiast. As far as the service technician is concerned, his services will be needed whether or not standardization ever becomes a reality, but the electronic parts distributor or the sound equipment distributor who deals in high-fidelity components is very much concerned with the continued sale of the elements that make up the system, from the tuner or turntable to the speaker. He is also concerned with any possible sales volume.

The problem seems to be the development of a mental block on the part of the individual interested in assembling and installing a hi-fi system. He believes there are undue difficulties involved; that the costs are higher than they should be; that once such a system is assembled it is forever “frozen” to the components initially selected; that any change in the system is tantamount to forming a new system; that acquiring “furniture” to house the equipment is a detailed, tiring affair; that finding people to make the installation is difficult. In substance, some people are becoming frightened by the complexities they conjure up in their minds, and slowly but surely are becoming discouraged from buying components.

We are fully mindful of the fact that a variety in hi-fi components is necessary to sales because the different likes of different people must be satisfied. We are mindful of the fact that manufacturers of these units cannot make identical components with similar performance characteristics. Such thoughts are farthest from our mind, but at the same time we feel that more attention can be paid by the manufacturer to those simple factors which might make the selection, assembly and installation of a hi-fi system easier, if they desire to increase sales, let alone maintain the sales level.

In line with the above, we think that a form of standardization in the physical dimensions of many units of like function (even if unlike in performance) is required. (This does not include the speaker, of course.) We think that removing as many of the variables as possible, involved in the housings of components in furniture would be conducive to more sales. We realize that furniture cannot be standardized, but even if the outside appearance of a cabinet is subject to variables in order to conform with the decor of a room, the inside space for the components of a system might well become standard.

What forms can this standardiza-
tion take? Consider, for example, the problem of interconnection between components. The types of connectors used should be alike. If the design of two systems is such as to afford two outputs, the two output connectors should be alike; if the output system calls for three, four, or more outputs, all systems identical in number of outputs should use similar connecting means. A move of this type, while it is not a major change, would afford maximum interchangeability with minimum difficulty.

Consider record changers and turntables. There are many brands on the market, and there are many types of mechanism, but there isn't any reason why the bases on which these devices rest should not be of uniform size, so that the opening in which record changers or turntables can be mounted in a piece of furniture would be the same size.

Standardization tends to remove the individuality in a product but we do not believe it applies to the suggestions being made here. One of the most progressive steps ever taken in the electronics industry was the standardization of the octal socket. It didn't affect the different types or the materials of which they could be made, nor did it limit any manufacturer in presenting the selling points of his product or the number of tube types. What it did was to minimize variables and afford the utmost flexibility to the user.
Imagine you are out in a small boat. The water gets rough, or fog closes in, or the engine dies. Right then, you become a red-hot prospect for marine-electronics equipment. You'll want a radiotelephone, a direction finder, and a depth indicator. Thirty-million people could get in this exact situation today, and their number is climbing.

"Not around here," you might say.

But boating is not limited to seaports any more—it abounds around Louisville and Las Vegas, as well as Long Beach, and the sound of the outboard fills the land. Its devotees spent a billion dollars last year. You don't need a computer to spell out the conclusion—here is a market worth looking into! And it isn't overcrowded—yet.

The secret of success in this field is service. Give boatmen the specialized attention they need, and they'll travel miles for it.

Unfortunately, you can't just put up a sign and be in business. Not safely, anyway. This is not like home-radio service, where a mistake has no great importance. In marine electronics one wrong connection can sink the ship! So here is a guide to a safe launching, and a course that will keep you securely in the channel.

Variety of Equipments Involved

First, let's see what the marine-electronics field involves. Once it was a strictly seawater activity, mostly concerned with wireless, which actually had more wire than anything. Today you'll work with packages as smooth and neat as an A&P coffee grinder. Foremost among these is the two-way radiotelephone. These range from pocket-size citizen's-band outfits, through battery-operated marine-band portables that can be used on any boat bigger than a one-man Kayak, up to many-hundred watt powerhouses that will talk hundreds of miles.

These sets have from 4 to 10 pre-tuned channels, selected by the skipper, who just turns a knob on the front panel. Prices range from a little over $200 to well over $1000. It is customary for the sales agency to install the equipment, which involves putting in wiring, and tuning up receiver and transmitter channels.
They also usually furnish the antenna, which retails at upwards of $50.00, and the frequency-control crystals, listed from about $40.00 up per set. Installation of a ground plate on the boat’s bottom may also fall to the radio-service agency, although this job is sometimes taken care of by the owner’s favorite shipyard. But it can be seen that every radiotelephone sale is a fairly important transaction.

Second to the telephone is the radio direction finder, which is simply a carefully engineered receiver using a highly directive loop antenna. These have reached the stage of development where they can be carried in almost any boat, and will help a skipper grope home using bearings on broadcast stations, as well as airways and marine beacons. A set that can be used for direction finding costs from $50.00 up. The dealer’s responsibility may end when he hands the set to the customer, or it may extend to wiring it into the boat, testing and calibrating the set for bearing errors, and then giving a short course of instruction in its use, which services may involve a fee of $50.00. (Continued on page 51)
This article presents a description of various makes and models of condenser checkers, and a simplified discussion of their circuits.
Capacitor is not shorted. The capacitor can, at this time, be tapped sharply. If the "eye" flutters, the capacitor is intermittent and should be replaced.

Open Test

In using the Sprague Model KT-1 the switch is placed in the OPEN position. The clip leads are connected to the terminals of the capacitor under test, or left connected from the short test. The test cable T2 and the impedance Z1 of Fig. 2 constitute a quarter wave transmission line operating at the same frequency as an oscillator circuit in the unit. The frequency is approximately 20 mc. A useful property of a quarter wave line, utilized in this test, is that the impedance connected to the output end of the line is reflected back reciprocally to the sending end. Thus, if the output is shorted the input end "sees" an open circuit.*

In operation, if the test clips are open or are connected to an open capacitor, the sending end, coupling coil L2, "sees" a short circuit (zero voltage), and the "eye" remains open indicating the connected condenser is open. Any good capacitor connected to the clips results in a voltage across L2 which is rectified by the 1N51 crystal. A resultant dc voltage is impressed upon the grid of the "eye". This dc voltage causes the "eye" to close in proportion to its magnitude. A small capacitor causes a small closure, while a larger capacitor causes the "eye" to close completely. If the "eye" closes (the capacitor must be larger than 200 μuf) to completely close the "eye") the capacitor is not open.

Here again the capacitor can be tapped sharply. A flutter of the "eye" indicates an intermittent condition.

A Capacity Measuring Meter

It is often desirable and sometimes necessary to be able to measure the capacitance value of a particular condenser. Means of doing this can be accomplished easily with such a unit as the Heathkit direct reading capacitance meter, Model CM-1. The circuit for this unit is shown in Fig. 3. The unknown capacitance is connected in series with a germanium crystal, a 1N34, shunted by a meter circuit. The measurement of capacitance is accomplished by rectifying a square-sided pulse and measuring the average value of the rectified dc voltage on a meter. The meter is calibrated in capacitance corresponding to the dc voltages impressed across it. The impedance of the meter circuit in conjunction with the unknown capacitance determines the shape and consequently, the average value of the rectified voltage.

The oscillator circuit of this unit employs a 6BY7 tube in a cathode-coupled multivibrator circuit. The frequency of the multivibrator depends upon the capacitance switched into the circuit, and varies from about 80 cycles to 80 kc. A 100 ohm cathode resistor provides the common impedance necessary to maintain the oscillator in operation and is also the source impedance of the pulse used for the measurement of the capacitance. The range switch selects the value of the feed-back capacity and the series calibrating potentiometer. These values establish the pulse repetition rate and therefore the maximum capacity that can be read on any range.

A more elaborate instrument for measuring capacitance and performing additional tests is found in the Heathkit Model C-3 condenser checker. This unit provides a means of capacitance measurement on four scales covering from 10 μuf to 1000 μuf. At the same time dc leakage test polarizing voltages are made available from 25 volts in five steps to a maximum of 450 volts. Also, resistance measurements covering two ranges, 100 ohms to 50,000 ohms and 10,000 ohms to 5 megohms, can be accomplished.

The Heathkit Model C-3 tester makes use of an ae powered bridge circuit employed for both resistance and capacitance measurements. The schematic diagram for the unit is shown in Fig. 4. This circuit resolves itself into the more simplified one shown in Fig. 5, which is known as a line frequency Wien Bridge. It can be noted that the main control is a potentiometer with its variable arm grounded. By rotating the control, the resistances, R1 and R2, in the two legs can be increased or decreased. A standard comparison condenser is connected into a third leg and the fourth leg of the bridge contains the unknown condenser. By adjusting the main control, which is calibrated in capacitance, the

[Continued on page 46]
The Service Dealer and HI-FIDELITY

by LAWRENCE FIELDING

Introducing a new series on Hi-Fi for the professional electronic serviceman. It is the writer's aim to make the servicing of this equipment mostly quantitative.

The term "high-fidelity", as well as its contracted and capitalized small cousin Hi-Fi, has suddenly become a household word for millions. True, many individuals who use the term would be rather hard-pressed to give an acceptable definition of high-fidelity, if asked. Nevertheless, the phrase has become a part of our daily conversation.

Regrettably, the entire subject has taken on all the outward appearances of a real "fad", and, as is true with all fads, a great many misconceptions exist in the mind of the general public. Uncontrolled, and often misleading advertising in mass media such as newspapers and nationally distributed magazines tends to amplify these misconceptions. It's not unusual to visit a customer's home in the course of a television service call and have him extol the virtues of his recently acquired, $20.00 "guaranteed" Hi-Fi children's phonograph.

It is the general purpose of this new series of articles to arm the reader with sufficient sound information to intelligently appraise the merits (or, in many cases, the demerits) of so-called high-fidelity systems. To do this we must first become acquainted with some generally accepted definitions of high-fidelity and, at the same time, perhaps dispel some popular notions concerning your place in this new mass-market industry. Next, in the series of articles to follow, we hope to change the approach to high-fidelity servicing from an opinionated art, to a calculated science.

Hi-Fi Defined

Before going any further, let's establish a working definition of high-fidelity. Most manufacturers of this type of equipment have, as their ultimate goal, the design, development and production of a set of components capable of reproducing sound which is indistinguishable from the original, live sound. Almost anyone intimately associated with this work will be quick to admit that we have not, as yet, reached this goal. Therefore, the term high-fidelity must be thought of as a relative term. Perhaps we should have labeled such equipment higher-fidelity—that is, higher than the fidelity achieved by table-model ac-dc radios, or higher than the fidelity of sound that "bounces" out of an open-backed, pre-war console. In any case, remember that there is no fine dividing line between high-fidelity and "low-fidelity." In fact, if this science should ever reach its ultimate goal, we would probably do just as well to drop the adjectives altogether and label such products as having "fidelity", or complete faithfulness to the original sound.

At this point the question naturally arises, "Who's to say if a particular system or set of components comes as close as possible to reproducing life-like sound?" Who, indeed, but a technically competent serviceman, properly equipped to measure the performance of a given system and to interpret his measurements in judging the performance of any high-fidelity system.

The Serviceman's Double Dilemma

The concept of high-fidelity probably grew in the minds of many engineers simultaneously, back in the middle thirties. These men were engaged in the new miracle of making motion pictures that "talked." Extremely rugged amplifying and reproducing systems were in use in those days. Many of them were capable of reproducing excellent sound in motion-picture theaters. Undoubtedly, some of these engineers, after a hard day in the sound-studios would go home and listen to their table-model radios or phonographs and wonder why the sound they heard was so inferior to the sound...
hey worked with at the studio. They
began to experiment, to build and to re-
build, using principles borrowed from
his industrial and public address sound
equipment manufacturers. The word
pread very slowly at first, so that before
he war there were at best, perhaps, only
wo or three companies devoted ex-
clusively to the manufacture of sound
equipment capable of reproducing rea-
onably life-like music and speech in
home. Most early owners of this
equipment were sufficiently technically
ninded to do their own servicing if the
equipment became faulty.
As is true in almost every field of
electronics, World War II advanced the
science very rapidly, so that in the late
nineteen-forties, high-fidelity began to
take on the aspects of a young and grow-
ing industry. The rest is history. Today,
leading small manufacturer in this
industry (and, by the way, most of the
manufacturers are small by comparison
with other "luxury item" industries)
will turn out about 75,000 component
items this year. Who services all this
equipment? Very often that job is
handled either directly by the manu-
facturer or by a few, scattered large
retail outlets who maintain major ser-
vice-organization set-ups. Up to
the present time, the thousands of owner-
servicemen all over the country just
haven't played a major role in this field.
Why? It's true that the number of ser-
vice calls per high-fidelity installation
has been relatively low up to now. That
is because the equipment is as new as the
infant industry and is usually fairly con-
servative in design. But, make no
mistake about it! High-fidelity equip-
ment uses the same capacitors, trans-
fomers, tubes and resistors that you've
been replacing in other electronic equip-
ment ever since you've been in business.
These components do not have "infinite
life" built into them, despite the quality
of sound reproduced by the equipment
containing them. And remember, too,
that not all parts of a high-fidelity system
are electronic. Turntables and record-
changers have motors to drive them. So
do tape-recorders. Needles have a way of
wearing out rapidly, at the expense of
the unsuspecting record collector. The
list of future work is endless. When all
this equipment begins to give way,

[Continued on page 48]
There's an old saying in our business: "You don't have to be crazy to be a serviceman, but it sure helps!" In like vein one might say: "Servicemen are not required by law to use business forms or business-like methods... but... by failing to do so they're inviting failure." If you don't subscribe to this theory, look at the record! The Department of Commerce maintains an excellent statistical record of business failures and successes. These records prove conclusively that 11 out of 13 newly established business enterprises that start out with properly maintained records have been successful. In contrast 4 out of 5 newly established businesses which did not use and maintain proper business forms from the outset failed in less than 10 months. If I were engaged in the radio, TV or electronic service business, even as a part-timer—I'd hate to buck such odds.

Cost of business forms

What will a comprehensive set of fundamentally needed business forms cost?... and, how much of a return can be expected to offset the investment? Well, looking at it from the most conservative and pessimistic angle possible I'd say that an initial outlay of from $9.55 to $14.00 is required and that amount should come back to the investor on the first 10 or 12 jobs he does. Then for his dividend he can expect upwards of $80.00 more. On the other hand a $20.00 initial outlay for business forms will provide the serviceman with a real fine set of material and its cost will come back in relative proportion many many times. Stated another way, the average full-time radio-TV serviceman will handle 1,200 to 1,600 repair jobs a year. Some part-timers will do upwards of 400 a year. But try as you will, you can't use up more than 5 cents worth of printed forms on any single job and as a matter of fact the average job will only require 2 to 3 cents worth of printed forms purchased from your parts distributor.

What basic forms should a serviceman have and use? Opinions on this will vary, but I'm entitled to my ideas so I'll express them. In doing so, I'll use throughout, as illustrations, the various stock printed forms that are produced by Oelrich Publications of Chicago. These are carried as stock-items, for over-the-counter sale, by practically every radio-electronics parts distributor in the country.

First thing I'd buy is the $705 "Customer Service File System" which lists at $6.95 and comes as a file...
A description of various business forms available that tie in with the ordinary run of business procedures followed in a typical serviceman's day.

box complete with 500 3" x 5" cards. See Fig. 1. Each card gives you a complete service history on any unit serviced—shows the nature of the complaint, the price charged, job number, date serviced, parts replaced, etc. It also shows warranty expiration dates on pix and regular tubes, parts, etc. If you happen to have your own small file box all you need are the No. 704 Customer Service Cards themselves. 500 cards printed maroon on white, cost $2.50.

Next, if I did both radio and television servicing, I'd buy (even if I were a very small-operation independent part-time serviceman) two pads of Oelrich's #209 "Radio Service Work Sheets" (Fig. 2) and two pads of their #212 "TV Service Shop Reports, (Fig. 3)—(each pad has 50 duplicate sets of data sheets so I'd start with a supply that would let me handle the first 100 jobs). If I only did radio servicing and no TV servicing I'd only get the #209's. Both of these forms sell for $.95 per pad—a $3.80 outlay—and they do a "selling job" for you, as each can be shown to the customer as a completely itemized job record. (and you'll have the duplicate for your files.) Here's an instance where invaluable customer goodwill can be obtained—and your prestige raised—simply for an investment of less than $1.00 per job. (If you tacked $.50 extra onto the labor charge you'd get it from the customer without a quibble because you used such an ethical approach. Being evasive or keeping information from a customer is the best way to make him suspicious . . . and a "suspicous" customer will quibble about charges and is never a really pleased customer.

Now I'd add to my business-operations stock a #111 "Parts and Service Guarantee Book" that lists for $2.00 (see Fig. 4). The book of 100 two-section parts and service guarantees help you keep a record of your parts warranty obligations and eliminates having a customer misunderstanding as to what a parts or service guarantee covers. In my opinion it's a most impressive way to convince the customer that he's dealing with a reputable serviceman! Servicemen have told me that by merely showing they use such guarantee forms to potential customers they frequently get jobs that otherwise would go elsewhere.

Up to this point I've shown four basic business form "musts" that would require an outlay of $12.75 even if the serviceman bought the file box, or only $8.30 if he had his own file box. Naturally a service shop or serviceman would want his name imprinted on every form so if we add the outlay of $1.25 for a rubber stamp and pad it gets us up to the original $14.00 investment I first mentioned, or $9.55 if he had his own box.

Now if I were a serviceman I'd want a supply of Oelrich's #207 "TV Job Tickets" and their #108 "Radio Repair Tags." See Figs. 5 and 6. (Of course you don't need the #107's if you don't do TV servicing.) These "Job Tickets" are on a manila tag stock, numbered, come 100 to a pad and cost but $1.60 per book. As their names imply the "Job Tickets" perform several functions. Rubber stamp your name on the bottom right section, tear it off and present it to the customer as his claim check. The upper [Continued on page 43]

Right: Fig. 7—Three samples of merchandising aids available. Right and below: Fig. 8—The Radio-Electronic Master Directory.

Below: Figs. 5 and 6—Job ticket forms.
**COLOR**

**R.F.-I.F. Section Analysis**

by BOB DARGAN and SAM MARSHALL

From a forthcoming book entitled "Fundamentals of Color Television"

**The section comprising the rf tuner, the video if stages and the video detector (or detectors if two are used) shall be called the RF-IF Signal Section; for it is in this section that the composite rf and if signals are processed before being fed into the separate chrominance, luminance, sound, and sync sections. In some receivers a stage of video amplification is included before this division is effected.**

**Classification of Composite Signal Section Types**

Block diagrams of various systems used are shown in Fig. 1. In (A) we observe a system using a single detector followed by a video amplifier stage, the output of which feeds separate chrominance, luminance, sound, and sync input circuits. Fig. 1B shows a dual detector system in which the luminance signal is recovered in one detector, and the sound and chroma signals in another. In Fig. 1C we illustrate another type of dual detector receiver in which the luminance and chrominance signals are recovered in one detector and the sound signal in the other.

**Tuner Considerations**

Tuners used in color TV receivers are essentially the same as tuners used in monochrome receivers except for more rigid adherence to component values and operating specifications. These specifications include:

1. Bandpass characteristics of tuner
2. Linearity of circuit operation
3. Impedance match between transmission line and tuner
4. Local oscillator frequency stability

Let us first consider bandpass characteristics. Whereas response variations of plus or minus 3 db over the rf pass band are generally acceptable in monochrome

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**Fig. 1—Various types of RF-IF sections employed in color television receivers. Notice that these receivers are categorized into three groups as shown in the figure.**

**Fig. 2—Comparable acceptable tuner response curves for color and B&W.**

**Fig. 3—Ideal video IF response curve showing levels for various carriers.**
how long would it take you to solve this service problem?

SYMPTOM:
Note the photo: The dial cord obviously needs repairing.

It might be possible to replace or re-string the dial cord without a diagram, but why waste valuable time trying to figure out the correct way? With a PHOTOFACT Folder by your side, you save time. Here's why:

In just seconds, you refer to the Dial Cord Stringing Diagram in your PHOTOFACT Folder. It shows the right way to re-string the cord. You don't waste time puzzling over why the dial pointer moves the wrong way, why the gang doesn't turn, why there's jamming or skipping. You solve this nuisance service problem in a few minutes with PHOTOFACT's help. It's just one of the important time-saving features found in PHOTOFACT—the world's finest service data.

what's your service problem?

PHOTOFACT gives you complete coverage on over 20,000 TV, Radio, Amplifier, Tuner and Changer models. And PHOTOFACT is a current service—keeps you right up with latest model production—brings you these exclusive features:

FULL SCHEMATIC COVERAGE
1. Famous "Standard Notation" uniform symbols are used in every schematic. Diagrams are clear, large, easy to read and handle.
2. Wave forms and voltages are shown right on the schematic for fast analysis.
3. Transformer lead-color-coding and winding resistances appear right on the schematic.
4. Schematics are keyed to parts lists and to parts on chassis photos.

FULL PHOTOGRAPHIC COVERAGE
5. Exclusive photo coverage of all chassis views is provided for each model; all parts are numbered and keyed to the schematic and parts lists for quicker parts identification and location.

ALIGNMENT INSTRUCTIONS
6. Complete, detailed alignment data is standard and uniformly presented in all Folders. Alignment frequencies are shown on radio photos adjacent to adjustment number—adjustments are keyed to schematic and photos.

TUBE PLACEMENT CHARTS
7. Top and bottom views are shown. Top view is positiond as seen from back of cabinet. Blank pin or locating key on each tube is shown. Charts include fuse location for quick service reference.

With PHOTOFACT by your side, you solve your service problems in just minutes...you service more sets and earn more daily.

*These are only a few of the 32 features found exclusively in PHOTOFACT—the world's finest service data.
The Radio Corporation of America opened an extensive advertising and promotion campaign in Chicago to tie in with the start of station WNBQ’s all-color local telecasting, it was announced by R. H. Coffin, Vice President, Advertising and Sales Promotion.

“Chicago Goes Color” will be the theme of the coordinated campaign to be conducted jointly by RCA, NBC station WNBQ and the RCA Victor Distributing Corp., which distributes RCA Victor products in the Chicago area.

“As of next Sunday station WNBQ will become the world’s first station to telecast all its local live programs in compatible color,” Mr. Coffin said. “We believe this is an extremely important milestone in the rapid progress of color television and we are giving it our complete support.”

RETMA reports that cumulative retail sales of television receivers during January and February 1956 amounted to 1,144,767 compared with 1,274,198 sets sold during the corresponding period a year earlier. Radio set sales during the first two months of this year, excluding auto sets, totaled 986,073 compared with 794,989 radios sold during the same period last year.

In February, 576,282 television receivers and 1,093,506 radios were manufactured compared with 585,347 TV sets and 1,078,624 radios produced in January. February 1955 production of television receivers had totaled 702,514 and radio output had been 1,089,724 units.

Television sets manufactured with UHF tuning facilities totaled 78,956 in February, while 2,660 TV receivers containing FM circuits were produced, RETMA said.

Picture tube sales in February totaled 898,063 units valued at $17,136,695 compared with 892,385 tubes worth $17,016,391 sold in January. Sales in February 1955 had totaled 859,529 picture tubes worth $17,119,568.

Receiving tube sales showed 37,754,000 tubes with a value of $30,756,000 sold in February, compared with 40,141,000 tubes worth $31,514,000 sold in January. Manufacturers’ sales of receiving tubes had totaled 38,526,000 units with a value of $28,108,000 in February 1955.

James M. Skinner, Jr., was elected President of Philco Corporation and William Balderston was re-elected Chairman of the Board of Directors, at the organization meeting of the Company’s Board Friday, April 6.

James H. Carmine, who previously expressed a wish to retire as Philco President at the conclusion of his term in office, will continue as an active member of the Board of Directors and Finance Committee, and will serve as a special consultant on sales and merchandising.

The manufacture of television receivers has been suspended by Stromberg-Carlson, a division of General Dynamics Corporation, it was announced by Robert C. Tait, President.

The decision to suspend the production of television receivers was reached after more than a year of careful study, and after a fact-finding survey of the field by an independent research organization, Mr. Tait said. The decision was actuated by an increasing demand on Stromberg-Carlson’s facilities as a designer and producer of electronics equipment for manifold industrial and government applications, he explained.

J. P. Brocki has been appointed television service manager of the TV and broadcast receiver division of Bendix Aviation Corporation, it was announced by H. C. Morgan, divisional general sales manager.

Brocki has been on the staff of the division for ten years. Previously he was assistant service manager, and foreman of TV test and inspection.

In his new position he will supervise the activities of the service and parts department.

The National Electronic Distributors Association joined the citizens of the Ellenville community in a tribute to Harry, Joe and Lou Resnick, founders and owners of Channel Master Corp.

The TV antenna and accessory manufacturers were presented with a bronze plaque by Mr. Aaron Lippman, Board Chairman of the Association, in recognition of “their personal integrity and their unfailing efforts to advance the interests of the Electronics Industry and in appreciation of their enthusiastic support of our mutual objectives.”

General Cement Mfg. Company of Rockville, Ill. is now acting as national distribution agency for Stackpole Resistor Division of the Stackpole Carbon Com-
company in Ardmore, Pa. Stackpole replacement components will be packaged under the name General Cement-Stackpole, and are available to servicemen through electronics parts distributors.

"Color schools" are being planned by the Radio and Television Division of Sylvania Electric Products Inc. to show the correct way to service Sylvania color television sets, which are to be unveiled later this year.

To open the nationwide training program for servicemen, a one-week, 60-hour course will be held in Buffalo in late Spring. Mr. Merriam, Service Manager, said the school will be tailored especially for service managers of Sylvania distributors and will include lectures and actual work on the Sylvania color chassis, with defects being introduced into the circuitry and servicemen being shown techniques for correcting them.

Following this, the Division plans a one-week, 60-hour course on color service for dealer service men and independent service contractors, also to be held in Buffalo. Afterward, local color clinics will be scheduled for dealer servicemen throughout the country, running 12 and 24 hours in duration.

An entirely new line of television receiving tubes which will reduce series-string heater power 25 percent—thus easing design problems in the trend to smaller sets—has been developed by the General Electric Tube Department.

These tubes will draw 450 milliamperes of heater current and are designed to meet series-string circuit requirements of portable television receivers. G.E. production facilities are ready to turn out 450-milliampere versions of any or all of the some 50 popular 600-milliampere controlled warm-up types as required. The company expects that the 600-milliampere series-string line of tubes, also originated by G.E., will continue to be used in the larger television sets.

R. J. Yeranko, Director of The Magnavox Service Department announces that Ray S. Guichard joins the Magnavox Service Department staff as Assistant Service Manager responsible for the administration of the Spartan Division service operations.

Guichard comes to Magnavox from Capehart-Farnsworth where he has been Director of Publications and Training of the Service Department since 1947.

The Spartan Division service operations will be carried on from the Magnavox Fort Wayne office.

Howard W. Sams & Co., Inc., Indianapolis electronic engineering and publishing firm which does an annual sales volume approaching four million dollars celebrates its tenth birthday this month, marking the growth of the company from a twelve-man nucleus to its present staff of over two hundred persons—eighty-four of whom have been with the company five years or more.

The event will be featured by a Service Awards Dinner at the Meridian Hills Country Club April 18th, at which fifteen persons will receive Ten Year Service pins. Eight of the twelve founders are still with the company.

The modern automobile, replete with safety features and long rear fins, is bringing about a revolution in automobile antennas, according to Ben Snyder, head of Snyder Mfg. Co., one of the world's largest manufacturers of auto radio and television antennas and automobile accessories. Snyder, one of the pioneers in rear deck antennas for automobiles, said the trend is accelerating to such an extent that manufacturers of autos will be using nothing but rear-deck antennas by 1958.

Shure Brothers, Inc. has recently moved into a new building located at 222 Hartrey Avenue, Evanston, Illinois. The new plant is situated just north of the Chicago city limits.

A record attendance of electronic engineers and scientists is expected to assemble in Washington for the seventh of a series of three-day technical meetings on electronic component parts and materials which opens on Tuesday, May 1, in the auditorium of the U. S. Department of Interior.

The theme of the 1956 Electronic Components Symposium is "Components—Accomplishments and Trends" and will feature addresses by top-level industry and government officials as well as papers by leading electronic experts from manufacturing concerns and federal agencies, the Radio-Electronics-Television Manufacturers Association announced.

Kenneth H. Brown has been appointed service manager of the television-radio division, Westinghouse Electric Corporation, G. C. Larson, assistant general manager, announced recently.

Mr. Brown was formerly service manager with the [Continued on page 50]
OLDSMOBILE offers two 1956 models in their auto radio line for Custom installation. One, part 2983334, is their De Luxe seven-tube set, including rectifier, with manual tuning and five push buttons. The other, part 2983336, is an eight-tube super de luxe job with electronic tuning and five push buttons. Both receivers are supplied by Delco, a division of United Motors Service (G. M. Co.). Each receiver comes in two units, one containing the complete tuner section, plus amplifiers and the other, containing the speaker and power supply.

Installation

The tuner unit mounts in the center of the instrument panel, directly above the glove box as shown in Fig. 1. Removal of the glove box presents the only difficult problem, but is rather easy if a few simple instructions are followed. Open the glove door and remove the six Phillips-Head self-tapping screws, as shown in Fig. 2. Do not remove the two screws holding the glove box door catch. Remove the glove box lite cover (snaps off) and bulb. Now push the box forward as far as possible and push the flexible depositor base up and out of the way (do not disconnect). At the same time push the glove box down, and it will fall to the floor.

The tuner unit is now accessible. Remove the front controls with a small screwdriver. Also the mounting nuts, using a 5/8" deep socket wrench. Disconnect the three-prong plug from the speaker unit, (held in place by Phillips self-tapping screw). Disconnect the green and black wires which are held together by two push-in type plastic connectors. Remove the antenna lead-in; then, with a 7/16" wrench remove the bolt holding the tuner to the mounting bracket, on the side facing the steering column. Push the unit forward, until the controls clear the mounting holes. Tilt the set down in back and out.

Disconnect the green "A" supply wire. Current is supplied to the set through the tuner unit from a fuse holder marked "radio" located directly under the steering column. The fuse is a 7½

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Oldsmobile Deluxe Model 983334 12 volt Delco auto radio.

Oldsmobile Super Deluxe Model 963336 Delco auto radio.
amp., type AGW. The speaker-power unit mounts directly behind the grille at the right end of the instrument panel. Four bolts hold the unit to the mounting bracket. Use a 7/16" wrench for removal.

Two antenna types are available. One is manually operated and the other is an electrical push-button control job. Both mount on the left front fender.

![Ignition coil condenser](image1)

![Voltage control condenser](image2)

![Speaker switch details](image3)

All 1956 Oldsmobiles have special resistor type spark plug and coil wires and no other suppression is necessary at the distributor. Condensers are mounted at the following points: (1) "A" terminal (brown wire) of the generator (see Fig. 3), (2) the primary terminal of the ignition coil (Fig. 4) (3) the positive (red wire) terminal of the generator-voltage control. (Fig. 5).

The super de luxe receiver, #983336 is identical to the above except for the addition of a 12AU7 tube for the operation of the automatic tuning feature.

**Service Suggestions**

The antenna trimmer condenser is located on the tuner unit at the rear on the side toward the steering column.

[Continued on page 39]
Inquiries Sent To The Answerman Will Be Acknowledged Only If Accompanied By Radio-TV Service Firm Letterheads Or Similar Identification.

BY RTSD TECHNICAL STAFF

Dear Mr. Answerman:

I have a Philco TV-332 chassis with an automatic tuning system. I am having a little problem with it and wonder if you can suggest a solution.

The customer’s complaint is that the remote feature of this system works sometimes, and sometimes not. Occasionally the tuner does not stop on station.

The unit is completely new to me and I don’t exactly know how to tackle it, or where to start. Is it possible that the gear train is binding somewhere?

R. P.
Chicago, Ill.

Philco automatic tuning systems have worked very well and ordinarily have not experienced any binding in the system. I don’t believe this is your trouble. I think that more than likely a small amount of grease or dirt has gotten down into the contacts of the stepper unit switch as shown in Fig. 1. The contacts on the stepper unit switch should be cleaned out with carbon tet

or contact cleaning fluid as used for TV tuners. Of course if the contacts have become carbonized it is necessary to remove the burned spot. The carbonization should be cleaned off and then the contacts washed to remove any possible oil or dirt.

Dear Sir:

I have noticed in several new TV sets that there has been a number of 6AU4-GT damper tube failures. I have been unable to come up with a good reason for this tube becoming defective so frequently.

Is it possible that there has been a bad run of these tubes?

E. H.
San Francisco, Calif.

It is not believed that the cause of repeated damper tube failures is necessarily due to the tube itself.

Some TV receivers, unfortunately, make use of the unused terminals on the damper tube socket as tie lugs. Recommendations by tube manufacturers with respect to this is that the damper tube socket not be used for such connections or tie points because it increases the possibility of breakdown in the socket between the damper tube high potential pins and anything connected to the vacant socket terminals. It has been noticed in some of these cases that arc-over has occurred across the socket, as well as through the socket material. Often there is evidence of the arcing on the socket in the form of a black carbonization between the pins with which it is occurring. It is suggested that such tie points be removed when repeated damper tube failure occurs. Generally it is indicated in most tube manuals that pins 1 and 2 on the socket as shown in Fig. 2 should not be used.

Mr. Answerman:

I have a Sylvania TV receiver that is causing me a little concern. The "Halolight" flickers when the set is in operation and my customer objects to it. Not being too familiar with this unit I am at a bit of a loss to know exactly what to do. I actually do not have a copy of the circuit diagram so I am further handicapped.

Any suggestions or hints you can give me as to why the Sylvania "Halolight" may be blinking and what to do about it will be of considerable assistance to me.

C. L.
Newark, N. J.
Although there is seldom trouble with this feature as applied to the Sylvania TV receivers, any number of things may have occurred to bring about the condition.

First, it is suggested that the transformer voltage be measured. As shown in Fig. 3, this voltage should be around 1200 volts ac for most receivers, except the 24 inch picture tube size which requires about 1800 volts. It is possible that the transformer has failed and is furnishing inadequate or improper voltage.

The next check to be made is of the two current limiting resistors, 33K ohms, and the series brightness potentiometer which is 250K ohms. It may be that one of these series resistors or the brightness potentiometer has become defective, or has increased in value. Perhaps the best method of testing these resistors is to substitute new ones in place of the existing ones.

If the blinking persists reduce the value of one of the 33K ohm resistors to about 27K or perhaps a little lower. It is very possible that the "Halolight" tube has aged and requires an increase in applied voltage to keep it lighted. A caution that should be observed in reducing the value of these resistors is that if they are made too low in value the dissipation rating of the components may be exceeded.

If the above change does not correct the bulb flickering the bulb itself should be examined. In the manufacture of these bulbs many times the required amount of mercury is deposited in the tube and it is generally visible as a small drop rolling around in the bulb if held up to the light. When a mercury drop is not found rolling around inside the tube it often indicates that there may be insufficient mercury in the tube and the tube requires replacement.

Another point about the tube is that it should be checked out of the metal light shield. If the tube lights when held in the hand (this can be done without being exposed to a shock hazard if the bulb is gripped away from the end terminals) then the terminals should be examined and covered with a few windings of cambric tape over the sleeves at each end. The plastic material may be cracked or defective and not providing proper insulation.

YES!

The NEW Model E-420 is compatible for Color and Monochrome TV.

It is the one Dot and Bar Generator that offers at a reasonable price, every desirable feature for color convergence and linearity testing.


Net Price: $150.00

Model E-420 Standard: Electrically identical to above, but in standard black ripple finished cabinet with black anodized aluminum panel. Case dimensions 101/4 x 12 x 6 inches. Complete with tubes, cables and manual as above.

Net Price: $145.00
COLOR RF-IF
[Continued from page 17]

linear operation for the range of signals received must be used.

The third item, "Impedance match between transmission line and tuner," is an important consideration because unless this match is maintained, standing waves will be introduced in the antenna circuit. Under conditions of mismatch the amplitude relations between the luminance and chrominance signals will not remain constant for the various channels tuned in, thereby producing the effects just discussed.

The final consideration, "Local oscillator frequency stability," refers to the ability of the oscillator in the tuner to arrive at an operating frequency in 30 seconds after turn-on, and its ability to maintain that frequency with negligible drift during the subsequent use of the set. One of the important consequences of oscillator drift which shows up in a color receiver reflects in the wideband character of the if bandpass (4.2 me), and the steep slope of the bandpass in the vicinity of the sound if notch. (See Fig. 3). Drifts of 200 or 300 kc would produce negligible sound-in-picture interference in the usual narrow band black and white receiver. However, this amount of oscillator drift in a color receiver will bring the sound if carrier well up the steep slope of the curve and produce annoying sound beat patterns. These beat patterns will consist of both 4.5 me sound information and a 920 kc beat. This 920 kc beat is produced by the interaction of the sound rf carrier and the if color subcarrier in the video detector. The beat frequency degrades the monochrome and color portions of the picture, giving rise to a fine herringbone color pattern. Obviously, keeping the sound signal attenuated will keep the 920 kc beat invisible.

Video I.F. Considerations

When comparing video if system requirements for color receivers with those of black and white receivers the first significant point that presents itself is the greater video if bandpass required in color TV. Taking into consideration that the color subcarrier is located 3.58 me above the picture carrier, and that an additional .5 me must be added for upper color sideband information, (plus about .1 me to allow for variations in if tuning), it becomes evident that the video if bandpass must be able to accommodate a bandpass up to 4.2 me.

This bandpass is much greater than that required for monochrome receivers. On this score alone, the circuits used in color TV will be found to be somewhat different from those used in monochrome receivers. Fig. 3 illustrates a typical video if bandpass characteristic for a color receiver, and points up the 4.2 me response range. This curve is drawn for a video if pix carrier frequency of 45.75 me and a corresponding sound if carrier frequency of 41.25 me.

Notice that the amplitude of the video if carrier (as in monochrome receivers) is adjustable to 50% of the maximum value of the curve to compensate for the vestigial sideband nature of the transmitted signal.

Proceeding to the color if subcarrier, we observe that at this frequency the response is on the flat part of the curve. This flatness is maintained for .5 me above the color subcarrier to accommodate the color video sideband signals from 3.58 to 4.08 me.

[Continued on page 32]
DEFLECTION YOKE ADJUSTMENT

The deflection yoke must be positioned far forward as possible on the neck of the picture tube. Do this, loosen wing nut on top of the yoke shield and push the yoke up against the neck of the picture tube. At the same time, use a screwdriver to move the yoke to position while tightening the wing nut.

VIRTUAL LINEARITY

This control increases or decreases the brightness of the upper portion of the picture. Adjustment of the Vertical Linearity may be necessary after adjusting the Vertical Linearity.

AGC LEVEL CONTROL

This control when adjusted may cause the picture to be overexposed or underexposed. To show vertical or horizontal jitter or picture pull, or buzz in the sound. If used as a vertical or horizontal jitter, picture pull, or buzz in the sound, the control must be readjusted by the method described by the manufacturers.

NOISE GATE CONTROL

With this control, it is possible to obtain improved picture quality in the presence of electrical interference. The adjustment may be made by tuning out the amount of interference by moving the control clock and/or counter-clockwise. The amount of interference will be reduced to the extent that the control is adjusted. If the control is adjusted too far, a signal of different strength is increased, so when the setting is in the range of the control. Therefore, the control should be made in the darkest area when the control is properly set. The limiting feature is the amount the picture is moved in the darkest area when the control is properly set.

BUZZ CONTROL

The buzz control is a method of adjusting the sound to be heard.

AGC LEVEL CONTROL ADJUSTMENT

CAUTION: Unlike most AGC adjustments, the AGC control cannot be adjusted in the usual manner by setting it to the position where the picture just begins to overload. Because the Contrast Control in the present set is located in the output circuit of the audio-amplifier, a different method of setting the AGC control must be used. Note, however, that the setting is somewhat critical. If the control is set too low, the picture may not be visible, but the AGC circuit may be overloaded, and/or picture pull, or buzz in the sound will be observed. If it is not advanced far enough, the video detector will be too low and cause a weak contrast in the picture.

The AGC Control is preset at the factory and is not adjustable. The AGC control setting of AGC Control, it can readily be checked by one of the methods below. The method using an oscilloscope is the best and most satisfactory way.

 WITHOUT AN OSCILLOSCOPE

1. Connect a 7 uf 150 Volts capacitor in parallel with the AGC Control and Noise Gate control.
2. Connect a 7 uf 150 Volts capacitor in parallel with the AGC Control and Noise Gate control.
3. Connect a 7 uf 150 Volts capacitor in parallel with the AGC Control and Noise Gate control.
4. Remove the 7 uf 150 Volts capacitor from the AGC Control and Noise Gate control.
5. Reconnect the AGC Control and Noise Gate control.
6. Repeat step 1, 2, 3, and 4.

HORIZONTAL FREQUENCY CONTROL

The horizontal Frequency Control is the adjustment on the black area to the right of the horizontal oscillator coil (L133) which is located below the Horizontal Deflection Tube. The control shall permit the adjustment of the control, when necessary, to compensate for any change due to shipping of the tube or components in the circuit which would shift the oscillator frequency beyond the range of the horizontal hold control.

PROCEDURE A

1. Set receiver to listen to the same station as the test station.
2. Tune in the test station and set the receiver to the position where the signal is heard.
3. Connect the test station to the receiver and set the receiver to the position where the signal is heard.
4. Adjust the horizontal Frequency Control until the signal is heard.
5. Repeat steps 2 and 3.

SERVICE DEALER & ELECTRONIC SERVICING

ELECTRONIC MANUFACTURERS SCHEMATICS. An exclusive service of Cowan Publishing Corp. by special arrangement with John F. Rider, Publisher.
**HEIGHT CONTROL** - This control increases the overall height of the picture. When making this adjustment it is sometimes necessary to also adjust the Vertical Linearity to obtain a picture that is correctly proportioned.

**REAR VIEW ADJUSTMENTS**

**DEFLECTION YOKE ADJUSTMENT** - The deflection yoke must be positioned as far forward as possible on the neck of the picture tube. To do this, loosen the wing nut on the top of the yoke shield and push the yoke knob against the bell of the picture tube. At the same time, rotate the yoke to left or right as required to make the picture parallel with respect to top and bottom of window frame. Be sure to hold the yoke in position while tightening the wing nut.

**CENTERING MAGNET ADJUSTMENT** - If the picture is off center or has neck shadow as shown in the illustration below, rotate either or both centering magnet levers until the picture is centered on the screen and is free of all neck shadow. Then readjust the Ion Trap.

**HORIZONTAL DRIVE** - With a screwdriver inserted through the small hole just below the Horizontal Output Transformer, adjust the Horizontal Drive Trimmer for maximum picture width.

**HORIZONTAL FREQUENCY CONTROL** - See Horizontal Frequency Adjustment.

**FOCUS** - On the terminal board located below and to the right of the deflection yoke, move the blue lead from one lug to another until the sharpest picture or sharpest horizontal lines are obtained. Note that the position of the lead may need to be changed if a replacement picture tube is installed.

**AGC LEVEL CONTROL** - This control when misadjusted may cause a picture to be overexposed, or to show vertical or horizontal jitters, picture pull, or buzz in the sound. If readjustment seems necessary, the control can be readjusted by one of the methods given under "AGC Level Control".

**NOISE GATE CONTROL** - With this control, it is possible to obtain improved picture quality in the presence of electrical interference (noise). To adjust, first turn the control completely counterclockwise, where its effect is minimized. Then advance the control clockwise only far enough to stabilize the picture. If the control is adjusted on a signal of one strength, it may require readjustment when a signal of different strength is received, or when the setting of the Area Switch is changed. The final adjustment of this control should be made on the strongest signal received. The limiting factor in this adjustment is the loss of sync stability or the introduction of buzz into the sound.

**BUZZ CONTROL** - See Sound Alignment

**ION TRAP MAGNET** - See Ion Trap Magnet Adjustment

**SPECIFICATIONS**

- **POWER SUPPLY**: 117 volts, 60 cycle, a.c.
- **POWER CONSUMPTION**: 2Y, 155 watts
  - TV, 120 watts
  - VHF, 100 watts
  - Models TH, 125 watts
- **AUDIO POWER OUTPUT**: 1.7 watts
  - Phone, 125 watts
- **ANTENNA INPUT IMPEDANCE**: 300 ohms balanced.
- **FREQUENCY RANGE**: 54 to 88 mc. & 174 to 216 mc.
  - (Channels 2 thru 13)
  - 470 mc. to 890 mc.
  - (Channels 14 thru 83)
- **INTERMEDIATE FREQUENCY**: Video Carrier - 45.75 mc.
  - Sound Carrier - 21.25 mc.
  - Intercarrier Interval - 4.5 mc.
- **DEFLECTION**: Electrostatic
- **FOCUS**: Electrostatic
- **ION TRAP**: Single Permanent Magnet.
- **HORIZONTAL SCANNING FREQUENCY**: 15.750 c.p.s.
- **VERTICAL SCANNING FREQUENCY**: 60 c.p.s.
- **FRAME FREQUENCY**: 30 c.p.s.
- **SCANNING**: Interlaced, 525 lines.
- **SPEAKER**: 8" x 12" PM
- **VOICE COIL IMPEDANCE**: 3.2 ohms @ 600 cycles.

**WIRING SIDE OF CHASSIS 476 & 477**

(Tube and Alignment Locations)

**ALTERNATE OSCILLATOR ALIGNMENT**

In the tuners used on chassis 476 and 477, there is an oscillator adjustment for each channel. When the receiver is installed, the oscillator should be adjusted for each channel on which a station is operating in the area.

Set the channel selector to the channel that is to be adjusted. Turn the Fine Tuning control to as near the center of its range as will permit the slug to be adjusted. The oscillator trimmer slug is to the right of the channel selector shaft, and is accessible thru a hole in the front of the tuner after the tuner knobs have been removed. Use a non-metallic screwdriver and adjust the oscillator trimmer slug until the proper tuning point is in the center of the Fine Tuning Range.

**TUBE SIDE OF CHASSIS**

(Tube and Alignment Locations and Tube Filament Wiring)

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**NOTE:** These are excerpts from a service manual for CROSLEY models J-21LPBF, LPKM, CHASSIS 476; -21LPBBA, LPKM, CHASSIS 477. For additional service data, see pages 25, 26, and 28.

**SERVICE DEALER & ELECTRONIC SERVICING COMPLETE MANUFACTURERS SCHEMATICS.** An exclusive service of Cowan Publishing Corp. by special arrangement with John F. Rider, Publisher.
OSCILLATOR ADJUSTMENT

If the range of the line tuning control is not sufficient to tune the VHF channel properly, the oscillator tuning slug will have to be adjusted. This slug is accessible through a hole in the tuner chassis which is directly to the right of the tuner shaft. Set the channel selector knob to the channel to be adjusted. Use a non-metallic screwdriver and adjust the slug until the proper tuning point is in the center of the line tuning range.

NOTES

1. All voltages measured with an electronic voltmeter connected from socket lug to chassis. Some voltages and voltages shown were measured with a normal picture on the picture tube and the contrast and brightness control set for 60 volt peak-to-peak on the cathode (pin #11) of the picture tube. Socket voltages tolerance 10%. Input signal 6000 microvolts, minimum for readings. Area switch in local position. SW104 to TV position.
2. Supply voltage, 117 volts 60 cycle A.C.
3. K-1000
4. All capacitance values in mfd, all resistance values in ohms unless otherwise noted.
5. R185 or R186 will be clipped off on some chassis.
6. SW101B is open when SW101A is closed.
7. Terminals of T204, T205 and L110 are viewed from cell side.
8. On some chassis R153 and R159 are replaced by R195, 4K ohm, 3 watt resistor (Part No. B-130712-3).
9. On some chassis C200 (100 mfd) may be replaced with two capacitors connected in parallel.
10. There were a few pilot run chassis 476 Code A and 477 Code A which were wired as shown in Figure 1. The differences between these and later production chassis are (1) the bottom winding of the transformer, (2) the value of R108, and (3) the use of R107 and C205.
11. Tube type 12Q6 is used in later production chassis instead of 12G6. It is also recommended to use the 12Q6 as a replacement horizontal output tube in any Crosley chassis where a 12G6 was originally used. The new type 12Q6 tube was created because the standards for the 12G6 proved to be inadequate. These standards allowed too wide tolerances with the result that some manufacturers were making lower output 12G6's while other manufacturers were making 12G6's with higher output. In many instances, a low output 12C6 can not be used in a circuit that requires a higher output tube. In the 12Q6 the standards are adequate to specify a tube which is the equivalent of the high output 12C6, but with narrow tolerances, to avoid another problem of interchangeability.
12. On later production chassis R173 ACC Level Control is Part No. 15001-1; it is the same as 15905-1, but with the 15K stop. For replacement purposes, use whichever control is currently available.

Fig. 1

10. There were a few pilot run chassis 476 Code A and 477 Code A which were wired as shown in Figure 1. The differences between these and later production chassis are (1) the bottom winding of the transformer, (2) the value of R108, and (3) the use of R107 and C205.

All service replacement transformers are like those used in the later production. Therefore when installing replacement transformers, remove C197 and C205, change R108 to a 2K resistor and connect the bottom winding of the transformer as shown in the complete schematic.

11. Tube type 12Q6 is used in later production chassis instead of 12Q6. It is also recommended to use the 12Q6 as a replacement horizontal output tube in any Crosley chassis where a 12Q6 was originally used. The new type 12Q6 tube was created because the standards for the 12Q6 proved to be inadequate. These standards allowed too wide tolerances with the result that some manufacturers were making lower output 12Q6's while other manufacturers were making 12G6's with higher output. In many instances, a low output 12G6 can not be used in a circuit that requires a higher output tube. In the 12Q6 the standards are adequate to specify a tube which is the equivalent of the high output 12G6, but with narrow tolerances, to avoid another problem of interchangeability.

12. On later production chassis R173 ACC Level Control is Part No. 15001-1; it is the same as 15905-1, but with the 15K stop. For replacement purposes, use whichever control is currently available.
Editor’s Note: Walter C. Bieda, Sr., Chief Service Engineer for the Radio and Television Division of Sylvania Electric Products, Inc., is a man with many hobbies ("ham" radio, sound movies, boating, organ playing) but with one overriding major interest: helping the radio and television serviceman. NATESA recognized this recently with a special citation honoring him as “Truly a friend of independent service.”

The television and radio serviceman is a “doctor”—and will be more successful if he acts and looks the part.

He’s called into the home to diagnose a “sick” television set or radio; he may operate there or in his shop. He has a wealth of technical information at his fingertips because of professional training and experience, just as a physician has. As important, the TV and radio serviceman deals in an area that is mysterious to the layman, the same as a doctor.

But a few servicemen fail to live up to the level they should ... and it hurts their business, as well as hurting the whole profession.

When you get right down to it, the respect you command from your customers determines whether you'll be called back and whether your customers will come to you when they’re ready to buy a new set. Commanding respect is greatly a matter of psychology.

How does a doctor dress? A lawyer? The answer is plain: with white shirt, tie, suit. How do their offices look? Clean and well-ordered, if they’re good men— for they know that orderly surroundings engender respect from their patients and clients.

Here lies a lesson for the serviceman.

A neat, clean shop is part of the lesson, for many television and radio work-rooms look like the day after a hurricane. It’s important also to have a foolproof system for finding sets that have been repaired and are being picked up by the customer; having to wait irritates the set owner, and hearing the clerk mutter that he can’t find the merchandise doesn’t help your shop’s reputation.

Then there's the matter of house calls.

A serviceman can’t always wear shirt, tie and suit. Doing roof jobs, or other dirty work, he’d quickly ruin his clothes. But one dealer outfits his servicemen in neat uniforms, with the firm name tastefully imprinted on the jackets—and you’d be amazed at the impression that makes on customers. A neatly-clad serviceman appearing at a housewife's door is sure to make a better impression than one whose outfit is too casual or even downright messy.

One serviceman carries a clean pair of gloves in his kit and does it for just one purpose: when he's ready to move the customer's set in the home, to get at the chassis, he puts on the gloves so he won't leave finger marks on the cabinet. Small item? Sure—but it pays of by leaving a good impression.

Another idea that’s been used successfully is for the serviceman to carry a small rug or mat, to protect the home-owner's rug or floor from dirty parts or tools. Too often, placing tools or set parts on a light colored rug leaves a smudge of dirt, and that disturbs the housewife more than many servicemen realize.

Taken separately, these ideas don’t sound important, and you might shrug them off. They aren’t important, when you consider how small the effort required; but they are important in shaping the impression you leave with the housewife. That impression may well determine whether you're called back—or whether, if you're a dealer, you get an order when the set owner is ready to buy a newer model.

Your doctor has a bedside manner. You can cultivate a “tele-side” manner, using tact and patience with customers—and it will pay off for you.

Help your Heart Fund

Help your Heart
Proper Billing

The presentation of the bill to the customer and its effect on customer relations.

by SAN D'ARCY

When a customer walks into a service shop with a radio set under his arm and describes his "problems" to the serviceman—or when a customer phones to a serviceman and asks him to "come out and see what's wrong with my radio (or television) set"—quite obviously two conflicting psychological happenings occur, to wit: 1)—the serviceman hopes first that he will be given the job, and second, that he'll make a profit on it; and, 2)—the customer hopes first that he won't be asked to pay too much money for the repair job, and second, that when the work is done he'll get satisfaction for his investment.

In this treatise we do not intend to discuss any of the sales or merchandising angles which take place during the initial parts of the serviceman-customer relationship as outlined above. Instead we will cover the final phase—that time when the bill is presented—which frequently is the moment when serviceman-customer relationships are either solidified or broken. It's a truism that: "A satisfied customer is your best advertisement" so let's see how "bill presenting time" can be reached, and concluded, to everyone's satisfaction.

When a bill is presented to a customer a serviceman can either win the customer's respect and future business or he can get into the customer's "doghouse."

With this in mind we called on several service shops and several part-time servicemen and asked them to show us how they presented their bills to customers. The procedures used by some made a very favorable impression, while others were quite the opposite.
We do not intend to embarrass any service shop by showing its billing method. Instead we'll show you how some use a system that in our opinion is very bad indeed, how others use a bill that is only passing fair, and finally how others use an order form which is highly effective. Incidentally, we learned that the latter is a stock form pad called "TV-Radio Service Order" type TVR-100 which is printed by Electronic Publishing Company, Inc., of Chicago and which is sold over-the-counter for a very nominal sum by practically every parts distributor.

First, glance at Fig. 1. Here, in our opinion, is a very bad method of billing. Now look at Fig. 2 and you'll see a printed form that is slightly better than that shown in Fig. 1. Now look at Fig. 3 and you'll see a "Form" that is better than either of the other two, but which still is far from perfect. Finally, glance at Fig. 4, which is the TVR-100 Order Forms sold by distributors. Here, in our opinion, is a well-executed "Order Form" that "has everything." Fig. 5—A and B shows what is printed on the back of the original and second sheet of the TVR-100 forms, which are done in triplicate.

As stated above, the TVR-100 forms come in pads with triplicate sheets. The original is white, the second or duplicate sheet is yellow, and the third, or office record triplicate is pink.

In preparing his TVR-100 Order Forms, Dave Rice, of Electronic Publishing Company was far-sighted. First of all, he protected the service shop by stipulating exactly what kind, part, and performance guarantee is given on a finished job. (This also makes a favorable impression on the customer). All customers get the original copy, or white sheet which has the guarantee on its reverse side. However, in cases where the serviceman has had to "pull" the set, by using the second, or yellow sheet of the order form, he,

[Continued on page 34]

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COLOR RF-IF

[Continued from page 24]

In the vicinity of the sound if carrier the response curve drops sharply into a notch at 41.25 mc. This sharp drop is accomplished by traps especially designed for this purpose, and is necessitated by the fact that the rejection of the sound carrier in the video if section must be kept high (about minus 40 db) in order to prevent formation of the 920 kc beat previously referred to.

Due to the complexity of design of a wide band if system some receivers are using a relatively narrow band if with a response such as that shown in Fig. 4. Although this if response appears to deliberately sacrifice chroma signal, this loss of signal level is compensated for in the chroma section of the receiver. The end result of this compensation produces relative luminance/chrominance amplitude ratios which correspond to those present in the original transmitted signal.

Traps

In addition to the conventional series resonant and absorption type traps found in monochrome receivers, elaborate traps are used in color receivers for the more exacting task of signal rejection in color video if sections.

One of the newer type traps, called a "bifilar T" trap, is designed to produce the effect of high attenuation with steep sloping sides, as shown in Fig. 5. In this circuit L2 is coupled to L1. The coil L3 is a bifilar winding where winding 1-2 is interwound with winding 2-3 to produce unity coupling. The 330 ohm resistance in combination with L3 provides a negative resistance effect which is opposite to the equivalent resistance of the resonant trap circuit Cl, L4. The explanation of this negative resistance effect is beyond the scope of this article. The resultant high Q of the trap provides a 32 db rejection of the sound if in the luminance channel.

Another type of trap circuit is shown in Fig. 6. Where fringe conditions are such that the sound reception is weak, it may be desirable to adjust the amplitude of the sound if carrier for a better compromise between adequate sound response and the 920 kc beat interference signal. The circuit shown in Fig. 6 allows for this adjustment.

In analyzing the trap action we observe that the trap is made up of three branches. The first branch, L1-C1 is predominantly inductive, because C1 is large enough to be negligible in this application. It is present only to prevent short-circuiting the agc voltage. The second branch C2-C3 is capacitive. The third branch R1-R2 is resistive. In effect, the inductive branch L1 is in parallel with the capacitive branch C2-C3, thereby providing a parallel resonant circuit which presents a high impedance to the sound if frequency.

The phase relations in the inductive and the capacitive branch are essentially equal and opposite at the sound if frequency. However, the phase in the capacitive branch may be altered by the resistance connected between the junction of C2 and C3 and ground. Variation of this resistance, and hence the phase, will control the effectiveness of the trap action. Thus, when an increase in sound transfer is desired, R1 may be adjusted for this purpose.

As in the tuner, similar precautions with respect to nonlinear circuit operation must be observed in the if section, otherwise cross-talk and an improper passband will result. For this reason special if amplifier tubes such as the 6DC6 and 6BZ6 with remote cutoff and high sensitivity characteristics have been developed and are being used.

Fig. 6—Sound level control used in adjustable trap circuit.

Fig. 7—Series resonant tuned circuit used in I.F. stages of color TV receiver.
The wider bandpass of the if section is effected by the use of overcoupled interstage transformers and the use of four or five stages of video if employing stagger tuning. Crystal detectors are generally used because they are more linear than their vacuum tube prototypes and, because they are small enough in size to be housed in the if cans, thereby eliminating stray pickup interference.

Bifilar coils in interstage coupling offer many desirable features as compared to conventional single tuned coils. In a bifilar-wound transformer both primary and secondary are wound together, thus affording almost unity coupling. This allows the use of the primary winding in the plate circuit of the driver tube and the secondary winding in the driven tube. The cost of the coupling capacitor and grid resistor usually used in stagger tuned systems is thereby saved. A single powdered iron core effects the necessary tuning.

As an added advantage, bifilar coil usage results in improved noise immunity. This takes place as follows. Conventional if circuits contain relatively high values of grid resistors. Because of this an incoming high level noise pulse can result in a grid bias with an amplitude high enough to cut off the tube. This will drive the picture tube toward the black level producing black spots or "holes" which give rise to annoying trailing white tails wherever these "holes" appear on the picture screen. With bifilar coils the grid circuit impedance is practically zero, so that even if a noise signal is present, the corresponding pulses will not give rise to grid bias, and will not produce the effect just described.

Another type of if amplifier coupling circuit employed in color TV receivers, as shown in Fig. 7, is one in which the plate coil is connected in series with the output capacitance of the tube to form a series resonant circuit. The resonant frequency of the latter is adjusted to the desired value so that the voltage drop across a line is a minimum and the voltage transfer to the next stage (as developed across RL) is a maximum. At any frequency other than the resonant frequency, the impedance is very high, so that where an unwanted signal is concerned the greatest voltage drop appears across LI and the voltage transfer to the next stage (as developed across R2) is a minimum. The purpose of resistor R2 is to reduce the Q of the coil so that a desired bandpass is effected.

Application of this method of coupling may be employed in the grid circuit by connecting a coil L2 in the manner shown in Fig. 7. In this case the grid signal load consists of L2 in series with the parallel traps tuned to the adjacent channel sound (47.25 mc) and the adjacent channel pix (39.75 mc).
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PYRAMID ELECTRICAL COMPANY
1445 Hudson Blvd., North Bergen, N. J.
Mfg: Philco   Chassis No. TV-354
Card No. PH 354-1
Section Affected: Audio

Symptoms: Mechanical hum emanating from components such as yoke, vertical output transformer, or power transformer.

Reason For Change: To improve, reduce or eliminate mechanical hum.

What to do: Install rubber grommets at the item causing the hum. If it is associated with the yoke, install rubber grommets under the CRT support brackets. The cabinet side and top is acting as a sounding board for the buzz transmitted through the metal brackets.

If the vertical output transformer is causing the hum, install the grommets under the mounting brackets of the transformer.

If the power transformer is the cause of the hum due to loose laminations correct by tightening cover and core holding screws.

Mfg: Philco   Chassis No. TV-354
Card No. PH 354-2
Section Affected: Pix

Symptoms: Trailing edges in certain portions of the picture due to undesirable oscillation.

Reason For Change: To improve the transient response of the video amplifier stage.

What to do: Replace: X10, 240 microhenry coil with a 400 microhenry coil.

R70, 22 ohm resistor with a 33 ohm resistor.

Mfg: Philco   Chassis No. TV-354
Card No. PH 354-3
Section Affected: Audio

Symptoms: No sound or distorted sound

Cause: Component failure. The cathode resistor has increased in value or opened.

What to do: Replace: R6, 270 ohm resistor. This resistor should be 2 watts.
Mfg: Philco  Chassis No. TV-354
Card No. PH 354-4
Section Affected: Raster and Pix
Symptoms: Insufficient width and poor horizontal linearity.
Reasons For Change: To improve circuit and make available a greater range of width control with better horizontal linearity.
What to do:
Change: WR-2 from 8200 ohms, 7 watts to 6500 ohms, 7 watts.
Note: This has been incorporated in chassis after run 6.

Mfg: Philco  Chassis No. TV-354
Card No. PH 354-5
Section Affected: Pix and Raster
Symptoms: No vertical deflection
Cause: Component failure. Resistor R24 burned open or increased very high in value. This resistor can also be the cause of vertical shrinkage if it increases in value as the receiver warms up.
What to do:
Change: R24, from 56K to two resistors, 33K and 22K in series each having a wattage dissipation rating of 2 watts.

Mfg: Philco  Chassis No. TV-354
Card No. PH 354-6
Section Affected: Pix and Raster
Symptoms: Vertical shrinkage and squeezing at bottom of picture.
Reason For Change: To increase decoupling of B plus supply, provide additional filtering and effectively make the screen 10 volts higher.
What to do:
Add: 330 ohm resistor, one watt and 20 µf condenser, 400 volts.
Note: Under low line voltage conditions or in a hot climate the bottom of the picture may shrink up during the first three hours of operation. This is very frequently due to an increase in resistance in the yoke as its temperature increases.
If shrinkage still persists change yoke to part No. 32-9689-1.
If shrinkage is still objectionable change Vertical Output Transformer to 32-8686 from 32-8687.
Choose from these

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   Model 648P Dynamic
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   Fastest Dynamic Tube Tester made, yet it's fully flexible for all receiving types, new and old. The set-up time is actually less than the warm-up time of the tube. Provides fast, accurate shorts tests. Metered plate current shows tube condition. Meter calibrated in Good-Bad as well as Percent of relative micromhos. Automatic Line voltage indicator, Life Line Indicator, Noise Test, plus a husky filament transformer with voltages for even the newest types make this an outstanding service tester.

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Test Data on New Tube Types
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**Video Speed Servicing Systems • DATA SHEETS**

Mfg: RCA   Chassis No. KCS-72
Card No. RC 72-1

Section Affected: Pix and sound

Symptom: No picture, No sound or weak sound. Brightness Okay.

Cause: Component Failure. Transformer T105 shorted primary to secondary

What to do:
Check: For a positive voltage on age line; if so:
Replace: IF transformer, T105

Mfg: RCA   Chassis No. KCS-72
Card No. RC 72-2

Section Affected: Pix and Sound

Symptoms: No picture or sound on channel. Snow off-channel

Cause: Component failure. Open C136, 220 µf condenser

What to do:
Replace: C136, 220 µf condenser, 22000 volt rating.

Mfg: RCA   Chassis No. KCS-72
Card No. RC 72-3

Section Affected: Pix and raster

Symptoms: No brightness or raster. High voltage normal.

Cause: Component failure. Condenser C158, .1 µf shorted.

What to do:
Check: Voltage variation at pin 2 of picture tube socket.
Replace: C158, .1 µf condenser.

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www.americanradiohistory.com
Mfg: RCA  Chassis No. KCS-72
Card No. RC 72-4

Section Affected: Pix and raster

Symptoms: Insufficient vertical deflection. Low voltage on plate of V113, 6J5 vertical oscillator tube.

Cause: Component failure. Condenser C183, .1 µf shorted.

What to do:
Replace: Condenser C183, .1 µf.

Mfg: RCA  Chassis No. KCS-72
Card No. RC 72-5

Section Affected: Pix and raster

Symptoms: No vertical deflection

Cause: Component failure. Open C153, .1 µf condenser.

What to do:
Replace: Condenser C153, .1 µf.

Mfg: RCA  Chassis No. KCS-72
Card No. RC 72-6

Section Affected: Pix and raster

Symptoms: Insufficient width. Width may shrink during operation.

Cause: Component failure. Screen dropping resistor has changed to higher resistance value or changes with operation. (R203)

What to do:
Replace: Resistor R203, 6.8K ohms, 2 watts.
AUTO RADIO
[from page 21]

Tune the set to a weak station between 600 and 1000 kc and adjust the trimmer for the loudest signal. This is very important and too often overlooked.

If the set is dead (no sound from speaker), and if the car is equipped with a rear speaker, be sure that someone hasn't accidentally moved the speaker switch to a neutral position (see Fig. 6). This is a common occurrence and many complaints have been traced to this source. Shorted antenna leads contribute a large percentage of complaints of intermittent and noisy reception. Substitute a test antenna. Always try the OZ4I by substitution (located in speaker unit). By removing the glove box and the tuner mounting bolts, the unit can be lowered far enough to remove the cover and tube replacement can be made on the spot.

Note: Be sure to ground the unit properly with jumper wire when testing this way.

If the set is over-sensitive to car accessories, etc., that is, if a clicking noise is heard in the speaker when applying the pedal or when directional signals are being used, antenna pickup may be suspected. To eliminate, this source of trouble, re-route the antenna lead.

High fidelity and tonal qualities associated with expensive multi-unit speaker systems—are similarly produced with new Norelco FRS Twin-Cone Speakers.

Norelco's exclusive Twin Cones are made from specially selected and matched materials—operated from the same magnet and voice coil—some covering an extremely wide range up to 20,000 c/s. Norelco's twin-cones are always in phase and operate in harmony—providing the same degree of efficiency under all conditions.

Unequalled manufacturing precision and quality is inherent in all Norelco speakers. All component materials—including magnets, wire and even cone materials—are manufactured and assembled by Philips to suit a specific speaker design.

Many sizes in standard impedances are available from your dealer or send to Dept. E5 today for more details. Norelco FRS speakers are priced from $59.98 to $9.90 audiophile net.

Add to... and improve any sound system
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*FULL RESONANCE SPEAKERS

NORTH AMERICAN PHILIPS CO., INC., 100 East 42nd Street, New York 17, N.Y.
HICKOK RECTANGULAR METERS

Newly developed 4½" rectangular meters permitting maximum length of scale to an accuracy of 1½% are now available in ac and dc models. Identified as Models 68 and 69, these meters are made for semi-flush panel mount applications and are supplied with or without illumination feature. An external zero adjust is provided in all cases. Two mounting stud locations are available for special applications.

(Weston Model 749 on inquiry card for more information)

WESTON ADAPTER

A new plug-in Adapter which greatly extends the use of the Weston Model 749 Miniature AC Clamp Volt-Ammeter has just been introduced by the Weston Electrical Instrument Corporation. This compact adapter has plug receptacles on either side; one of which reduces the scale range of the Model 749 by a factor of 10, permitting low current measurements. The receptacle on the other side is for reading the ampere scale directly (1:1).

(Weston Model 501 on inquiry card for more information)

FLOOR STAND FOR TUBE TESTER

A new floor stand for use with the Dyna-Quik Tube Tester is now made available by B&K Mfg. When combined with the B&K Dyna-Quik Model 500 chassis, this unit makes an integrated, one-piece permanent tube tester and vendor. The Dyna-Quik "500" quickly and accurately tests over 95% of all popular TV tubes in use today for dynamic mutual conductance, shorts, grid emission, gas content, leakage, and life expectancy.

(Weston Model 506 on inquiry card for more information)

TRICRAFT TUBE ANALYZER

Tricraft Products announces an inexpensive tube checker which is compact and rugged enough to take it day in and day out in the service kit. It checks all standard octal, loktal 7 and 9 pin miniature tubes for emission, gas, shorts, opens, microphones and filament continuity. (Also picture tubes). All elements checked independently. Obsolete proof. No circuit changes necessary to check new tubes as they are developed.

(Weston Model 504 on inquiry card for more information)

CAPACITOR CHECKER KIT

Allied Radio Corporation announces the release of a new capacitor checker that tests capacitors for opens or shorts while the capacitors are still wired in the circuit. The test for opens can be made on any capacitor of 20 mmf or greater capacity, even if the capacitor is in parallel with a resistance as low as 50 ohms. The test for shorts can be made on any capacitor up to 2000 mmf, even when shunted by 20 ohms.

(Weston Model 505 on inquiry card for more information)

3½" RECTANGULAR METER

Phaeton announces a new line of 3½" Rectangular Custom Meters. Their metal cases will not chip, shatter or warp. In addition, they provide anti-magnetic shielding to the meter movement to provide more lasting accuracy to the advertised 2% full-scale calibration (which is really calibrated to 1% of full-scale deflection). The scales are large and clear so that they can be read at 8 feet.

(Weston Model 507 on inquiry card for more information)

WIN-TRONIX SYNC ADAPTERS

Winston Electronics, Inc. has announced the Model 915/960 Sync Adapter for producing sync pulses when used with the Model 830 Sweep Circuit Analyzer. The sync pulse outputs from the adapters are injected into sync circuits for trouble shooting by signal substitution. This instrument converts the saw tooth waves of the Model 820 to sync pulses at either the horizontal or vertical frequency. Either positive or negative pulses may be obtained.

(Weston Model 508 on inquiry card for more information)

DONNER SINE WAVE GENERATOR

The new Donner Model 1200 Sine Wave Generator produces pure sinusoids from 1 cps to 1 mc in 6 decade ranges. Stable amplitude, freedom from drift, and high calibration accuracy are insured by a fully regulated power supply and generous negative feedback. The Donner Model 1200 has application wherever high-quality sine waves are essential, as in communications, audio, and laboratory testing.

(Weston Model 509 on inquiry card for more information)

KAAR DIRECTION FINDER

The new Kaar 238 Direction Finder with simplified controls allows positive and direct operation because it is completely controlled from the front panel. Front loop panel control, with vertical compass rose, assures smooth, easy operation so necessary for accuracy. It allows eye-level mounting; helps the operator take bearings more rapidly; and permits orienting the direction finder in any position on the boat.

(Weston Model 509 on inquiry card for more information)
AMPLIFIERS—(Audio, Hi-Fi, P. A.)
Allied Radio Corp. 100 N. Western Ave., Chicago 11, Ill.
Blonder-Tongue Labs. Inc. 525 North Ave., Westfield, N. J.

ANTENNAS
American Phonic Corp. 1830 S. 54th Ave., Chicago 30, Ill.
Blunder-Tongue Labs. Inc. 525 North Ave., Westfield, N. J.
Channel Master Corp. 535 North Ave., Westfield, N. J.
Clear Beam Antenna Corp. 195 Taylor Ave., Rochester, N. Y.
General Ceramic Mfg. Co. 3540 S. Racersgrove Ave., Chicago 12, Ill.
Halladay Electronics Corp. 6127 44th Ave., N. Y. W. 14, N. Y.
Jontz Manufacturing Co. 4515 South 2nd St., Cleveland 12, Ohio

BOOKS & MANUALS
Cinn. Harry C. Cown Publishing Corp. 67 West 44th Street, New York 36, N. Y.
Electronic Publishing Co. 180 N. Western Drive, Chicago 11, Ill.
Rider, John F. Publisher 400 Canal Street, New York 15, N. Y.
United Catalog Publishers 110 Lafayette Street, New York 13, N. Y.

BUSINESS ORDER FORMS
Electronic Publishing Co. 180 N. Wacker Drive, Chicago 6, Ill.
Delphic Publications 4398 N. Milwaukee Ave., Chicago 41, Ill.

BUYER'S DIRECTORY OF ADVERTISED PRODUCTS

- This department is an additional service to our readers and advertisers. It is not intended to cover all products in all categories, nor is it intended to cover all products made by any manufacturer.
- The classifications are broad. Under each is listed the name and address of only those manufacturers who have, in the recent past, or who are currently advertising these particular products in this publication.
- This service is not part of the advertiser's contract. The listings may change in future issues. Every reasonable precaution is taken to avoid errors and omissions.

CAPACITORS
Accupax Corp. 255 Grant Ave., East Newark, N. J.
Centralab, Div. of Gulf & Western, Inc. 500 E. Rand Field, Northvale, N. J.
Cordell-Telecommunication Electric Corp. 1120 E. 35th St., Cleveland 14, Ohio
Illinois Condenser Co. 1615 N. Throop St., Chicago 22, Ill.
Planet Jones Corp. 1050 Calhoun Ave., Chicago 11, Ill.

CHEMICALS, SPRAYS, LUBRICANTS
Electronic Chemical Corp. 813 Communications Ave., Jersey City 4, N. J.
General Cement Mfg. Co. 163 Farnham Ave., Poughkeepsie, N. Y.
Krylon, Inc. Ford & Washington St., Kirtland, N. J.

COMPARISON OF AQUA-TEST WITH REJUVA-TUBE!

- Only Device That Meters Cathode Activity During Rejuvenation
- Tells Exactly When Rejuvenation Should Stop
- Prevents Damage to Cathode Emitting Surface
- Built-in Current Limiter Eliminates Possibility of Accidental Cathode Ribbon Burn-Outs

COMPARE THESE FEATURES
Tests — Repairs TV Picture Tubes Without Removing Tube From Set

- Compact, light-weight and easy to use
- Complete Tester: detects open or shorted elements and leakage as high as 3 megohms between elements
- High quality lab instrument construction
- Special metered circuit removes "particle" shorts between heater and cathode
- Cathode emission and grid cut-off characteristics
- Predicts approximate life-expectancy of tube—identifies gassy tubes

DEALERS! Now you can sell those "dim-out" trade-ins at a good profit, and back them up!

SERVICECEN! Sell rejuvenation service. Fully 80% to 90% of picture tubes that have gone dim in service can be quickly reactivated to furnish up to years of "bright as new" service!

FREE LITERATURE REQUEST FORM
Valid for 6 weeks only, expires 7/1/56
Business Card MUST be attached

Circle numbers for Free Technical Literature or Information on New Equipment:
501 502 503 504 505 506
507 508 509 510 511 512
513 514 515 516 517 518

If you want more details on products advertised in this issue fill in below:

[Continued on page 47]
RF NOISE FILTER
Astron Corporation has announced the development of a new miniaturized rf noise suppression filter, style AF1108. Containing 14 toroids and 8 capacitor sections, the AF1108 features a noise suppression range of 15 to 1000 megacycles. Its rugged construction enables it to withstand great amounts of shock and vibration as well as elevated operating temperatures. The unit is small and light and can be custom-engineered without shape limitations.
(Check 517 on inquiry card for more information)

DEFLECTION YOKES
Ram Electronics Sales Co. has released 2 new 90° television deflection yokes, the Y90F12/47 and the Y90F19/43. They incorporate the latest design features to eliminate early problems of pin-cushioning and edge-to-edge focusing and a vinyl insulator between horizontal and vertical coils for longer life. These yokes are replacements for yokes in the sets made by 37 different TV manufacturers, from Admiral to Zenith.
(Check 515 on inquiry card for more information)

WORK CLOTHING LOCKERS
Change-O-Matic, a new type of locker system, has been introduced by the Change-O-Matic Corporation. It acts as a soiled uniform container, supplies clean uniforms quickly and replaces old fashioned clerk and counter distribution. A compact steel cabinet of either ten or sixteen compartments, it provides an individual locker for each employee while utilizing a minimum of valuable floor space.
(Check 511 on inquiry card for more information)

MINIATURE TRIMMER CAPACITOR
JFD has introduced a new, unique type of Trimmer Piston Capacitor. There are two models, each designed to meet the extremely critical, exacting requirements of automation and printed circuitry. The overall lengths of both models are exceptionally minute: model VC9G measures 9/16", while model VC10G is 5/16". They both employ glass dielectrics and invar silver-plated rotors. They are now available at low cost.
(Check 514 on inquiry card for more information)

FIXED/MOBILE POWER SUPPLY
The James Wiwawpower Company announces the addition of model C-1450 to its line of communications power supplies. It operates from 6 or 12 volt vehicular ignition systems or from regular 117 volt 60 cps. ac lines. It can supply dc output up to 250 volts at 100 ma for receiving and dual output of 500 volts at 175 ma and 250 volts at 75 ma for transmitting. When operated from a 117 volt ac source, it also supplies up to 10 amps. at either 6 or 12 volts.
(Check 518 on inquiry card for more information)

REMOTE CONTROL UNIT
A new low cost, attractively designed, completely new remote control tuner has been developed and manufactured by ITTnational TV Remote Control Company. The "it" tuner allows the viewer to switch channels and even fine-tune the television picture automatically from anywhere in a room. It can be installed in three minutes right in the home. The unit will attach to all major television sets without connecting wires or using tools.
(Check 513 on inquiry card for more information)

MINIATURE RESISTOR
A new, silicone-sealed ceramic shell type resistor is now in production at Reon Resistor Corp. The miniature precision power unit, compact and self-supporting, is resistant to humidity and salt spray military tests. Ideal for terminal board or printed circuit mounting, the ceramic shell offers uniform outer dimensions and is unaffected by abrasion and rough handling. Unusual stability is achieved by special design and maximum environmental protection.
(Check 510 on inquiry card for more information)

AEROSOL CAN
Krylon, Inc announces the largest seamed aerosol can ever made commercially for its spray enamels and coatings. It is a 178 ounce aerosol can at the same price as Krylon's former 12 ounce size. The consumer will get 35% more of the acrylic plastic and the spray enamels at no extra cost. The container will give the consumer slightly more than a full pint of paint for less cost than a traditional pint can of paint plus the cost of a paint brush.
(Check 512 on inquiry card for more information)

ATR INVERTER
American Television and Radio Co. announces its new line of 6 and 12 volt inverters. This group of ATR Inverters is especially recommended for use with standard ac operated tape or wire recorders, dictating machines, radios, amplifiers, and similar electronic equipment. These inverters also come equipped with four-point voltage regulators which make possible the correct output voltage for minimum to maximum loads.
(Check 516 on inquiry card for more information)

FREE LITERATURE REQUEST FORM APPEARS ON PAGE 41
BUSINESS PROCEDURES

[Continued from page 15]

right portion tears off and has a ¼" hole through it so it can be slipped onto a set's volume control shaft for easy identification. The third section is filled in as work is done by the serviceman and gives you the preliminary facts needed so your completely itemized bill can subsequently be made up. These "Job Tickets" take guesswork out of billing and should also be used as an inventory control guide. (For example, each night or once a week check off from the "job records" the number of parts used that day, or week, and you'll know how many replacements should be bought from your distributor to maintain a level inventory.)

In the Oelrich line of printed business forms for servicemen there are a dozen or more other types of forms that are not being covered in this treatise because of space limitations. Every service firm owner or independent serviceman should look the items over at their distributor's store and decide for himself which of these would be worth having.

Sales aids—Sign Cards

Next I would recommend two more steps for servicemen to take. First, that all service firms and service dealers look at Oelrich's "Business Sign Kit 800" which consists of 25 different merchandising messages (some of which are shown as Fig. 7). The kit sells for only $2.50. These 25 signs, attractively printed on wood-simulated cards, each 5" x 10" are designed not only to be decorative, but also to call the customer's attention to products and services you offer which are frequently overlooked. A sign maker would charge much more than $2.50 for any single sign found in Kit 800 and yet the whole batch of 25, which sell for a pittance, can act as effective, dignified silent salesmen.

Finally, remembering that most customers carefully examine bills that are submitted to them, and, knowing from experience that it doesn't pay to trust to memory when writing down charges for replacement items used on any job, if I were a serviceman I'd always have handy a copy of the latest "Radio-Electronic Master" (see Fig. 8) which is represented as the official buying guide of the industry by United Catalog Publishers, who issue it periodically. You'll find every part distributor continually referring to and using the "Master" because it describes products completely and gives the list price for each.

Isn't it logical that when a customer questions a price you've used he will be completely satisfied when you open your copy of the "Master"—show him the item and its published list price? If you charged less than published list price you'll be a "hero" and if it is your policy to charge actual list, then you're proving that you're not a "phony price" chiseler.

Remember, the "Radio-Electronic Master" contains thousands of listings, all indexed and cross-indexed for easy reference. The parts distributor pays United Catalog several dollars for each copy and practically all distributors make it a standard practice to give a "Master" free of charge to all of their better customers. I have no idea as to what dollar volume of business you transact each year with your distributor, but I venture the guess that if you do any appreciable amount he will be only too happy to give you a copy of the "Master" in the hope that it will cement your good-will toward his firm.

---

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GET A LUGER TODAY! If your distributor has not yet stocked this new gun, send your order to us with his name, Model A single heat $9.95. Model B, dual heat $11.95.

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Our products are distributed coast to coast. . . look for our big red display unit on your jobber's sales floor. Solve many of your business problems by including our forms and sales aids in your business plans.

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by PAUL GOLDBERG
Service Manager

THE WORK BENCH

Unusual Service Problems And Their Solutions

This Month's Problem:
The author analyzes two cases involving trouble in horizontal afs circuits.

This month's installment concerns horizontal afs problems. A knowledge of horizontal oscillator and afs circuitry and operation is a great aid in solving such problems.

GE 21T30 "J" line

The receiver was turned on and it was noted that the picture was out of horizontal frequency range. Tubes V107-12AT7, and V112-12A17, the horizontal phase detector and horizontal oscillator and discharge tubes, were replaced individually but had no effect. See Fig. 1.

The diagram was then analyzed. The horizontal phase detector or afs tube, V107B, compares the received sync pulse with the pulse fed back from the horizontal discharge circuit. If there is a difference in frequency or phase between these two signals it results in a dc corrective voltage which is directed to the control grid of the horizontal reactance tube V112A.

The horizontal pulses flowing from the phase splitter V110A, are coupled to the cathode of the phase detector. A sample of the horizontal waveform from the discharge tube V113A is fed to the plate of the phase detector and hence modulates its plate current. The horizontal reactance tube V112A acts as a variable resistance which is connected in series with C260 across the horizontal tank circuit. The combination of this capacitance and variable resistance results in a variable reactance, and produces a variable frequency. As the dc output from the phase detector changes amplitude or polarity, the reactance tube plate resistance changes accordingly. A positive voltage causes the tube to conduct more heavily thus lowering the resistance between the condenser C260 and ground. This increases the effective capacitive reactance of C260 across the oscillator tank circuit and causes a lowering of its natural frequency. By the same token a negative grid corrective voltage will result in a higher natural resonant frequency of the tank circuit.

The horizontal oscillator is of the Hartley type. Feedback occurs by a return tap to the grid tank coil from cathode.

Knowing these facts, a voltage check was first made at pin 21 of V112B, the horizontal oscillator. It measured correctly at about 175 volts. The voltage at pin 26 of V112A also measured correctly at about 195 volts. Before setting up the scope for waveform checks a last voltage check was made at pin 27 of V112A. This is the dc corrective voltage check. The voltmeter instead of reading about 10 volts, which is a normal reading, measured zero volts.

Fig. 1. Partial schematic of General Electric Model 21T30, "J" line. This is an example of an automatic frequency control circuit which makes use of a triode type of phase detector in combination with a reactance tube. A separate horizontal discharge tube is employed. Cause of trouble was shorted C268.
Fig. 2. Partial schematic of the Zenith Model 22T20. This illustrates a type of automatic frequency control circuit which makes use of dual diode for phase detection. Note that in this case the correction voltage is applied directly to the horizontal oscillator, without making use of a reactance tube. A separate discharge tube is used here also. Cause of trouble was leaky C91.

A resistance measurement was then taken from pin #7 of V112A to ground. The ohmeter read zero ohms. Condenser C258, (.001 µf), was then clipped out of the circuit and measured for leakage. It was found to be shorted completely. Following the replacement of this condenser the horizontal oscillator slug adjustment L251 was adjusted and the receiver now functioned properly.

**Zenith 22T20**

The receiver was turned on and it was observed that the horizontal frequency was far out of range. The afc tube, V11 (3AL5) and V12 (6SN7) the horizontal oscillator and discharge tube were replaced individually but had no effect.

The diagram was then analyzed. The cathodes of V11 obtain sync information from the sync clipper through C90, (68 µf). A sample of the horizontal sawtooth voltage is obtained from the plate of the discharge tube and applied to the plates of the 3AL5 tube through the .001 µf condenser, C94. The sawtooth divides equally between the diodes. When the sawtooth is in phase with the sync pulse, each diode conducts equally and the difference of potential across the one megohm load resistors R69A and R69B is zero and no change appears at the grid (pin #1) of the horizontal oscillator. If line fluctuations cause the horizontal oscillator frequency to change, one diode will conduct more than the other and a difference voltage at the grid of the 6SN7 will pull the oscillator back into phase.

Components R7, (100K) and C65 (.15 µf) form a stabilizing anti-hunt circuit. This circuit introduces a small parabolic voltage from the cathode of the vertical oscillator which cancels the effect of the parabolic voltage appearing in the B+ applied to the plate of the horizontal oscillator.

The horizontal oscillator is a cathode coupled multivibrator which is stabilized by the tuned circuit L32 and C91 in the plate circuit of the oscillator tube.

Knowing all the facts, (including the fact that all the tube filaments in this receiver were in series) pin #4 of V12A was clipped out of the circuit at point "X", in order to sectionalize the trouble in either the circuitry of V11 or V12. (Ordinarily V11 (3AL5) could be pulled out of the socket as a check, but this could not be done because a series filament receiver was involved).

The receiver was again turned on and it was noted that the horizontal frequency, although not holding, naturally, was now back in range. It was deduced therefore that the trouble was in the 3AL5 circuit. Point "X" was next resoldered and a quick resistance check was made of all components in the afc circuit. When R69A was measured, it was found to be 1000 ohms. Noting that C91 was directly in parallel with R69A, (one megohm), C91, (75 µf) was clipped out of the circuit and measured. It was found to measure about 1000 ohms. When a new 75 µf condenser was installed the receiver functioned properly.

**Facts About Self Service Tube Testers**

- Testers are put in drugstores, service stations, dept. stores, etc.
- Customers do the actual checking
- Customer pays cooperating merchant for tubes purchased
- 2,000 new testers are being placed each month
- Testers have taken over 40% of tube sales in many places
- Tester owners report average profit per tester of $90 monthly

**$34.50 PUTS YOU IN THE PROFITABLE "SELF-SERVICE" TUBE BUSINESS!**

**THIS IS THE "GENERAL PLAN":**

- No wiring for you to do. We ship panel with tube chart, signs, tube trays, window banners, and EVERYTHING but the cabinet.
- In one day, you make the cabinet; and "earn" $110.
- We furnish suggested cabinet drawings.
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- Send $34.50 for each tester. Pay $45 balance at $15 per month, FROM YOUR PROFITS, the next three months!

Don't delay. There are only a limited number of top locations in your area. Get yours before they're gone.

**GENERAL ELECTRONIC RESEARCH COMPANY**

P.O. BOX 223

WHITELAND, WISCONSIN
CONDENSER CHECKERS
[from page 11]

A power factor controller is employed in further adjusting for balance when measuring electrolytic condensers. In the Heathkit Model C-3 indication of bridge balance or null is observed by means of a magic "eye" electron beam indicator tube. At balance the "eye" is open to its maximum angle.

Electrolytic condensers have a certain amount of internal resistance in series with their capacitance. To completely balance the bridge it is necessary to also balance this internal resistance with a resistor in series with the standard condenser. This resistor is known as the power factor control on all units. As electrolytic condensers are only found in the higher capacity values, the control only functions on the higher and extended ranges of the Heathkit unit as can be noted in Fig. 4.

Power factor percentage is a measure of the energy loss in a condenser. In filter applications a high power factor percentage decreases the effective capacity. When measuring the capacity of electrolytic condensers the power factor control as well as the main control should be adjusted for a null indication. The power factor percentage is then taken at the same time.

In measuring resistances with the Heathkit Model C-3 tester either of two resistors, 2k or 200k, are switched in position in the bridge instead of the standard condensers. The fourth arm then contains the unknown resistance and the scale of the main control is read, having been calibrated in ohms as well as capacitance values. When balance or zero voltage is indicated by the null indicator the ohms value is read directly on the main control scale.

After the capacity value has been determined with this unit a leakage test for quality can be quickly made. The selector switch is set to one of the five polarizing voltages made available. The leakage switch is then changed to the leakage test position and the action of the electron beam indicator tube observed. If the shadow angle closes suddenly and then returns to normal a satisfactory condenser is indicated. Leakage is indicated by the degree of closing angle on the electron beam tube. A partially closed "eye" or a fluttering condition indicates a leaky condenser. If the "eye" closes entirely or overlaps, the condenser is shorted.

[To Be Continued]
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SPEAKERS

Attas Sound Corp. 1446 33th Street, Brooklyn 18, N. Y.
Daimo Radio, Div. of General Motors Corp. 36th and Union Ave., East York, Ind.
North American Philips Co., Inc. 134 East 42nd Street, New York 17, N. Y.
Ober Electric Corp. 301 S. Michigan Ave., Chicago 8, Ill.
Philipo Corp. 386 North Ave., Rockford, Ill.
Quin-Nichols Corp. 3511 S. Colorado Ave., Denver, Colo.
University Loudspeakers, Inc. 35-65 32nd Street, New York 7, N. Y.

SPEAKER ENCLOSURES

Jensen Mfg. Co. 1400 North Ave., Chicago 8, Ill.
Kaplan, Inc. 408 North Ave., Rochester, N. Y.
University Loudspeakers, Inc. 35-65 32nd Street, New York 7, N. Y.

TEST EQUIPMENT & INSTRUMENTS

American Scientific Development Co. 334 S. Main St., Fort Atkinson, Wis.
B & K Manufacturing Co. 3375 S. Humboldt Blvd., Chicago 15, III.
Electro Electronic Corp. 3-37 33rd Street, N. Y. 5, N. Y.
Electronic Test Instrument Corp. 309 W. 47th Street, New York 1, N. Y.
General Electric Research Co. 400 University Ave., Syracuse, N. Y.
Univ. Audio Research Corp. 400 University Ave., Syracuse, N. Y.
Hewlett-Packard Corp. 3501 S. Superior St., Chicago, III.

TOOLS

Electric Soldering Iron Co. 1301 S. Calle, San Diego, Cal.
General Electric Co. 3501 S. Superior St., Chicago, III.

Buyer’s Directory of Advertised Products

PHONOGRAPH NEEDLES

Jensen Industries, Inc. 245 S. Wood Street, Chicago 12, Ill.
Orem, Inc. 6415 N. Ravenswood Ave., Chicago 29, Ill.
Saltzman Mfg. Co. 62-55 Barrett Ave., Long Island City, N. Y.
Wales-Electrovox, Inc. 60 Franklin Street, East Orange, N. J.

PHONOGRAPH PICKUPS & CARTRIDGES

American Microwave Co. 37 S. Fair Oaks Ave., Pasadena 3, Cal.
Clairtone, Inc. 900 E. Eleventh St., Chicago, Ill.
Columbia, Inc. 100 E. Eleventh St., Chicago 10, Ill.
Dryden Corp. 1100 W. Van Buren St., Chicago 7, Ill.

POWER SUPPLIES (Converters & Inverters)

American Television & Radio Co. 700 East First St., St. Paul 1, Minn.
Pemen-Cichy Co. 76-53 Ozone Ave., New York 7, N. Y.
trim-Power Corp. 4721 N. Damen Ave., Chicago 29, Ill.
Vokar Corporation 35-50 West 42nd Street, New York 36, N. Y.

RESISTORS & CONTROLS

Aerovox Corp. 510 E. 10th St., New York 9, N. Y.
Bell Microelectronics & Controls 100 E. Eleventh St., Chicago 10, Ill.
Cincinnati, Inc. 141 S. Michigan Ave., Chicago 8, Ill.
Dell Radio, Div. of General Motors Corp. 100 W. Van Buren St., Chicago 7, Ill.
Erie Resistor Co. 370 S. Lake Shore Dr., Chicago 10, Ill.

SEMI-CO N D U C T OR S

CBS-Hytron 401 E. 46th St., New York 7, N. Y.
Federal Telephone & Radio Corp. 1000 S. La Cienega Blvd., Los Angeles 40, Cal.
General Electric Co. 624 E. Eleventh St., Chicago, Ill.
Philco Corp. 100 W. Van Buren St., Chicago 7, Ill.
RCA (Tube Div.) 600 Hamilton Ave., Somerville, N. J.

SERVING AIDS

Aerovox Corp. 215 W. 33rd St., New York 1, N. Y.
North American Philips Co., Inc. 215 W. 33rd St., New York 1, N. Y.
Philco Corp. 101 S. Michigan Ave., Chicago 8, Ill.
University Loudspeakers, Inc. 35-65 32nd Street, New York 7, N. Y.

POPULAR WITH SERVICEMEN

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brings audio into the palm of your hand.

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SERVICE DEALER and ELECTRONIC SERVICING • MAY, 1956

47
By popular demand, the serviceman’s most-wanted book, Video *speed* Service Systems Vol. 1, is now also available in a low cost **PAPER BOUND COVER EDITION**

**VIDEO SPEED SERVICING SYSTEMS**

Simplifies Servicing All Television Receivers

VOLUME 1

Has the identical contents of the Ring Binder Edition but the price is only $2.95

**Facts About Video *speed* Service Systems:**

**CONTENTS:**
A compilation of specific receiver service repairs, “bugs”, chronic troubles, field circuit changes, manufacturers’ production revisions, etc. The compilation enables the service technician to pin-point what is wrong with any given TV set and to correct the fault in the shortest possible time.

**USES:**
The VSSS data sheet for any particular TV set maker’s model or chassis number gives: 1—the section of the set affected; 2—the symptom; 3—the cause of complaint; 4—the solution, in simple, understandable and usable form.

**SOURCEs:**
The material was obtained directly from manufacturers, distributors’ service departments, TV service organizations, and top TV Service-dealers throughout the country. Furthermore— all material has been checked carefully to assure dependability and accuracy.

**SERVICING MAY, 1956**

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City __________________________________________ Zone State 

HI-FI [from page 13]

many servicemen will find themselves totally unprepared, both technically and psychologically, to bid for their fair share of this source of income.

The Hi-Fi Enthusiast

Lack of technical training on the part of service personnel is due, in part, to the rapid expansion of the field in such a short period of time. There is also another, perhaps more subtle reason for the inactivity of servicemen in this potentially lucrative field. Because the early enthusiasts were primarily technical people, it became universal practice to publish a good deal of technical data concerning high-fidelity equipment. This practice has persisted to the present day. As a result, many high-fidelity customers have had to acquaint themselves with technical terms, some of which are more familiar to them than to their prospective servicemen. Not all high-fidelity enthusiasts fall into this classification, but those who do can make things pretty rough on the initiated service dealer who is, perhaps, a bit rusty on his decibels, equalization curves, Fletcher-Munsen effect and variable speaker damping. These terms, and many more, constitute the language of high-fidelity. In order to instill confidence in a customer, a service dealer must not only speak that language, but must thoroughly understand the concepts behind the terms used.

The second major potential customer is at the other end of the scale, compared to our “engineering-minded” friend described above. This fellow knows absolutely nothing about electronics and cares even less. However, bear this in mind. This latter fellow is fast becoming the majority consumer of high-fidelity components. He requires even greater understanding in trying to cultivate his friendship and win his confidence. *This fellow is a music lover*! There are more and more of them joining the ranks of high-fidelity equipment owners every day. This is the fellow, who, when asked on the telephone to state the nature of his complaint, will, nine times out of ten reply, “It just doesn’t sound right!” What you, the serviceman, say and do
at that critical point can determine once-for-all whether or not you've added another customer to your list. Believe me, arriving at his home, listening for a moment, and then telling the customer that it sounds just fine to you is the worst possible thing to do. This constitutes the "opinionated art" approach we mentioned before. You'll have to forget that approach if you ever hope to get your share of this up and coming Hi-Fi business.

A very specific and important purpose of this series of articles will be to alter that approach to one of scientific analysis, measurement, test and interpretation. We will not abandon the use of our ears completely in favor of test equipment any more than we would think of shutting our eyes to the symptoms displayed on a TV screen. Instead, we hope to show you how proper use of test equipment (much of which is already on your work-bench) can, together with your sense of hearing, enable you to prove to your customers positively that his equipment is either not performing according to specifications, or, in many cases, that it is! In any case, there won't be any debate about it, or any cupping of the hand over the ear in an attempt to measure hum, distortion, or "right-soundingness."

Of course, in order to use test equipment in the audio field, it is necessary to know the function of every element of a high-fidelity system. A few simple tests by a trained technician can usually determine whether an electronic part of the system is operating correctly or not. So, our second purpose will be to acquaint the reader at some point in each article with the normal or expected behavior of each element of the system. By learning to recognize correctly functioning equipment, systems requiring trouble-shooting stand out quite readily.

In one sense, this can prove to be simpler than any service work you've done to date. Remember that most high fidelity equipment in service today is put together very much like a block diagram. That is, several components operate in what might be called a series-parallel arrangement, as shown in Fig 1, for example. In such installations, isolation of the defective block is very simple and will be the subject of our first technical article next month.
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Hi Fi-Audio
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[Continued from page 47]

Bendix Television Division at Towson, Maryland. Previously, he was sales engineer with the Raytheon Manufacturing Company, Inc.

He attended Denver University, and is a graduate of Capital Institute of Engineering. He later spent eight years with the U. S. Navy and was honorably discharged with the rank of chief fire controlman.

The current issue of New Jersey Business Magazine, in an article “Meet Mr. Antenna,” is featuring the story of Michael D. Ercolino, electronics scientist whose antenna inventions made possible TV reception as we enjoy it today.

A resident of Ocean Township, New Jersey, Ercolino is regarded a foremost authority on antenna principles.

Making reference to Ercolino's nick-name “Mr. Antenna,” the article states:

"Whenever there is talk about the electric light, one almost inevitably thinks of Thomas Alva Edison. When radio is the conversational topic, the name Guglielmo Marconi comes to the fore. Likewise, the name of Michael Ercolino is synonymous with antennas."
MARINE ELECTRONICS [from page 9]

The next most popular item is the depth finder, which is an automatic radar-like mechanism that bounces an ultrasonic "beep" off the bottom and measures the time in transit of the depth of water in feet or fathoms. It will also detect fish. Unit cost runs from the neighborhood of $200.00 up, and the installation bill may go from a few dollars up to several hundred, depending upon the amount of shipfitting required to accommodate the transducer to the hull of the boat.

Radar, Loran, and other more complicated aids to navigation are not ordinarily handled by beginning operators, but there is still a possibility of breaking into this service if you can work up a convincing record of reliability in complex jobs. These projects run into the kind of money it would be nice to collect a couple of times a year.

If all of the above seems exotic, there is still a great bulk of marine work to be done in just adapting shore-side electronic gadgets to operation on a boat. The man who has advanced to the stage of luxury of owning a yacht may not wish to step back to such primitive discomfort as scraping off his whiskers with a sliver of steel. Yet his electric shaver won't work from the boat battery. Some smart serviceman can fix him up with an electronic converter that will chew up his 6, 12, or 32 volts dc and spit out 110-volts ac. Converters will produce any power desired from 50 watts on up, so almost any ac-operated device an owner may want can be used aboard his boat.

It may seem odd that a man will go to the trouble of buying a boat to get away from the annoyances of everyday life, and then turn around and bring most of them aboard his boat—but it is done! Accordingly, where large fleets of boats are gathered, TV dipoles are almost as prevalent as the sloop sailing rig; and the high-fidelity rumble of open-diaspon organ pipes drowns out the hungry seagull. Installing high-grade broadcast, short wave, TV and Hi-Fi equipment on boats is a specialty any service agency would do well to learn about.

In the field of small, fairly simple devices, there are electronic "sniffers" to detect the presence of explosive gas in a boat's bilge, automatic steereers to hold the boat on course, electronic tachometers for the engines, and electronic detectors to find things dropped overboard. There are even electric swizzlers for mixing drinks. A small shop could enter this field since it doesn't require much investment—just knowledge.

The Technical Side

Sell a midget radio, and the buyer can
tuck it under his arm and go out of your life. Sell a boatman a piece of electronic equipment, and you've barely finished one phase of your relationship. You may have gone over the sales literature with him, the drawings of his boat, (or the boat itself), and studied his cruising itinerary for the next five years. You have helped him decide on the equipment that will best serve his needs, and committed yourself on the performance he is to expect.

And, now it is up to you to see that he gets it.

Suppose your customer has bought a radiotelephone. In a house, you plug a new appliance into the nearest wall outlet. There is bound to be one hand-underwriter's rules call for at least one in every 20 feet of wall space. Boats don't have outlets. And even if they should, the wiring would probably be too light for electronic equipment use. This means that when you install your equipment you must provide the power wiring.

Common radiotelephones consume between about 90 and 600 watts when transmitting, depending upon power output and efficiency. This doesn't sound like much—until you convert the watts to current figures at the usual boat-battery voltage. Using the first figure, 90 watts, the telephone would draw 15 amperes from a 6-volt battery. And the huskier 600-watt job couldn't be used on 6 volts. At the minimum practical input potential of 12 volts, current would be 55 amperes. In either case, heavy wire is obviously necessary to prevent excessive line drop, which would reduce power output and possibly harm the vibration power supplies and other voltage-sensitive components.

Accordingly, cables are never smaller than 10 gage, even for a very short run, and are more usually #8, 6, or 4, with occasional cases where "starter" cable is needed. And, of course, terminals and fittings to handle cable this size are rugged.

Fortunately, power wiring is not required to be inclosed in conduit, but on a $50,000 (or even on a $5000) mahogany-trimmed boat, it had darn well better be neat. Usually, it is required to be concealed, either in the boat's original structure, or by a matching molding. If the installer can't double as a carpenter, he may have to hire one.

Because ac-power is hardly ever available, work is done with hand tools. Connections are made whenever possible without soldering, by using crimping or screw-clamping connectors. However, it is sometimes necessary to do a little torch work, or to have a chemically-heat iron. And some tricks which will be shown when we get to the details can be used for emergency soldering without special tools.

While antennas on shore can be anything from a piece of wire hung up anywhere to a prefabricated pipedream on the chimney, boat antenna systems are often individual jobs of custom engineering. On sailboats, adapting the rigging may be necessary. You don't do this by simply cutting into a piece of wire and twisting an insulator in each end. This piece of rigging may be 3/4" in diameter and carry a stress of 20,000 lbs. or more. Not being a qualified rigger, you hire one, or contract with a shipyard for the work.

On powerboats, prefabricated antennas are used. But mounting them so they will stay up through wind and wave, and making the job fit harmoniously with the boat's lines, would sometimes tax the artistic and engineering talents of a Da Vinci.

The key to this work is solidness and safety. You don't set equipment on a table—it would fall off. You screw things in place, or use-through bolts and nuts. Above all, the work must be clean and neat.

If this sounds formidable, there's another side to the story. Circuits, even for the most elaborate radiotelephone or direction finder, are comparatively simple. The theory involved is within easy grasp of anyone who has a firm hold on the fundamentals. And the tools and instruments required are comparatively inexpensive—some of them can be fabricated by the serviceman himself.

Other Requirements

All of the various phases of work in this field will be gone into in full detail in succeeding installments. The next will deal with instrumentation. Some instruments you'll already have. Others you will have to purchase. And there are some you can make yourself.
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