JUNE 25 CENTS

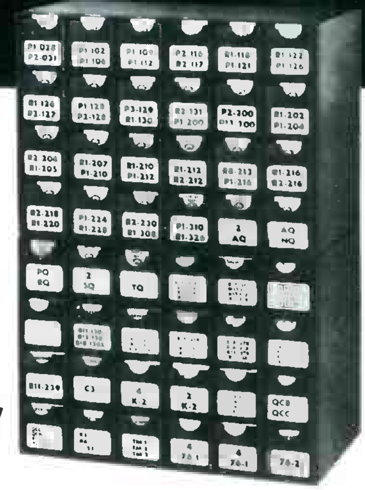
Howard W. Sams

PF PHOTOFACT® **REPORTER**

FOR THE ELECTRONIC SERVICE INDUSTRY

This Month's Highlights

You are more apt to get the volume control you need from your IRC distributor than from any other source



BIGGEST BARGAIN IN VOLUME CONTROL COVERAGE IN THE INDUSTRY

Whether you need a special exact duplicate control or a standard replacement carbon or wire-wound control, you are almost sure to find it at your IRC Distributor.

He carries the most versatile line of controls in the industry. He offers you better, more complete replacement coverage. He can supply an almost endless variety of combinations of resistance elements and shafts.

He can take care of your needs far more frequently than any other source.

And you can depend upon IRC quality and dependable performance. Exact duplicate TV and Auto Set controls (over 850 of them) are specified to manufacturers' procurement prints—they will fit and operate without modification.

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Wherever the Circuit Says—

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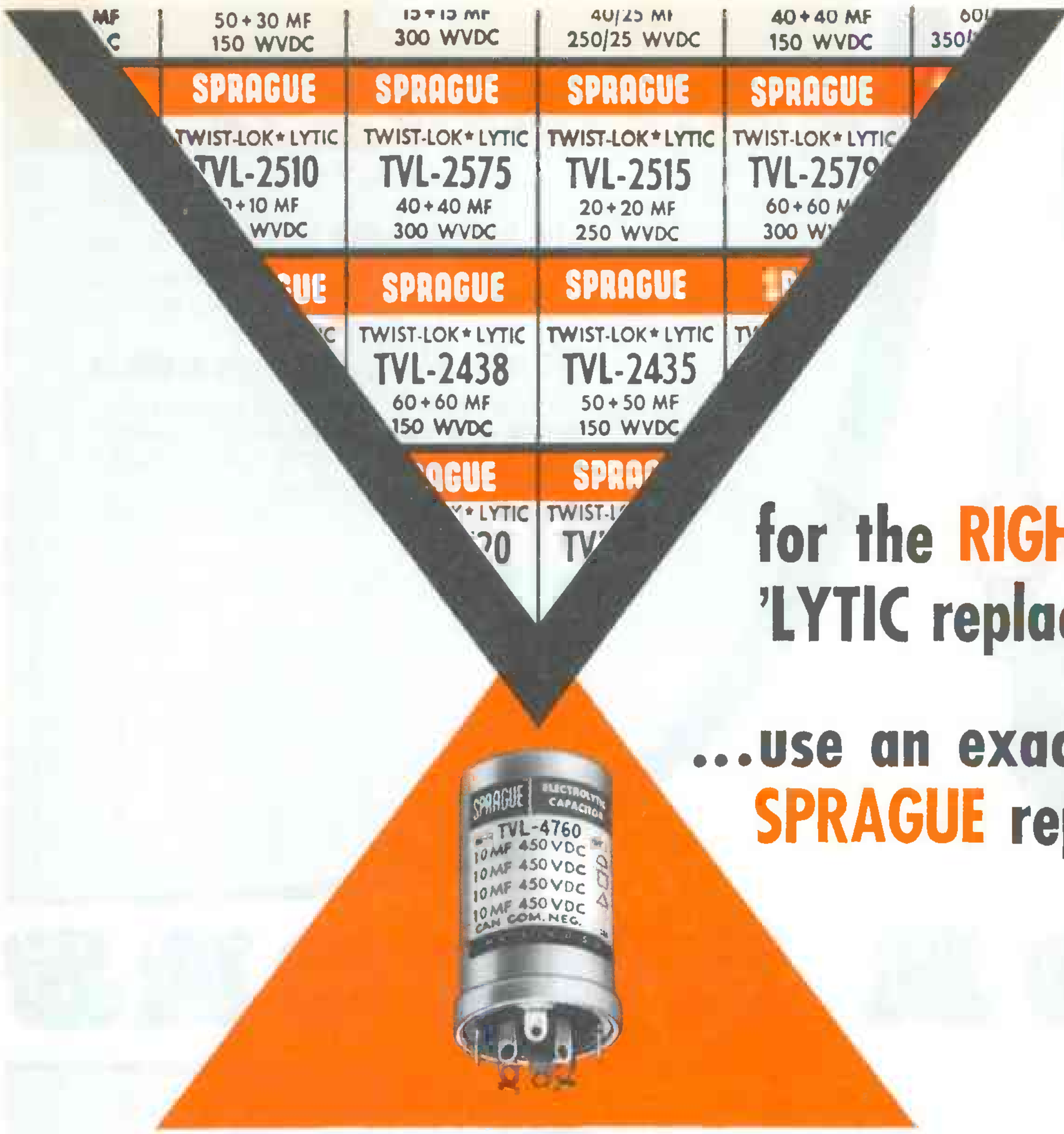
INTERNATIONAL RESISTANCE CO.

Dept. 362, 401 N. Broad St., Phila. 8, Pa.

In Canada: International Resistance Co., Ltd. Toronto, Licensee



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YOU GET EVERYTHING IN A SPRAGUE TVL! *Every* TVL for *every* voltage rating is made with the more expensive high-purity etched-foil anode construction using ultra-stable film formation techniques. Cathodes are etched to meet high ripple requirements. Sprague TVL's give maximum trouble-free service—NO HUM—as well as long shelf life. And they perform just as well in the cold North as they do in the sub-Tropics. Yet this premium quality costs you no more!

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WRITE FOR NEW CATALOG C—611a

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Published monthly by Howard W. Sams & Co., Inc., at Indianapolis 5, Indiana.

Entered as second class matter October 11, 1954, at the Post Office at Indianapolis, Indiana, under the Act of March 3, 1879.

A limited quantity of back issues are available at 35c per copy.

next month

TRANSISTOR APPLICATION CHART II

Listing of the makes and type numbers of transistors used in 60 current models of transistorized portable and auto radios.

INDIVIDUALIZED SERVICE PAYS OFF

Report on a thriving Canton, Ohio, television service operation, including many business, management and technical tips that you can profit from.

WHAT'S NEW IN BATTERIES

Facts for servicemen about mercury batteries, solid-electrolyte batteries and other developments which will affect battery inventory and replacement.

COLOR SERVICING SIMPLIFIED

Trouble-shooting procedure in chart form to help the TV technician handle calls for color service work.

PF REPORTER

FOR THE ELECTRONIC SERVICE INDUSTRY

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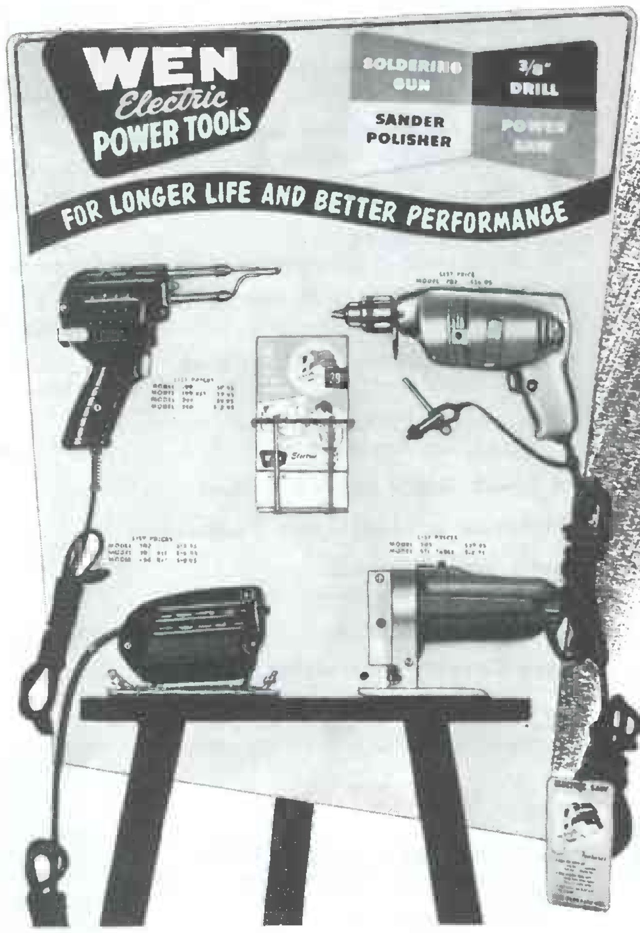
Add to Your Income this Easy Way

SELL AS WELL AS USE WEN TOOLS

1 SMALL COMPACT DISPLAY

PUTS YOU IN THE TOOL BUSINESS

4 BASIC POWER TOOLS *Plus*



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From this 1 compact display you can supply the proper tool for practically every requirement of the home handyman, hobbyist, or home repair man. With these tools he can solder, hot-cut plastic tile, heat-seal plastic containers, etc., remove old putty or dents from wood surfaces. He can saw almost any material any shape, swiftly and accurately. He can drill ⅜" holes in metals or masonry; up to ¾" in wood. He can sand and polish. Furthermore, you have the advantage of offering WEN products—recognized as the best designed, most complete line of power tools of professional quality at home workshop prices. They're U.L. listed; fully guaranteed. And they're PRE-SOLD for you by extensive national and local advertising, publicity in magazines, newspapers, trade papers, and by highway signs coast to coast.

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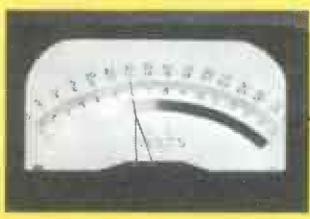
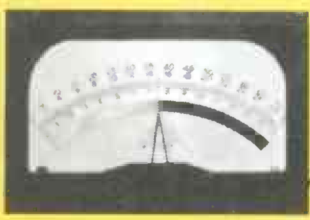
Sylvania IF Amplifier Tubes

"fixed-bias" tested

Low "fixed bias" point at −1 volt (bottom scale)



Mid-range "fixed bias" point at −3 volts (top scale)



High "fixed bias" point at −7.5 volts (bottom scale)

In determining the plate current (I_b) and Transconductance curves, grid bias is fixed at three points. These points, representing conditions of weak, average, and strong signals establish the nature of the plate current characteristic curve. The "fixed bias" points selected vary according to tube type.

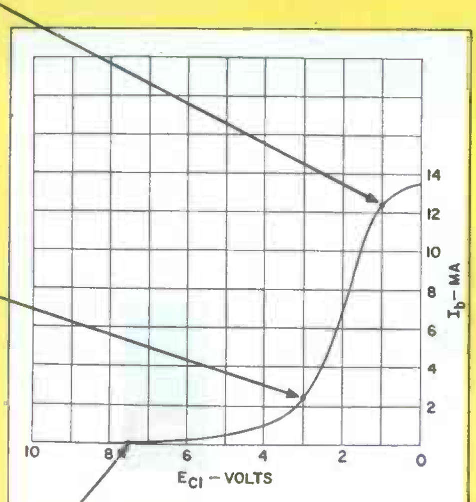
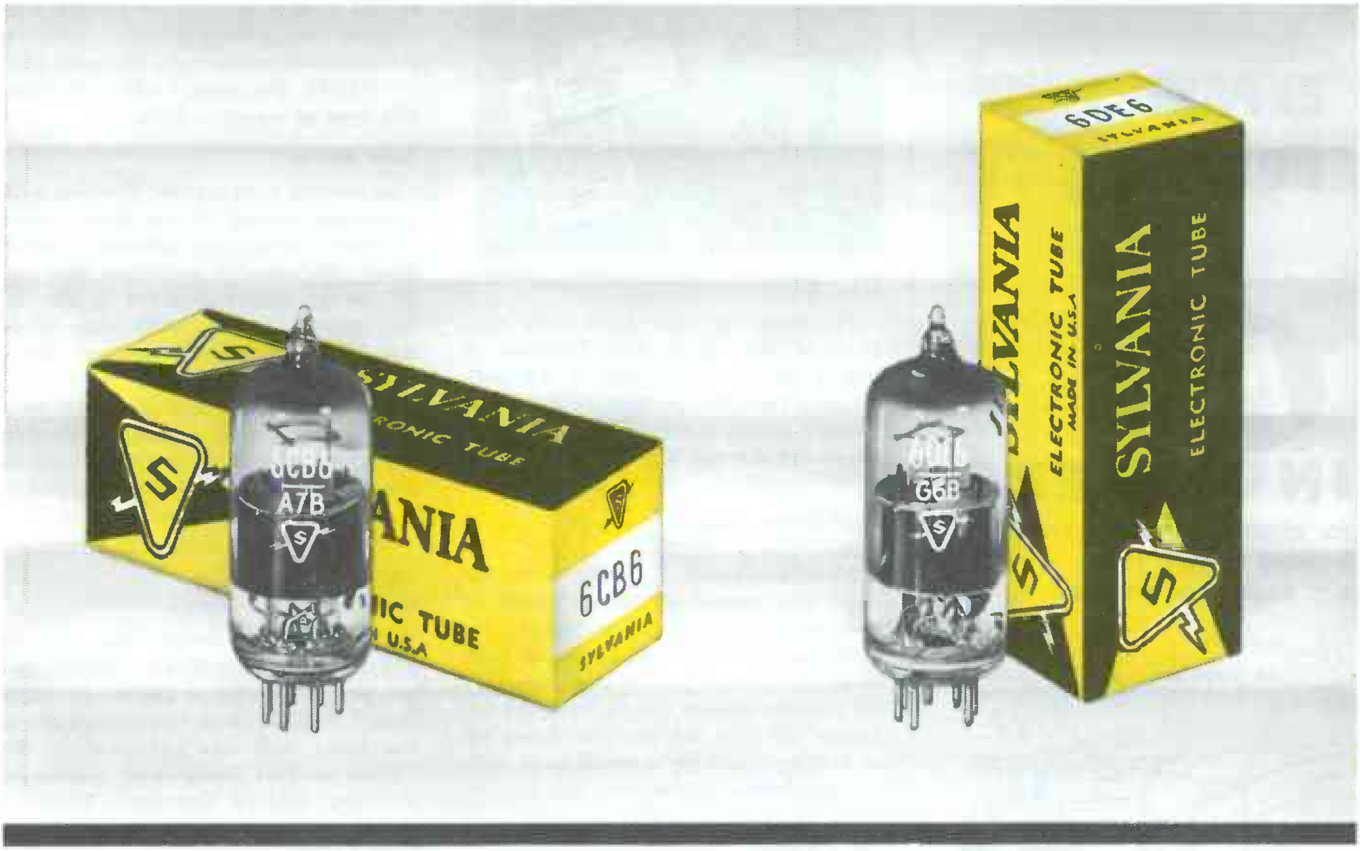


Plate current characteristics, shown on this typical test curve, are carefully controlled by the "fixed bias" test, assuring good performance and stable AGC functioning over a wide range of TV signal conditions.

Dynamic TV set conditions are set up in these test bridges making the "fixed bias" test a true measure of how the tube will perform in TV sets encountered by you in the field.



for stable performance and service dependability

It has always been Sylvania's policy to search for new and better ways to test tubes under dynamic conditions for closer control over performance. The "fixed bias" test is typical of these techniques. It places a more stringent, realistic measure on the tube's ability to perform under varying circuit conditions.

By controlling the plate current characteristics and transconductance of IF amplifier tubes, the "fixed bias" test gives the serviceman an extra measure of dependability regardless of make, model, or age of the TV set serviced.

The range of stable operation is controlled, too, for smooth AGC action over wide variations in signal strength.

These are the same reasons that Sylvania IF types are the choice of leading TV set manufacturers, attested by the wide assortment of Sylvania original types listed among IF tubes now in popular use.

In addition to the "fixed bias" test many other electrical tests are performed on Sylvania IF amplifier types including stability during life. During life tests, close controls are placed on interelectrode leakage.

In every way, Sylvania IF amplifier types offer you maximum assurance of trouble-free service based on sound, newly developed testing methods. Specify Sylvania IF amplifier tubes in the new yellow and black carton.

SYLVANIA

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In Canada: Sylvania Electric (Canada) Ltd.
University Tower Bldg., Montreal

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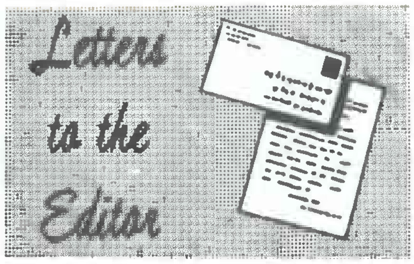


Dear Editor:

The cover on your April issue was, as usual, very up-to-date. However, is that a new way to carry a TV set? Judging from the position of the technician's hands, it would seem that the set would slip out of his grasp.

B. V. Reinecke

Shell Beach, Calif.

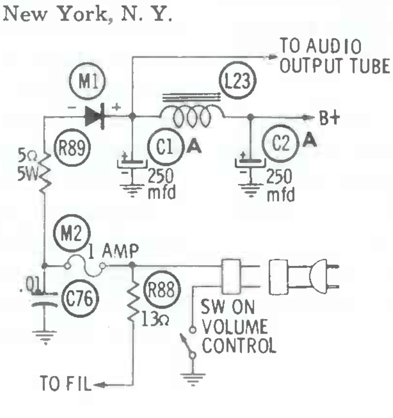
Whoops—Reader Reinecke, with his sharp eye, caught us! So, we might as well make a complete confession. To help the poor rain-soaked model hold on to the cabinet (which was slippery), we took the chassis out to make the set lighter and also left the rear cover off so that he could get a better grip with his left hand.—Editor

Dear Editor:

I would appreciate your help in overcoming a low B+ trouble in an Emerson Model 1102. I am supposed to get 135 volts of B+, and all I can get is 110 volts. I took everything off the input filter and still got only 130 volts. I have tried new filter capacitors, selenium rectifier and choke without success. There is vertical instability, and I know this is due to the low voltage supplied to the 12W6. The vertical linearity and height controls must be turned all the way out in order to fill the screen.

Edward J. Durkin

New York, N. Y.



Since the input filter capacitor should charge to 1.414 times the applied AC voltage, or 161 volts DC, where there is no load, we can narrow down the number of possibilities. All of these troubles will lie ahead of the rectifier, if the rectifier and filter capacitors have been replaced and the entire load disconnected. Check for increased resistance in R89 (see schematic) or for low line voltage. Any poor connection between the selenium rectifier and the male plug on the AC line cord could also cause this type of trouble.—Editor

Dear Editor:

In reading your article "Working with Transistor Radios" in the March issue, I found under the heading "Bench Power Supplies" a statement that the DC power supply pictured in Fig. 3B has greater control over AC ripple than the conventional battery eliminator.

I have used a number of different magnifying glasses trying to identify the manufacturer of this unit without success. Would it be possible for you to give me this information?

George G. Rachels

Rachels Radio Repair
Beebe, Ark.

Excuse our oversight—the unit in Fig. 3A is Mallory Model 12RS6D, and the one in Fig. 3B is Electro Products Model D-612T. More information about the latter unit was published in the "Notes on Test Equipment" column of the May, 1957 PF Reporter.*—Editor*

Dear Editor:

Regarding the article "Radio for the TV Man" in the March issue, apparently the writer was unaware of the importance of one additional step in undertaking radio alignment. It is important to disable the oscillator before attempting the alignment of any receiver. If the oscillator is allowed to operate, one will hear many squeals and responses, depending on the position of the receiver tuning control.

A. J. Sica

Brooklyn, N. Y.

Disabling the oscillator isn't absolutely required since squeals can be minimized by turning the tuning gang to its fully open position during IF alignment. Of course, the oscillator must be functioning for RF and mixer alignment.—Editor

Dear Editor:

How about publishing an article on causes for vertical rolling? To my misfortune, 9 out of 10 sets involving poor or no vertical sync have to be taken to the shop. Although relatively simple circuits, some of them can be real stinkers, especially when the cause is found to be in the video output stage or some other unsuspected circuit. Sometimes makes me feel that I should be repairing bicycles instead of TV's.

Bud Munroe

Altamont, N. Y.

Coincidentally, a coverage entitled "Pinpointing Troubles in Vertical Sweep Circuits" appears in this issue.—Editor


He does...
He doesn't...
RCA
RADIO-ENGINEERED FOR Extra LISTENING HOURS
RADIO B BATTERY
No. VS 016 · 67½ VOLTS
RCA
RADIO A BATTERY
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"I cut testing time in half" ... "doubled our tube sales" *

"Adds to my income and saves me unprofitable call-backs."

"We have two... one for the shop and one for house calls."

"Paid for itself several times. Really indispensable."

"Best tube tester I've ever owned. Simple to operate. Saves time."

"Makes lots of money for us. Wonderful instrument."

"Serves my purpose best for speed and dependability."

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FASTEST SELLING TUBE TESTER IN THE WORLD

Tests over 95% OF ALL POPULAR TV TUBES — IN SECONDS

Accurately makes each tube test in seconds. Checks average TV set in minimum minutes.

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One switch tests everything. No multiple switching. No roll charts.

Shows tube condition on "Good-Bad" scale and in micromhos. Large 4½-inch plastic meter has two highly accurate scales calibrated 0-6000 and 0-18,000 micromhos.

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One extra tube sale on each of 5 calls a day pays for the Model 500 in 30 days

Enthusiastic comments like those above* come from servicemen all over the country. *Actual experience shows an average of close to 2 additional tube sales per call.*

Instead of the "trial and error" method of substitution testing, the Dyna-Quik 500 quickly detects weak or inoperative tubes. Cuts servicing time, saves costly call-backs, shows each customer the true condition and life expectancy of the tubes in the set, and makes more on-the-spot tube sales. Helps keep customer good-will, give a better service guarantee, *and make more profit.*

The B&K Dyna-Quik 500 measures *true dynamic mutual conductance.* Completely checks tubes with laboratory accuracy under actual operating conditions right in the home *...in a matter of seconds.* Saves time and work in the shop, too. Simple to operate. Easily portable in luggage-type case. Weighs only 12 lbs.

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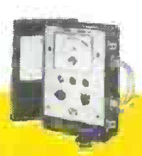

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Designed to check and adjust test instruments with laboratory accuracy. Net, $54.95

Shop Talk

MILTON S. KIVER

Author of . . .
How to Understand and Use TV Test Instruments
and Analyzing and Tracing TV Circuits

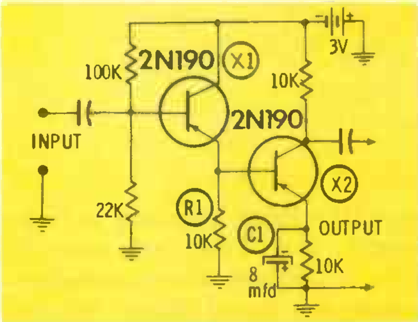


Fig. 1. Amplifier using one common-collector stage and one common-emitter.

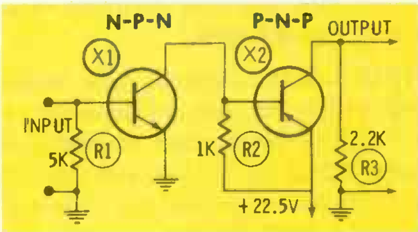


Fig. 2. Direct-coupled amplifiers using n-p-n and p-n-p transistors.

Last month we examined a number of RC and transformer-coupled amplifiers, noting their similarities and differences. Transformer coupling excels in achieving a closer impedance match between stages and, hence, in providing the best transfer of power. RC coupling offers the advantages of economy and more easily attainable bandwidth, but is not conducive to maximum gain per stage.

DC-Coupled Amplifiers

Although not heretofore mentioned, DC coupling can also be used between transistor stages. There is a problem, however, in matching the relatively high collector potential of a preceding stage with the lower base-emitter voltage needs of the following stage. There are several ways to get around this obstacle. For example, the base of the following stage can be connected to the emitter rather than the collector of the preceding stage, as shown in Fig. 1. The base of X2 is connected directly to R1 and the emitter of X1. To partially balance the DC voltage present at this point, X2 possesses a resistor equal in value to R1 in its emitter leg. Further, to prevent signal degeneration and loss of gain, this resistor is bypassed with C1.

The circuit of Fig. 1 is comprised of a common-collector followed by a common-emitter amplifier. The first stage provides no voltage gain and actually serves as an impedance converter, helping to match X2 to whatever circuit preceded X1. Such combinations are common in vacuum-tube circuitry, and whatever is true of them insofar as gain is concerned is generally applicable here, too. The system is useful in bridging the gap between high and low impedances.

Thus far we have employed transistors in what might be called the conventional manner—n-p-n transistors followed by n-p-n transistors and p-n-p units followed by p-n-p units. However, when we mix the two types together, interesting results are obtained. Consider for example the circuit shown in Fig. 2. The first stage contains an n-p-n transistor which is directly connected to a p-n-p unit. A single 22½-volt battery provides the required DC power to both circuits, being connected to the collector of the n-p-n transistor and the emitter of the p-n-p unit. This is in accordance with the polarity requirements of these transistors.

In the absence of any applied signals, the first transistor is practically biased to cutoff because both base and emitter elements are at the same potential. (This is something which may take a serviceman some time to accept because it differs so radically from the cutoff requirements of vacuum tubes.) Since the base and emitter of the second transistor are also connected together, this stage, too, is practically at cutoff. The qualifying word "practically" is inserted because of the presence of the saturation current (I_{co})

• *Please turn to page 60*

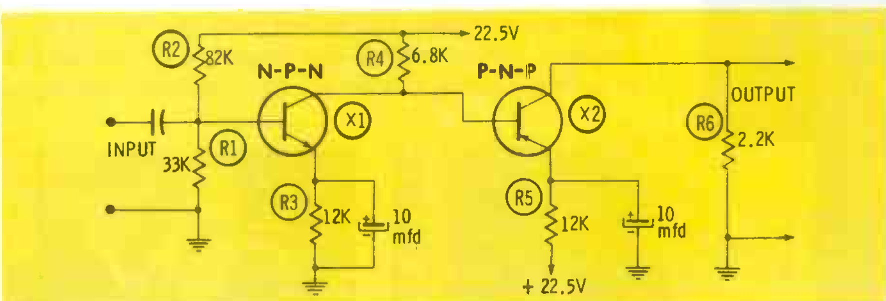


Fig. 3. An n-p-n/p-n-p complementary circuit which is used in General Electric Models 675 and 676 transistor radios.

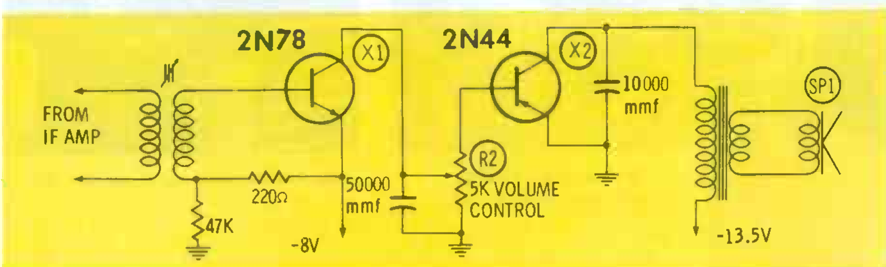
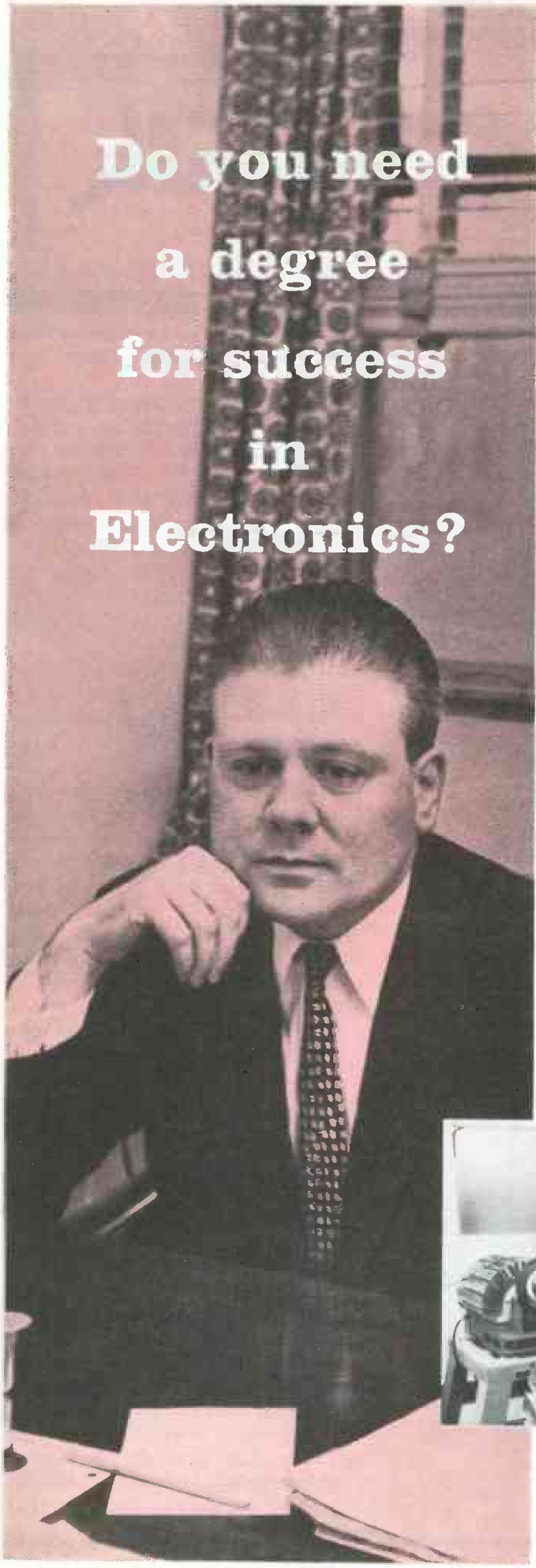


Fig. 4. Another direct-coupled amplifier which uses the complementary symmetry of n-p-n and p-n-p transistors.



Do you need a degree for success in Electronics?

"Not necessarily," says Dick Brani, Instructor in Project Sage at IBM—Kingston, New York. "Oh, sure—I'm aware of my limitations to design electronic equipment—that's the big advantage of a formal degree. But I am qualified to maintain it. The point is . . . there are many management positions in IBM for men like myself, and I'm convinced that comparable positions elsewhere would probably require an engineering degree."

Some years ago, IBM took the initiative with respect to technical training within its own organization. It realized, even then, that a great number of intelligent and capable men were falling by the wayside because they lacked 4 years of college engineering. Statistics indicated that because of financial difficulty or improper high-school preparation, close to 50% of the potential engineers in the country became lost in the educational shuffle. While some people ignored or bemoaned the fact, IBM did something about it. Consequently, men like Dick Brani now enjoy satisfying, more rewarding work than ever before.

Great Interest in Mathematics. While Dick was attending high school, his principal academic interest was mathematics. And, like many other young men of that time, Dick was realistic about his future. He decided his best bet might be business accounting. When Dick graduated, he accepted a position with a New York banking firm. It was not until he entered the Army that he had the opportunity to pursue a more advanced form of mathematics—an A.S.T.P. training program at Lehigh University. This all-too-brief experience convinced Dick that he should make his career in a field related to electrical technology.

Postwar Education. Discharged with the rank of Staff Sergeant, Dick returned home to marry a girl he had met at Lehigh. During this period, he successfully supported

Dick trouble shooting Magnetic Drum Frame.

He studies computer pluggable unit.

DATA PROCESSING • ELECTRIC TYPEWRITERS

his family selling various lines of food. In the evening, however, Dick continued his study of radio, TV, and electronics at the Allentown Branch of the Temple Institute. In two years' time, he graduated and secured an F.C.C. license—his technical career began to take shape.

IBM Looks Especially Good. Glancing through an issue of *Time Magazine* one evening, Dick happened to read an article about Thomas J. Watson, Jr., the president of IBM. The story emphasized Mr. Watson's great faith in the future of electronic computers . . . the wonderful promise it holds for the ambitious, intelligent young man. Later, Dick spotted a classified ad describing IBM's association with Project Sage. That was all Dick Brani needed.

Asked to Become an Instructor. Three-quarters of the way through his nine-month computer systems course, Dick was invited to remain at Kingston as an instructor. "It was like a bolt out of the blue," he recalls. "I knew I'd enjoy teaching, but I always thought it was out of the question. I accepted all right. I can't tell you how much I've enjoyed helping these fellows and watching them grow within the organization. Right now, there's a fellow in my class whose education is limited to correspondence school. He's in the top third of his class, and has a real future with IBM—all because he has the native talent and is willing to work."

What Does Dick Brani Teach? "Actually, I teach three separate courses in field engineering. One is computer systems testing, which is for the more advanced student. It lasts for 33 weeks—a long time, perhaps, but it's well worth it. Another is a program of 24 weeks' duration that deals with computer input-output units. Finally, I teach a course in computer units displays. This also lasts for 24 weeks. Each one of these courses is an education in itself." Experience has shown that IBM's educational programing is most successful. Men accepted receive their training with no strings attached. Upon graduation the road to success is wide open in *all* divisions of the corporation.

Computer Analyzes All Air Traffic. "This computer is really fantastic. It contains approximately 1,000,000 parts, and it's housed in a building 4 stories tall. Information is filtered in from Texas towers, picket ships, reconnaissance planes—even ground observers. Every object in the sky is analyzed. Then it checks each object against available traffic data and identifies it as either friendly or hostile. It can make suggestions, but it can't send a Nike missile against a 'baddie.' Only authorized personnel can make that decision."

What About Dick's Future? "Well, right now, I'm doing work that most technicians couldn't touch with a ten-foot pole. I guess it's a matter of approach, but I know of few companies other than IBM where technicians are actually doing engineering work. Both kinds of companies will get the job done, but IBM prefers to think in terms of the man, encouraging him to grow into more responsibility. You might say that IBM gets more out of the man. In the final analysis, it seems a lot more efficient from the corporation's and employee's viewpoint. Personnel policy at all levels—management, engineering, or technical—is the same. The future is wide open."

Just recently, Dick bought a home in Saugerties, near Kingston, where his wife Betty and their three children, David, 9, Sharon, 7, and Paul, 3, enjoy a pleasant, contented life together. Occasionally, in the summertime, Dick plays softball with his co-workers. But his family is—and always will be—his predominant interest.

What About You? Permanent opportunities in the nationally important Project Sage program are still growing. If IBM considers your experience equivalent to an E.E., M.E. or Physics degree, you'll receive 8 months' training, valued at many thousands of dollars as a Computer Systems Engineer. If you have 2 years' technical schooling or the equivalent experience, you'll receive 6 months' training as a Computer Units Field Engineer, with opportunity to assume full engineering responsibility. *Assignment in area of your choice.* Every channel of advancement in the entire company is open. All the customary benefits and more. For more information, please write to: Nelson O. Heyer, Dept. 9606, IBM, Kingston, New York. You'll receive a prompt reply.

Dick explains computer logic to a Systems Class.

At the Operating Console.

At home Dick plays with one of his three children.

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ANALYZE YOUR WAY TO Bigger Profits!

NEW! INTERMITTENT CONDITION ANALYZER Model 828

Unique principle locates intermittents, detects borderline components Fast —

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Locate intermittent capacitors, resistors, coils, chokes, tubes, and other component and hidden wiring failures in minutes —without waiting. Exclusive Wintronix circuit using modulated special r-f test signal, immediately makes any radio or TV receiver super-sensitive to intermittents—gives both audible and visible indication so you can pin-point trouble right away. Reduces callbacks by detecting borderline components *before* they fail.

Dynamic SWEEP CIRCUIT ANALYZER

Model 820

A complete sweep circuit tester. Simplifies sweep circuit troubleshooting by signal substitution and component testing. Supplies 60 cps sawtooth and 15,734 cps sawtooth or square wave signals to TV deflection circuits. Restores raster to normal by substituting for defective stage. Tests all flybacks and yokes right in the set for continuity and shorts . . . Even tests 1-turn shorts. Completely self-calibrating—no chance for error.

SYNC PULSE ADAPTER

Model 915/960 Troubleshoot sync circuits by signal substitution. This unit with Model 820 injects (+) or (—) pulse voltages into vertical and horizontal sync stages. Locates defective sync separators, sync amplifiers, AFC, and vertical integrator circuits.

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NEW! Dynamic AGC CIRCUIT ANALYZER Model 825

Takes the guess-work out of AGC troubleshooting for faster, far more profitable color and black-and-white TV servicing.

Here's all you need to test, analyze, service any television AGC circuit . . . all in one compact instrument. Saves you hours by quickly detecting obscure AGC faults before you look further. Requires only two test connections and a flick of a switch to: 1) Furnish standard, adjustable r-f test signal to antenna terminals; 2) Monitor AGC action; 3) Check for shorts and opens in AGC buss; 4) Measure action of gated pulse systems; 5) Clamp and supply AGC bias to correct AGC action and restore operation by substitution.

HERE'S ALL YOU NEED FOR COLOR SERVICING

RAINBOW GENERATOR Model 150

Align, adjust, troubleshoot complicated color TV circuits this easy way. Produces vertical color bars of all possible hues representing 360 degrees of phase sweep. Furnished with detailed instructions and illustrations to simplify color TV servicing in the home and in the shop.

$49.95 Net

NEW! COLOR CONVERGENCE DOT GENERATOR Model 250

Here's a complete ultra-stable signal source for color convergence. Contains complete standard sync chain with AFC. Produces optimum white dots, cross hatch, vertical or horizontal bars for color or black-and-white servicing. Absolutely "jitter-free" regardless of picture tube size. Preset r-f frequency, variable 30 db. Highly portable, only 10½" x 7" x 6".

$129.95 Net

FLYBACK and YOKE TESTER

Model 810

Makes foolproof GO/NO-GO tests of *all* color and black and white flybacks and yokes right in the circuit. Checks 1-turn shorts — self-calibrating.

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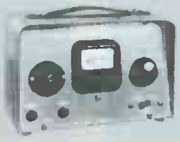

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BY JOHN MARKUS
Editor-in-Chief, McGraw-Hill Radio Servicing Library

Branded Service. Out in Tucson, Arizona, T.T. stands for Tucson-Tested, used by Smith and Waldman to identify their particular type of television servicing that takes into account the temperature and dryness of the locality. Though primarily a promotion designation, it makes a strong impression on the firm's customers, so that they remember and come back.

Does your own locality lend itself to branded service? Do you have four-seasons climate, with servicemen that look for humidity-caused defects in summer, for rodent damage in fall as the critters seek warm winter homes, etc. Along the seashore you can advertise specialized knowledge of troubles caused by salt-laden air, etc.

$ & ¢

Hiring. When the time comes for adding a man to your staff, you'll soon find that most of the good men already have jobs somewhere else. It is still essential to have in mind a clear blueprint of what you want in a man, however, even though you'll have to compromise on many of these points.

A brief conversation will usually serve for the preliminary screening if you keep the conversation under control so that it doesn't turn into a rag-chew. Get the facts; don't let first impressions and appearances trap you into premature decisions for or against the man. Does he have the training and experience your job requires? Is he willing to work evenings and weekends if you require it? Will he stick with you, or do frequent past changes of jobs brand him as a job-hopper? Will he be satisfied with what you can pay him? Is he subject to a draft call? Does he have a settled family life? Does he have the right personality for contacting your customers? Is he a safe driver?

How does the applicant speak about former employers? Remember that men do not change very much; if they are not loyal to any of their former employers, they are not likely to be loyal to you, either. Try to find out how well the man handles money, in his home life as well as on the job. His credit rating is an important factor here.

If the answers to the above questions are largely favorable, you can then ask for specific work references and try the man out on a few typical service jobs in the shop. Be sure to check his references, because former employers are your best source of information about the man. A personal call is best here if at all possible, because a former employer will tell you many things in person that he wouldn't put in a letter.

Before making your final interview and decision, be sure that you give the most likely applicants a clear job description. State exactly what you expect them to do, how you expect them to act and how you will pay them. Go into your vacation policies, provisions for sickness, coffee break rules, and any other factors that will affect working conditions.

Remember that interviews are not inquisitions. You must sell yourself and your firm's policies just as much as the applicant is trying to sell himself, if you are to reach a meeting of minds that will result in a long and mutually profitable working arrangement.

Hiring a man is definitely the same as making an investment in your business. If you misjudge your investment, you lose the salary paid him during the inevitable breaking-in period and you possibly also lose the customers he may mishandle.

$ & ¢

Breaking the News. Surprise is an enemy of management. The first reaction of a person to a change is apt to be resistance. If the change takes place before this natural resistance can be counteracted by talking over the matter and explaining the reasons, much harm is done.

Management unquestionably has the right to make changes, but management hurts only itself by surprising its employees. Even such a simple act as moving the water fountain or coke machine can create deep resentment if done as a surprise. When not told the true reason, employees imagine other reasons and build up the action way out of proportion to its true significance.

Remember—to get the most out of your men, you have to sell yourself to them over and over again with each managerial decision you make. The reward for doing this is well worth while; you achieve a working team that will fight with you and for you in good times and bad.

$ & ¢

Tail Wags Dog. The year 1957 will go down in the history of television and radio as the first year in which consumers paid more money for servicing than they spent on new receivers. In 1957, it is estimated that servicemen will take in well over 1.5 billion dollars for replacement parts and labor needed to keep TV and radio sets running. This places servicemen, at long last, in a dominant position, and one which will receive more attention and recognition.

Despite the gross of 1.5 billion, it is the net income or take-home pay that counts, after paying operating expenses and the cost of parts. Therefore, concentrate on these operating expenses to make sure they do not get out of hand. Make sure your net profit increases steadily each month, in step with the increased cost of living and the increasing value of your ability. Companies reward employees with more or less regular raises in recognition of this, and servicemen similarly deserve merit raises even when working for themselves. Don't let your new dominant role lead to carelessness and overconfidence—the forerunners of bankruptcy.

PINPOINTING

Table 10-A
VERTICAL SWEEP
Integrating Filter. Plate Coupled MV

	Compressed At Bottom	Compressed At Top	Fold, Vertical	Height Excessive	Height Lacking	Interlace Poor	Line (Horz), One	Rolling, Vertical	Stretched, Bottom	Sync Critical (Vert)
INTEGRATING FILTER										
Capacitor In Series										
1 Open								●		
2 Leaky			●			●		●		
3 Shorted							●			
Capacitor To Ground										
4 Leaky, shorted					●			●		
5 Too great								●		●
Resistor In Series										
6 Open			●					●		
Resistor To Ground										
7 Open						●				
8 Shorted								●		
MULTIVIBRATOR, PLATE COUPLED										
Discharge Section										
9 Plate voltage zero							●			
10 Plate voltage low					●					
11 Plate voltage high				●						
Output Section										
12 Plate voltage zero							●			
13 Plate voltage low					●					
14 Cathode-heater leak					●					
15 Grid resistor open							●			
16 Grid resistor too small								●		
17 Grid resistor too great					●					
Coupling Capacitor (Discharge to output)										
18 Open							●			
19 Leaky			●					●		●
20 Shorted			●							
Feedback Capacitors										
21 Series. Open			●							
22 Series. Leaky			●	●						
23 Series. Shorted			●							
24 To ground. Open		●							●	
25 To ground. Leaky, shorted	●		●				●			●
26 To ground. Too small		●		●						
Feedback Resistors										
27 Series. Open			●							
28 Series. Shorted		●			●					

Table 10-B
VERTICAL SWEEP
Blocking Oscillator. Cathode Coupled MV.

	Bright Bar, Bottom	Compressed At Bottom	Compressed At Top	Fold, Vertical	Height Excessive	Height Fluctuates	Height Lacking	Line (Horz), One	Rolling, Vertical	Split, Top-Bottom	Stretched, Bottom	Stretched, Top	Sync Critical (Vert)
BLOCKING OSCILLATOR													
29 Plate voltage zero								●					
30 Plate voltage low		●					●						
31 Plate voltage high			●		●						●		
32 Cathode-heater leak				●					●				●
Grid Capacitor													
33 Open									●				
34 Leaky, shorted								●					
35 Too great, too small									●				
Feedback Transformer													
36 Defective				●				●	●				●
MULTIVIBRATOR, CATHODE CPLD													
37 Plate voltage zero								●					
38 Plate voltage low					●								
39 Plate voltage high				●			●						
40 Cathode-heater leak									●	●			
Cathode Resistor													
41 Open								●					
42 Shorted				●									
43 Too small				●			●						
44 Too great				●									
Cathode Bypass Capacitor													
45 Leaky				●			●						
46 Shorted				●									
Coupling Capacitor (1st plate — 2nd grid)													
47 Open								●					
48 Leaky				●				●					
49 Shorted								●					
50 Too small				●					●				
51 Too great				●						●			
OUTPUT TUBE (Not Oscillator)													
52 Plate voltage zero								●					
53 Plate voltage low			●				●						
54 Plate voltage high					●								
55 Cathode-heater leak	●			●	●					●			
Coupling Capacitor													
56 Open								●					
57 Leaky				●								●	
58 Shorted				●				●				●	
Grid Resistor													
59 Open					●	●							
60 Too great					●								
61 Too small	●												

TROUBLES in

Vertical Sweep Systems

EDITOR'S NOTE: The material in this article is based on a portion of the book, *Pin-Point TV Troubles in Ten Minutes*, a publication of Coyne Electrical School, distributed by Howard W. Sams & Co., Inc.

Table 10C VERTICAL SWEEP Controls. Sawtooth System	Bright Bar, Bottom	Bright Bar, Top	Compressed At Bottom	Compressed At Top	Fold, Vertical	Height Excessive	Height Locking	Line (Horz), One	Lines (Horz), Many	Rolling, Vertical	Split, Top-Bottom	Stretched, Bottom	Stretched, Top
HOLD CONTROL (Entire resistance)													
62 Open								●					
63 Too great					●					●	●		
64 Too little					●		●			●			
65 Shorted								●					
HEIGHT CONTROL (Entire resistance)													
66 Open								●					
67 Shorted				●		●							
68 Too great			●				●						
69 Too little				●		●						●	
SAWTOOTH SYSTEM													
Capacitor													
70 Open		●			●				●				
71 Leaky			●		●		●						
72 Shorted					●			●					
73 Too great			●				●				●		
74 Too small				●		●						●	
Peaking Resistor													
75 Open		●			●				●				
76 Shorted		●		●								●	
77 Too great	●				●		●						
78 Too small		●		●			●			●		●	
LINEARITY CONTROL (Entire resistance)													
79 Open								●					
80 Too great				●									
81 Too little	●					●					●		●
Bypass Capacitor													
82 Open							●						
83 Leaky, shorted						●				●			
84 Too small or open							●						
OUTPUT TRANSFORMER													
85 Internal open								●					
86 Internal short							●	●					

The following tables list picture symptoms which most often or most probably result from various faults in the vertical sweep section of a TV receiver. A particular trouble will often cause different symptoms, depending on the severity of the trouble. For instance, picture symptoms due to a leaky capacitor might merge into symptoms due to the same capacitor being internally short circuited, since a short is, after all, a case of extreme leakage.

Some symptoms are closely related to others. A certain trouble might cause the picture to roll upward or downward; but should the picture hold stationary, the same trouble might cause splitting of the picture, top and bottom, along a horizontal line or bar.

Vertical hold controls in some receivers have a greater range of resistance adjustment than in others and can prevent rolling even when some faults are present in moderate degree. With less range of adjustment, the same faults would cause uncontrollable rolling.

In Table 10-C, you'll find a heading titled, *Lines (Horiz), Many*. This refers to a viewing screen covered with thin, bright trace lines which shift irregularly. The condition results from extreme vertical stretching which separates horizontal trace lines by wide dark areas.

To illustrate the use of these tables, let us assume that we are faced with a symptom of excessive height in the picture and the receiver employs a cathode-coupled multivibrator. First, we locate the column headed *Height Excessive*. We also find that the cathode-coupled multivibrator is listed in Table 10-B, where beside Item 38, *plate voltage low*, there is a black dot in the *Height Excessive* column. Therefore this fault may be causing the trouble. Going further down the list, we find that Items 54, 55, 59 and 60 are also possible causes for this symptom. Items 67 and 69 in Table 10-C tell us that the height control may be shorted or too low in value. Item 74 tells us that the capacitor in the sawtooth-forming system may have decreased in value, and Item 81 points to a defect in the linearity control. ▲

Go Modern

What with the huge replacement market for automobiles, the increasing use of car radios, and the striking new designs auto antenna makers are introducing, there's more of a potential in the installation of auto antennas today than ever before.

And, more important, this business can be highly profitable for the average serviceman, with but a little effort and application on his part.

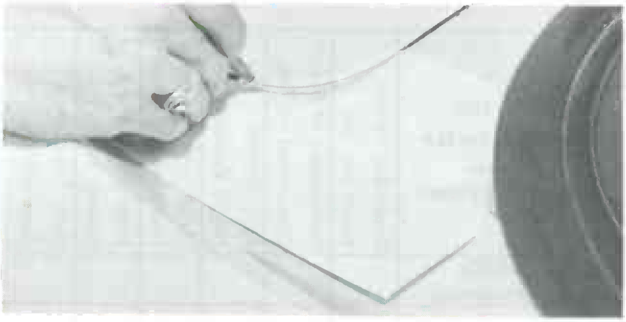
Both of the twin, rear-deck installations shown at right were made by independent servicemen. In one of them, a set of antennas available through parts distributors was used, and in the other, a pair of factory-furnished units.*

Information on the installation of either type, with principles applicable also to the installation of any auto antenna, is given in the following photographs.

*The rear-deck units used as illustrative examples in this article were supplied by Radiart Corp. and Tenna Mfg. Co. Similar and other types of automobile antennas are also made by other firms, among which are: Antenna Specialists Co., Brach Mfg. Corp., National Electronic Mfg. Co., Snyder Mfg. Co. and Ward Products Corp.

PRELIMINARY CHECKS

Before marking the body of the car, first make certain that there is sufficient clearance below the intended cutout to permit an unimpeded installation. For twin installations, this check should be made on both sides. Beware of hidden metal plates or extra layers of metal which could cause trouble.



PREPARING THE TEMPLATE

Prepare a template (of heavy paper or cardboard) that matches some particular line of the body and tape it in place. Position the antenna over the template, using it to locate and mark the necessary cutouts. Remove the template and cut the necessary holes in it to permit marking of the car body.

MAKING THE CUTOUT

After drilling a small pilot hole and then a ¼" hole in the previously-punched spots, use a 1" reamer to enlarge the cutout as needed. If a reamer isn't available, a rattail file may be used. In either case, be careful not to make the cutout too large.

SHAPING THE CUTOUT

If the shape of the cutout is to be other than round, make round holes for the ends of the cutout and then either saw or file out the remaining metal. Be sure that all burrs are removed.

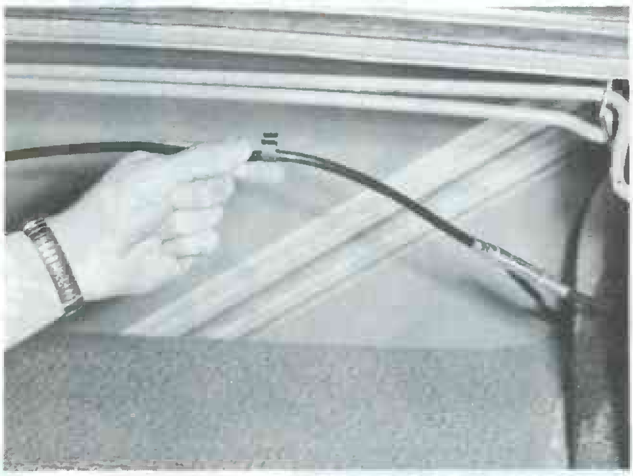
in auto antenna installations

MARKING BODY FOR CUTTING

Place the template first on one side of the body and then the other, marking the necessary cutouts with a sharp grease pencil. In marking the side of the body opposite the one used to prepare the template, remember to turn the template over. After marking the body, again check the intended antenna positions—remember, after the holes are cut, it's too late to change your mind.

PREPARING TO DRILL

Very carefully locate the points for drilling into the body; and, using a center punch (or nail with a sharp point), make a starting point in the exact center of the holes to be drilled.



INSTALLING THE HARNESS

Following the wiring diagram furnished with the antenna kit, hook up the harness between the two antennas and secure the cable to the body with wiring clips. (These clips may or may not be furnished in the antenna kit.)

INSTALLING THE ANTENNA LEAD

In most cars, there is an opening into the trunk behind the rear seat through which the antenna lead-in cable can be fed. After removing the rear seat, connect one end of the antenna cable to the harness junction and feed the other end into the cab through the front of the trunk. Route the lead under the floor mat along the driveshaft tunnel or along one side of the car and connect it to the radio to complete the job.

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DO FUSES CONFUSE You

HERE ARE FACTS EVERY SERVICEMAN SHOULD KNOW

by Calvin C. Young, Jr.

Fig. 1. 3AG regular and pig-tail styles.

First, what is a fuse? In the average customer's opinion, it's "that little thing in back." Some service technicians must also share a lack of knowledge about these important components, since there are so many television receivers in which the wrong size fuses have been used as replacements.

The indiscriminate installation of whatever size fuse happens to be available can lead to serious consequences. Generally, engineers who design TV and radio receivers have been very careful to include fuses that will both protect the circuit and withstand normal current surges. A thorough reading of this article should give the technician a new insight into the why's and wherefore's of fuses.

Construction and Characteristics

The fuses used in radio and TV receivers are generally housed within a glass tube ¼″ in diameter and from ¾″ to 1½″ long with metal caps bonded to each end. There are six basic series in common use; namely, the 3AG regular, the 3AG time-lag, the 8AG, the SFE Standard, the Type N, and the Type C. The 3AG regular and time-lag units are ¼″ in diameter by 1¼″ long and are supplied in both the standard cartridge and pigtail styles (Fig. 1). Externally, the 3AG regular and time-lag fuses are identical and can be readily interchanged in their respective fuse holders after due consideration of the circuit requirements. Let's examine the internal structures of the 3AG regular and time-lag series, however, and see what makes these fuses different, even though units with comparable current ratings are available in each series.

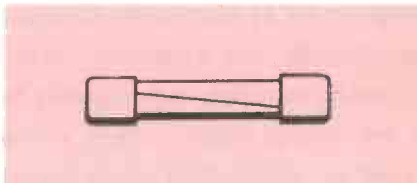

Fig. 2. Thin wire used as fusible element in 3AG regular fuses (2 amps or less).

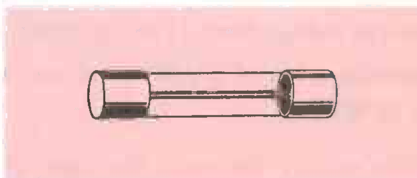

Fig. 3. Strip of fusible metal is used in 3AG regular fuses (over 2 amps).

Regular Series

In the 3AG regular series, the fusible element is either a very thin wire (Fig. 2) that has been treated in the center ¼″ to blow when heated too hot or a strip of fusible metal (Fig. 3) which will melt under overload. The thin

· Please turn to page 65

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50	75	4,800	8,000	10,000
100	125	2,000	3,500	5,000
150	175	1,500	2,500	3,500
200	250	1,000	1,500	2,500
250	300	800	1,250	1,750
300	350	700	1,000	1,500
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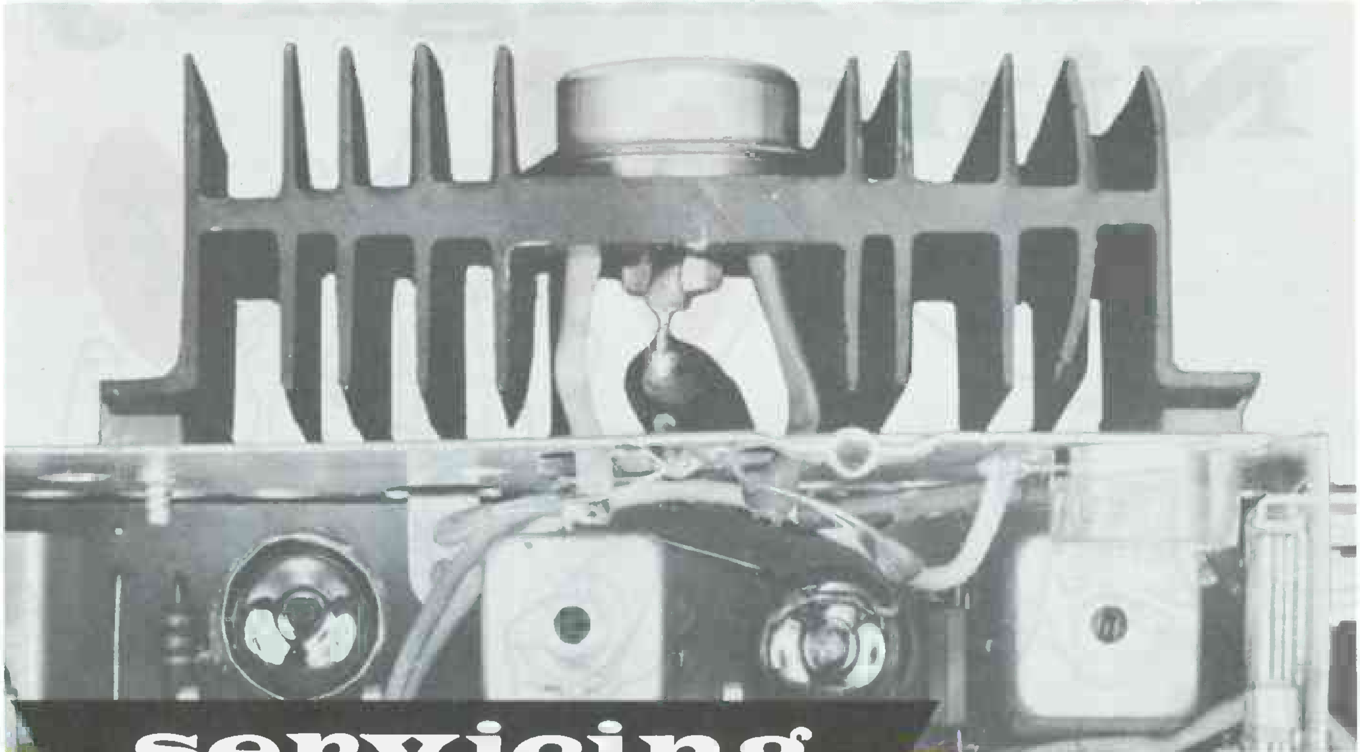


servicing new designs

Fig. 1. The power transistor of the Chevrolet Model 987575 radio is mounted on a large heat sink insulated from the chassis.

by Thomas A. Lesh

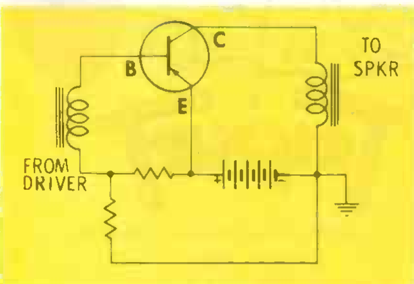


Fig. 2. This basic p-n-p, common-emitter circuit is used as an output stage in many new auto radios.

Transistor Stages in Auto Radios

Mention "fins" in connection with 1957 model cars, and most people will immediately think of the new look in rear fenders. But more important to the service technician is the fact that thousands of these cars have a second set of fins—small, inconspicuous ones that carry heat away from the power transistor in the car radio. (Fig. 1 is a closeup of one of these finned heat radiators.) Since auto radios with transistorized output stages are becoming a familiar sight, the time is ripe for a comparison of some of the new transistor circuits. This is also a good time to mention certain servicing procedures that apply to nearly all these circuits.

A large proportion of the 1957 "hybrid" radios contain a single transistor which is being used as a class A audio amplifier. Fig. 2 is a typical circuit of this kind, reduced to bare essentials. This basic schematic shows a p-n-p transistor connected in a common-emitter circuit. The input is applied between the base and emitter, and the output appears between collector and emitter. As far as the signal is concerned, this arrangement is directly comparable to that of a grounded-cathode vacuum-tube amplifier. (If this point or any other in the following description is not clear to you, a re-reading of "Shop Talk" in the

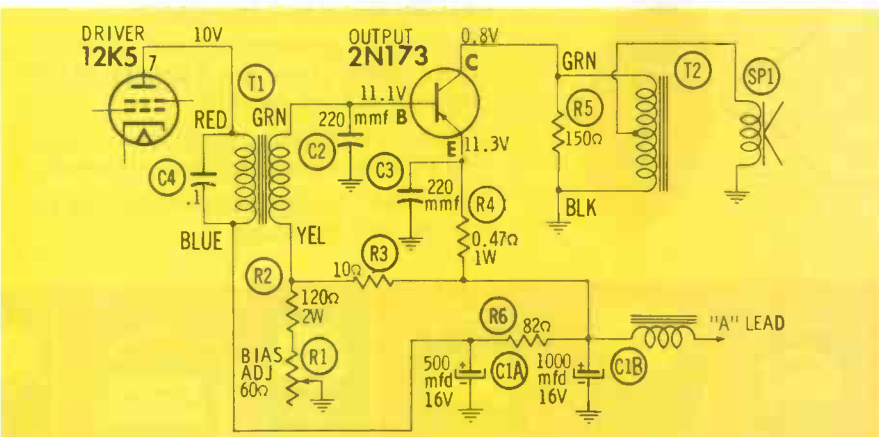
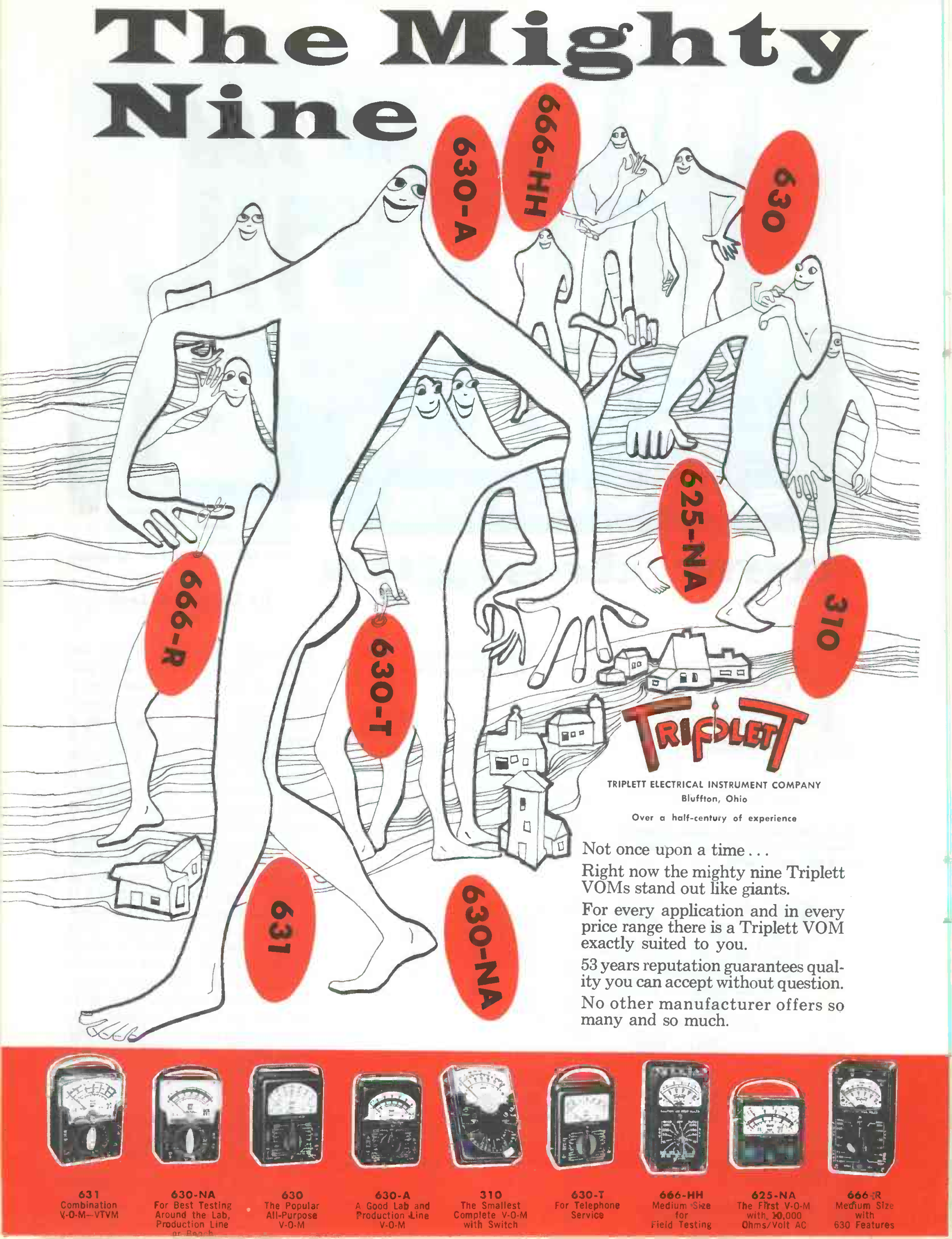


Fig. 3. This output stage from a Chevrolet radio features a 2N173 transistor driven by a 12K5 space-charge tetrode.

• *Please turn to page 68*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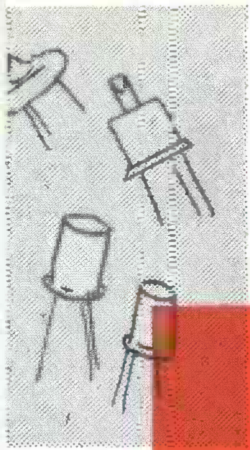

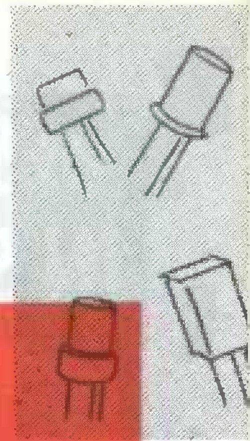

TROUBLE SHOOTING and SIGNAL TRACING in TRANSISTOR RADIOS

by Leslie D. Deane

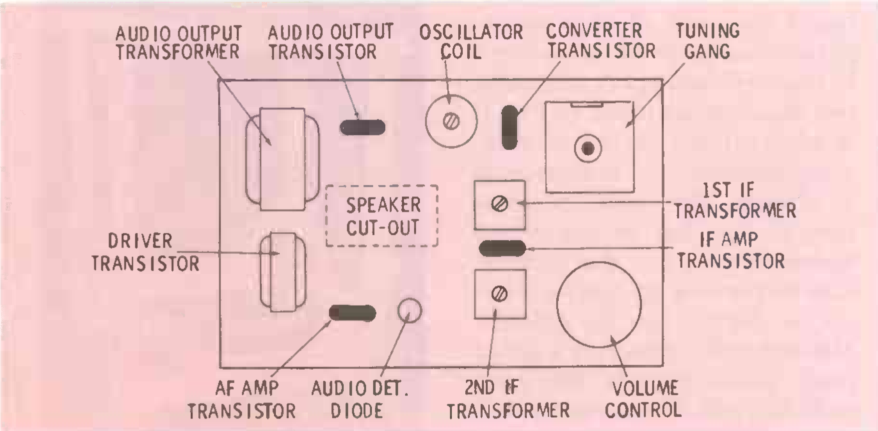

Fig. 1. Major component locations in a typical 4-transistor portable radio.

Not only do the new portable radios use unfamiliar transistors in place of vacuum tubes, but most of them employ printed wiring and subminiature components as well. To even the most experienced technician, these features call for a new approach to radio servicing. The technician need not be too alarmed, however, for by using common sense and by slightly modifying conventional procedures, he should have little difficulty in servicing transistor circuits.

Locating Components

Perhaps the first thing one notices when attempting to service a transistor radio is the unfamiliar locations of components on the small printed wiring chassis. In conventional radios, the technician automatically recognizes the physical location of various stages by the arrangement of familiar tube types. In a transistor portable, however, these landmarks are not to be found and the technician may be in doubt as to what applications various transistors serve. Let's look into this component location problem further in an attempt to become better acquainted with these new miniature chassis.

The line drawing of Fig. 1 represents a typical 4-transistor radio chassis with the location of all major components clearly indicated. As in conventional radios, the converter and 1st IF amplifier stages are almost always located close to the tuning gang. The converter transistor is usually the one nearest the oscillator coil, which may be identified from the fact that it is unshielded, while the IF transformers are mounted in small, round or square metal cans.

A crystal diode is often employed in the audio-detector stage. It is normally smaller than a transistor and will have only two cat-whisker leads. In some designs, this component will be mounted on the underside of the board. Sometimes, a transistor may be used in this application, in which case it will always be mounted on top of the chassis like the other transistors.

The AF amplifier stage can usually be found on the chassis somewhere between the detector and the audio output transformer. If an interstage or driver transformer is employed in the set, look for the AF amplifier transistor near this component and the audio output transistor near the audio output transformer. The secondary leads of the output transformer will naturally connect to the speaker, so you should have little trouble in distinguishing between the driver and out-

· *Please turn to page 73*

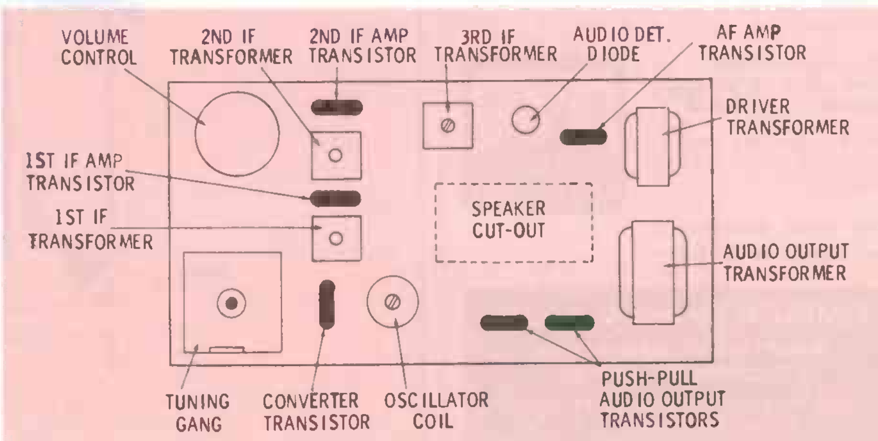

Fig. 2. Component placement diagram for a typical 6-transistor portable radio.

how to build a tv test stand

by Carleton A. Phillips

As in all businesses, the saving of time and effort is an important factor to be considered in the service shop. A television test stand, as pictured in Fig. 1, is of great aid to the serviceman, especially in the removal of chassis. The open construction of the top of the stand makes it easy for the serviceman to remove all screws holding a chassis in its cabinet. Mounting this stand on a set of good grade casters for easy mobility will add to its usefulness.

Fig. 1. TV test stand.

The stand is constructed of fir stock, and the legs are 1¼" or 1½" square. No height is given for these legs because this dimension is determined by individual preference. It is suggested that the height of the stand be approximately equal to the height of the serviceman's work bench.

Dimensions of all other pieces of the stand are given in the diagram of Fig. 2. All pieces of the stand are first glued and then assembled with bolts or wood screws.

The average serviceman will find a constant use for two and sometimes three of these stands in the shop.

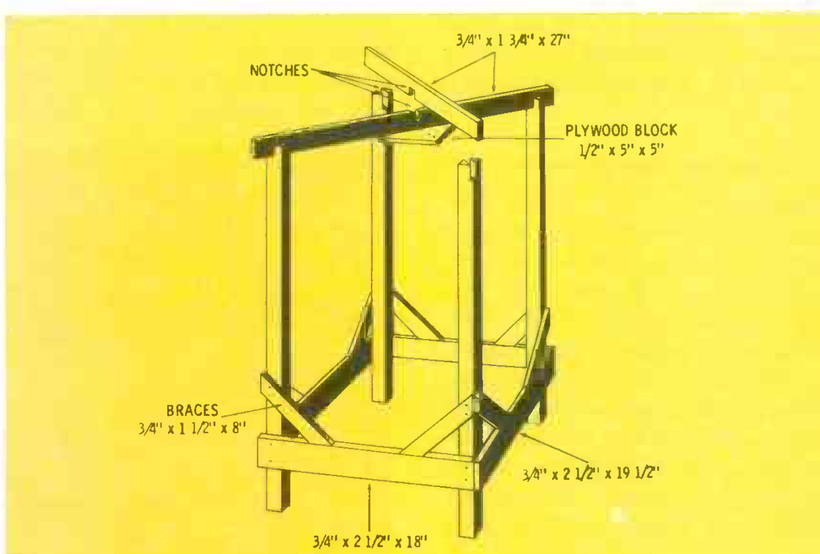

Fig. 2. Construction diagram for stand.

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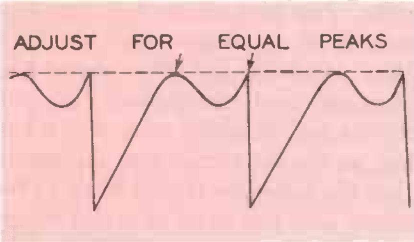
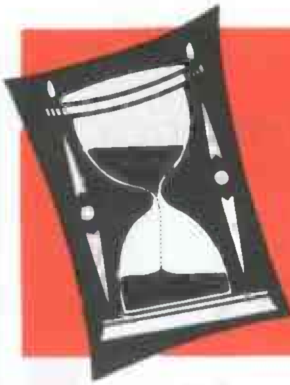


Fig. 1. The horizontal frequency and phasing slugs are adjusted so that equal peaks will be produced in the waveform.



QUICKER SERVICING

by Calvin C. Young, Jr.

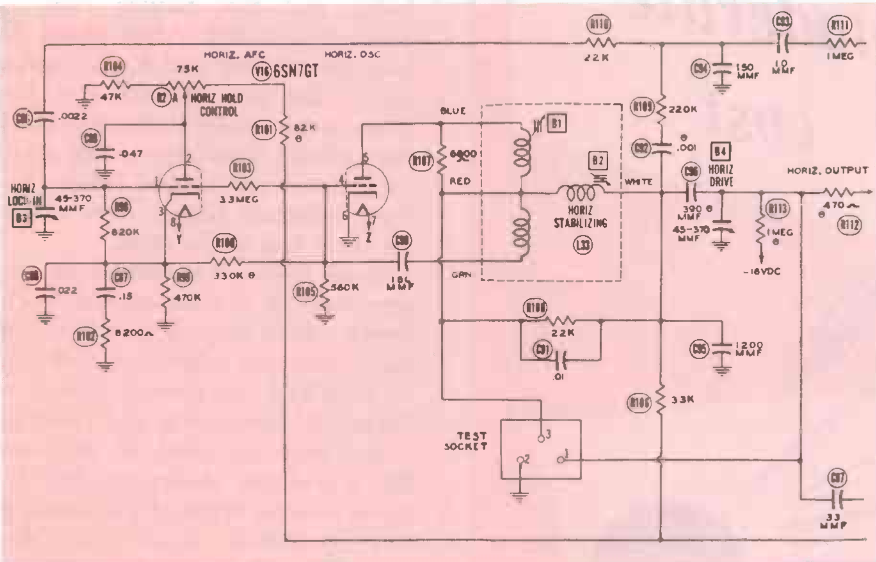


Fig. 2. Horizontal AFC and oscillator circuits used in the Philco receiver.

Fig. 3. Horizontal drive signal should have linear slope and minimum flat top.

On a home service call, the replacement of a defective tube in the horizontal AFC and oscillator section of a TV set should always be followed by an operational check of horizontal sync stability. This is particularly required when the set uses a pulse-width or synchroguide AFC system, which is often sensitive even to the slight variations that exist in new tubes of the same type. In fact, it would minimize the risk of a recall if the waveforms associated with the oscillator in a synchroguide circuit were checked and corrected each time the oscillator-AFC tube is replaced. Let's consider an actual case history which illustrates the need for this check.

Test Jack Simplifies Repair

On his first call to fix a certain Philco TV receiver, the technician found a defective 6SN7 horizontal oscillator tube. After installing a replacement tube, the picture wouldn't synchronize horizontally and it was found necessary to adjust the horizontal frequency coil. This caused the picture to "lock in," but the range of the hold control was not correct. In other words, the picture would fall out of sync at one end of the range and just barely synchronize at the other end. At any other setting of the frequency coil, the picture would be out of sync or show a "Christmas-tree" pattern.

This particular Philco receiver happened to be the split-chassis type employing a pulse-width horizontal AFC system, and both frequency and phasing adjustments had to be accurately made to insure stable operation.

Since he had not taken an oscilloscope on the call, the technician resorted to "twiddling" the phasing adjustment. He managed to set it so that the picture remained in sync over the center range of the hold control. Knowing that the horizontal oscillator should be stable with the hold control set to its center position, the technician switched off-channel and back again to check the stability. The picture remained in sync, so the technician happily collected his fee and left.

But wait—there's more to this story. The customer called about three days later and complained that the picture fell out of horizontal sync every time a commercial came on. Of course, there was nothing the technician could do but make another trip to investigate the complaint. The customer was asked to turn the receiver on so that it would be completely warmed up by the time the technician arrived.

Sure enough, on the first commercial, the set lost horizontal

Fig. 4. Checking phase adjustment after slipping chassis out of cabinet.

sync. The technician felt that the use of an oscilloscope would help him correctly set the horizontal phasing and frequency adjustments and thereby cure the trouble, so the customer was informed that the receiver would have to be taken into the shop to make these adjustments.

It's common knowledge that each half of the Philco chassis is held in place by several chassis bolts, and the picture tube is cabinet mounted. After about 10 minutes of time and 6 very quiet oaths, the two chassis and the yoke were finally removed from the cabinet. Two trips to the service truck were needed before the three separate pieces were ready for their trip to the shop.

Once there, the technician assembled the chassis on the work bench. With the outside antenna connected and a picture tuned in on a 5AXP4 test picture tube, the horizontal frequency and phasing slugs were adjusted to produce the waveform shown in Fig. 1. Since several turns of the phasing and frequency slugs were required to achieve the proper waveform, the technician knew that the circuit had not been properly adjusted by the hit-or-miss method he had used in the home.

All of this procedure had taken quite some time, and the customer's resultant repair charge, even after allowance for the recall, was quite large. This caused the technician to wonder if there wasn't some easier way to accomplish a lasting repair in cases of this type.

Close examination of the schematic (Fig. 2) revealed the presence of a test jack, which was physically located on the chassis next to the oscillator tube. Inserting the tip of a solder pick into the proper pin of this jack would have permitted the oscilloscope to be used to monitor the signal while the phasing and frequency slugs were being adjusted. The technician thought to himself, "Why couldn't I have taken my small scope into the home to make this adjustment?" (By so doing, he could have saved much time and expense and spared the customer the loss of the set while it was in the shop.)

It's really not necessary to know which pin on the jack is the correct test point, since there are only three pins, and the correct one can be determined by trial and error. However, the schematic in Fig. 2 shows that the test point for the horizontal oscillator waveform is offset from the other two. To prevent loading the circuit and a resultant change of the oscillator waveform, a low-capacity probe should be used with the oscilloscope. If one isn't available, a small ceramic or mica capacitor can be used in series with a standard probe.

Since the horizontal output grid is also connected to one of the test points, the drive trimmer can be adjusted while monitoring the waveform on the output grid. Best operation of the horizontal output tube will be obtained when the slope of the grid waveform is linear and has the least or smallest flat span on its upper portion (see Fig. 3). It goes without saying that there must also be enough sweep to adequately fill the width of the screen. The sweep signal must be linear to prevent the appearance of "drive lines" in the raster.

Philco isn't the only receiver that uses the pulse-width AFC system. In fact, this type of circuit has been incorporated in a great many of the new receivers because its operation is stable and only one tube is required for the oscillator and control stages.

No Test Jack Available

Of course, not all TV receivers have a test jack for use when adjusting the horizontal frequency and phasing slugs. Neither do all sets have both frequency and phasing adjustments accessible from the top of the chassis. Even so, it is still a simple matter to remove the chassis bolts and knobs, slip the chassis out of the cabinet and make the phase adjustment. Fig. 4 shows a technician making this adjustment on a home call. Remember, this procedure will save the time which would otherwise be spent traveling to and from the shop.

In some newer receivers, vertical chassis are used, and it may be necessary to remove the cabinet to make the adjustments; but the cabinet would have to be removed in the shop anyway, so you still save a lot of time. Explaining the necessity for these adjustments and the advantages the customer gains by your making them in the home will do much to eliminate any possible complaint about charges.

Proper phase adjustments can be made only if an oscilloscope is carried on service calls. Since a certain amount of jostling will be given an instrument carried in the service vehicle, and since a broad frequency response is not required in the scope used for this purpose, a small inexpensive unit should serve very well. Its initial expense can be quickly charged off against the time saved in using it.

Test-Lead Jungle

When test leads are allowed to hang from equipment on a shelf and lay on the work bench, they can become tangled with tools or with a TV set itself. If this should occur, there is a danger that some of the equipment may be dragged from the bench and broken.

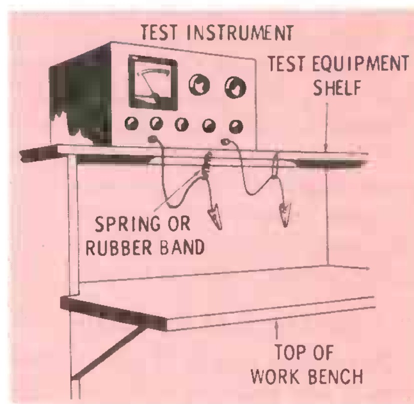


Fig. 5. Test leads on springs.

A very effective remedy for this problem is illustrated in Fig. 5. One end of a light-weight spring or rubber band about 12" long is fastened to the edge of the shelf. The other end of the spring is fastened to the test lead about ⅓ of its length away from the instrument. The author has found that this arrangement works very well for his particular bench; but since the height of a shelf over a work bench may vary, best results in your case may be obtained with different spring lengths and different connection points along the test lead. This hook-up may also be employed for the AC cords of soldering irons or guns used on the bench. ▲

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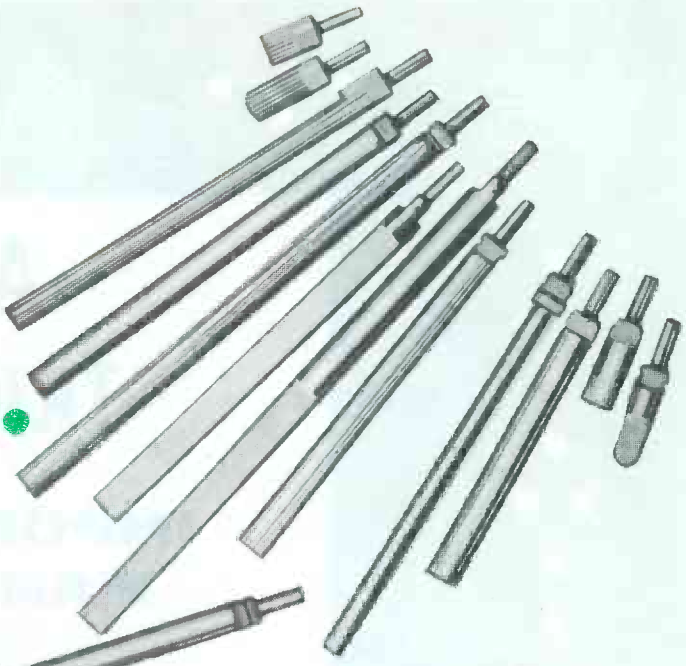

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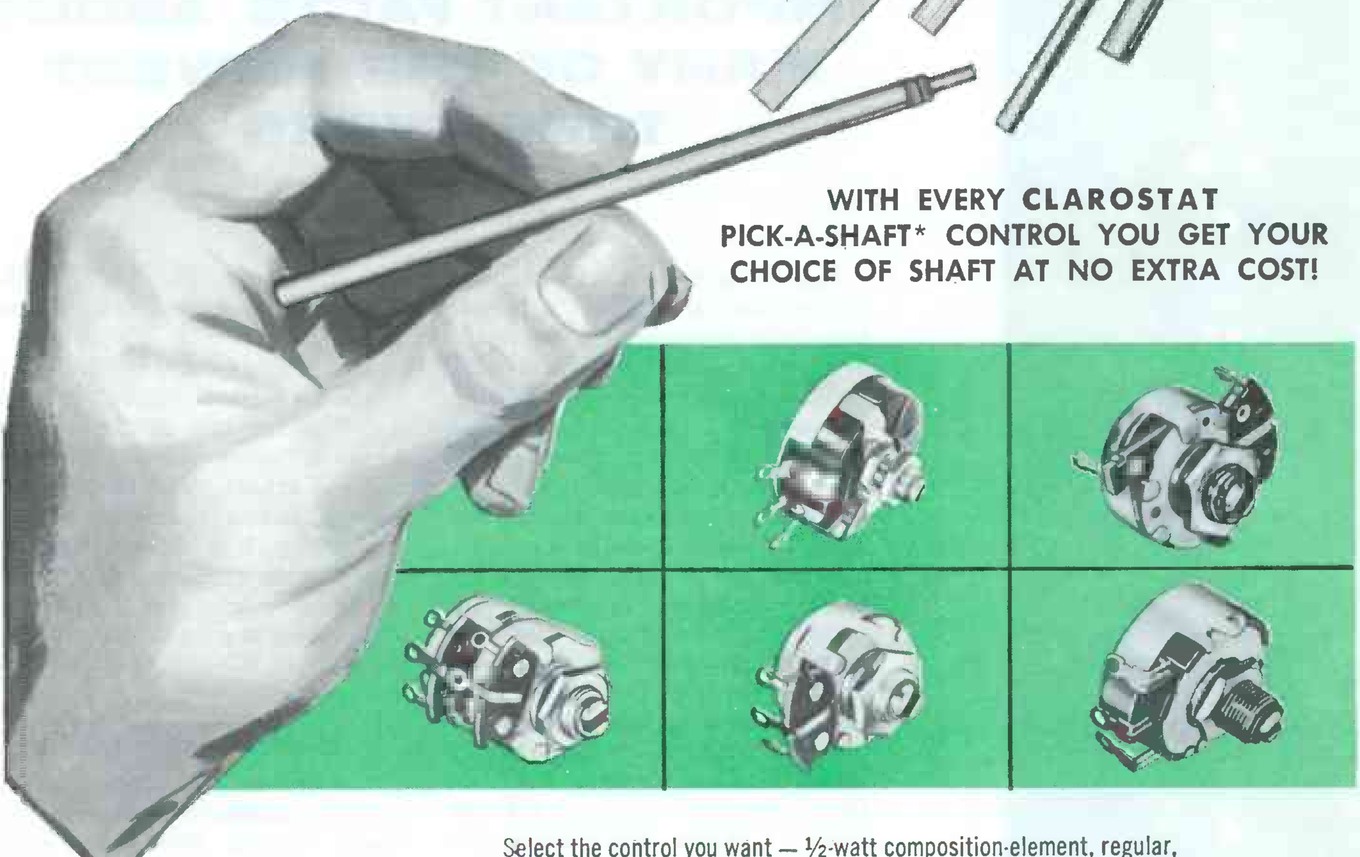

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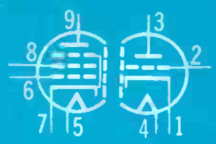
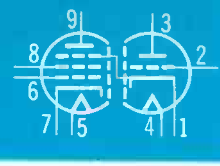
□ 5AV8

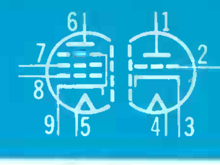


□ 5B8



6AN8

□ 5AN8 △ 6AN8A



A GALLERY OF TRIODE/PENTODES

IMPORTANT FACTS ABOUT MANY OF THE NEWEST TUBE TYPES

by Thomas A. Lesh

Squeezing both a triode and a pentode into a single 9-pin miniature tube envelope is not exactly a new idea; the 6U8 and 6X8 oscillator-mixer tubes are triode/pentodes that have been with us for several years. However, it wasn't until 1954 that the industry, spurred by a new demand for color TV sets containing a reasonable number of tubes, took an intensive interest in developing tubes with two or more separate sections powered by the same heater. Among the many new multi-purpose tubes evolved were triode/pentodes such as the 6AN8 which was extensively used in RCA Victor's original CT-100 color TV chassis. Such tubes also proved useful in black-and-white receiver design, making it possible to produce smaller, lighter, less expensive chassis with lower power requirements.

Demand for these two-in-one tubes has led to refinements in their design. Unfortunately, this has meant that a large assortment of new types has piled up so fast that the serviceman has hardly had time to get familiar with the distinctions between the different types.

The majority of these tubes are made in two or three different versions for use in the various kinds of heater circuits. Throughout this article, those designed for 600-ma heater operation will be marked with a square, and the new 450-ma versions will be designated by a triangle. If no reference mark is shown, the tube has a standard 6.3-volt, parallel type heater.

Oscillator-Mixer Tubes

The earliest TV applications of triode/pentodes were in oscillator-mixer circuits. The two original tube types in this category, the 6U8 and 6X8, are still in wide use, and various modifications of both types have been developed.

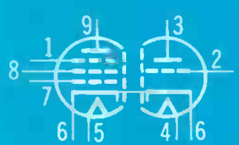
6U8

□ 5U8 △ 6U8A

The "U" in this type number might well stand for "Useful" or "Universal," for this tube is now

6X8

□ 5X8 △ 6X8A

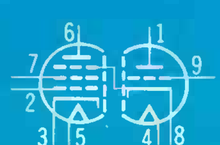


6U8

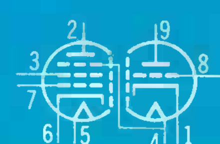
□ 5U8 △ 6U8A

6AX8

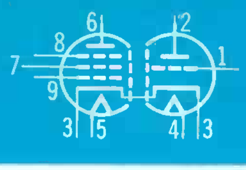
△ 6CR8



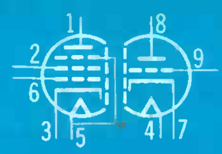
6CH8



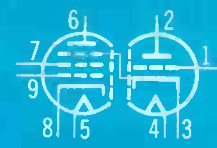
6AT8
□5AT8 △6AT8A



6AZ8



6BE8
□5BE8 △6BE8A



being employed in many circuits besides those for which it was originally designed. It is capable of operating in the IF, video, sound, AGC and sync sections of the TV receiver, and many manufacturers are now choosing to utilize it in one or more of these applications.

A few of the characteristics of typical operation of the –U8 group are as follows:

	Pentode	*Triode*
Plate voltage	250	150
Cathode resistor	68	—
Transconductance	5200	8500
Mu	—	40
Cutoff*	–10	–12

* Cutoff is the value of control-grid voltage at which the plate current will be equal to 10 microamperes if the tube is being operated with the specified value of plate voltage.

Three groups of tube types very similar to the 6U8 have been developed. In two of these, the major difference is a change in the base arrangement. These changes most probably arose from a lead dress problem which would have been a source of difficulty in certain new tuner designs if a regular 6U8 had been used.

6AX8

This seldom-used tube is identical to the 6U8 except that the pentode has a slightly lower transconductance and a 120-ohm rather than 68-ohm cathode resistor is recommended. The base is the same as for the 6U8.

6BE8

□ 5BE8 △ 6BE8A

Except for different base arrangements, interelectrode capacitances are about the only electrical differences between these tube types and the –U8 design. Note that the suppressor grid of the pentode in the –BE8 group is internally connected to the cathode of the triode. There is a logical reason for doing this. In a 9-pin triode/pentode with separate cathodes for the two sections, the elements number one more than the pins; so the suppressor must be connected internally to some other element. Ordinarily it can be tied to the cathode of the pentode, but suppose you wish to use the pentode as an IF amplifier with an unbypassed cathode resistor. The suppressor must then be returned to ground so that the degenerative feedback voltage present on the cathode will not be on the suppressor also. An easy way of making this ground connection is to ground the cathode of the triode (feasible if this section is a VHF oscillator or sync stage) and to link this cathode to the suppressor.

6BR8

□ 5BR8

This group is just like the –U8 type electrically, but has still another basing arrangement, again for reasons of lead dress in tuners.

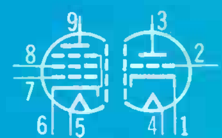
6X8

□ 5X8 △ 6X8A

This is the second of the two older types of mixer-oscillator tubes. Notice that this type has a common cathode for the two sections, and a separate pin connection for the suppressor grid. Here are some typical operating characteristics:

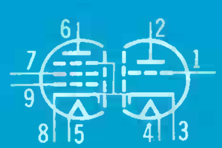
	Pentode	*Triode*
Plate voltage	250	100
Cathode resistor	200	—
Transconductance	4600	5800
Mu	—	40
Cutoff	–10	–10

□ 6AU8 □ 6BA8
△ 8AU8 □ 6BA8A
△ 8BA8A

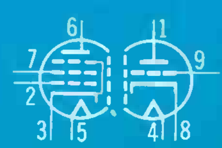


□ 6AW8
□ 6AW8A □ 6BH8
△ 8AW8A △ 8BH8

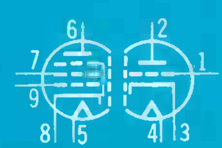
6CG8
□ 5CG8 △ 6CG8A



△ 6CM8 △ 6CS8
□ 5CM8



6BR8
□ 5BR8



By the way, these plate voltages are not hard-and-fast requirements; but the other characteristics were determined with these voltages applied.

6AT8

☐ 5AT8 △ 6AT8A

This group is like the –X8 electrically, except for minor differences in cathode resistor and input and output capacitances, but the basing is considerably different.

6CG8

☐ 5CG8 △ 6CG8A

A newer revamped –X8 design, the –CG8 group has a common cathode for the two tube sections and has two cathode pins to minimize lead inductance at VHF. Since there is no longer a pin available for the suppressor, it is internally connected to the cathode. Electrical specifications, except capacitances, closely match those of the –X8 group.

General-Purpose Types

To call the following tubes "general-purpose" is no understatement. The pentodes are usable as video and sound IF amplifiers, video output tubes, AGC keyers, and tubes in various chrominance stages. The triodes find use as sync separators and audio amplifiers, as well as chrominance tubes.

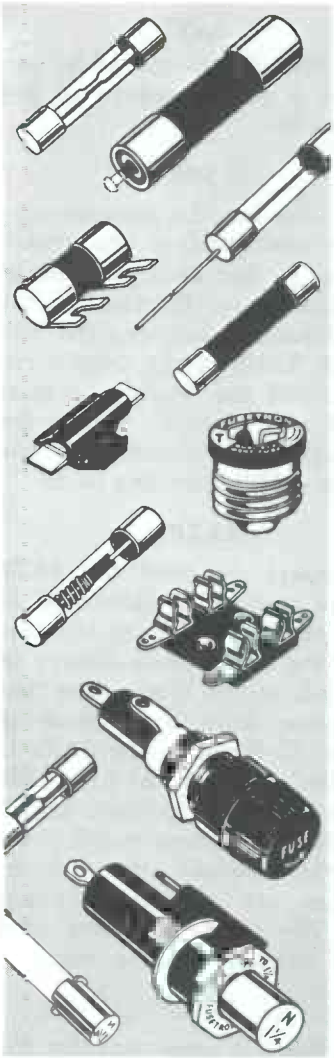
6AN8

☐ 5AN8 △ 6AN8A

This group is the earliest development of the general-purpose types. Some of its characteristics are shown below. Note the similarity of the pentode section to the popular 6CB6.

	Pentode	*Triode*
Plate voltage	200	200
Cathode resistor	180	—
Transconductance	6200	3300
Mu	—	19
Cutoff	–8	–19

Several variations of the –AN8 design, but differing from it in base connections, have been developed. Most of the changes involve the question brought up earlier: What to do with the suppressor grid?



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☐ 5AV8

This tube is like the 5AN8 except for a rearrangement of pin connections.

☐ 5B8

This tube has the pentode suppressor connected to the triode cathode, in the same manner as the –BE8 group. Electrically, the main difference between the 5B8 and the 5AN8 is the output capacitance of the triode—1.4 mmf instead of 0.27 mmf. Except for the suppressor connection, the 5AV8 and 5B8 have like bases.

6AZ8

Engineers designed the 6AZ8 with its suppressor connected to heater pin 5. Needless to say, this side of the heater must always be grounded, so this is one tube that will never have a series-string version. Electrically, the 6AZ8 is very similar to the 6AN8, but the control grid of the pentode has an unusual semi-remote cutoff characteristic, whereas other triode/pentodes are all sharp cutoff types. The 6AZ8 has been used mainly in color TV receivers.

6CH8

The 6CH8 is somewhat like the 6AZ8, but the opposite heater connection, pin 4, is the tie point for the suppressor. In addition, the 6CH8 has a sharp-cutoff pentode section. All base connections differ from those of the 6AZ8.

6CM8
☐ 5CM8

These recently developed tubes have a pentode section electrically like that of the –AN8 types, but the triode is a new unit with a mu of 100 and a transconductance of 2000 micromhos—quite different from the –AN8 triode!

The following four tube groups all have the same base connections, but are quite different electrically. Compare their characteristics:

☐ 6AU8
△ 8AU8

	Pentode	*Triode*
Plate voltage	200	150
Cathode resistor	82	—
Transconductance ...	7000	4900
Mu	—	40
Cutoff (20 μa)	–6.5	–8

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□ 6BH8

△ 8BH8

The pentode is almost identical to the –AU8, but the triode is completely different, having a mu of 17 and a transconductance of 3300 micromhos.

□ 6AW8

□ 6AW8A △ 8AW8A

Both "A" versions in this –AW8 group differ from the original in having a controlled-knee plate voltage characteristic for better operation at low plate supply voltages. Notice the differences between the following –AW8 specifications and those which were listed above for the –AU8 group.

	Pentode	*Triode*
Plate voltage	200	200
Cathode resistor	180	—
Transconductance	9000	4000
Mu	—	70
Cutoff	–10	–5

□ 6BA8

□ 6BA8A △ 8BA8A

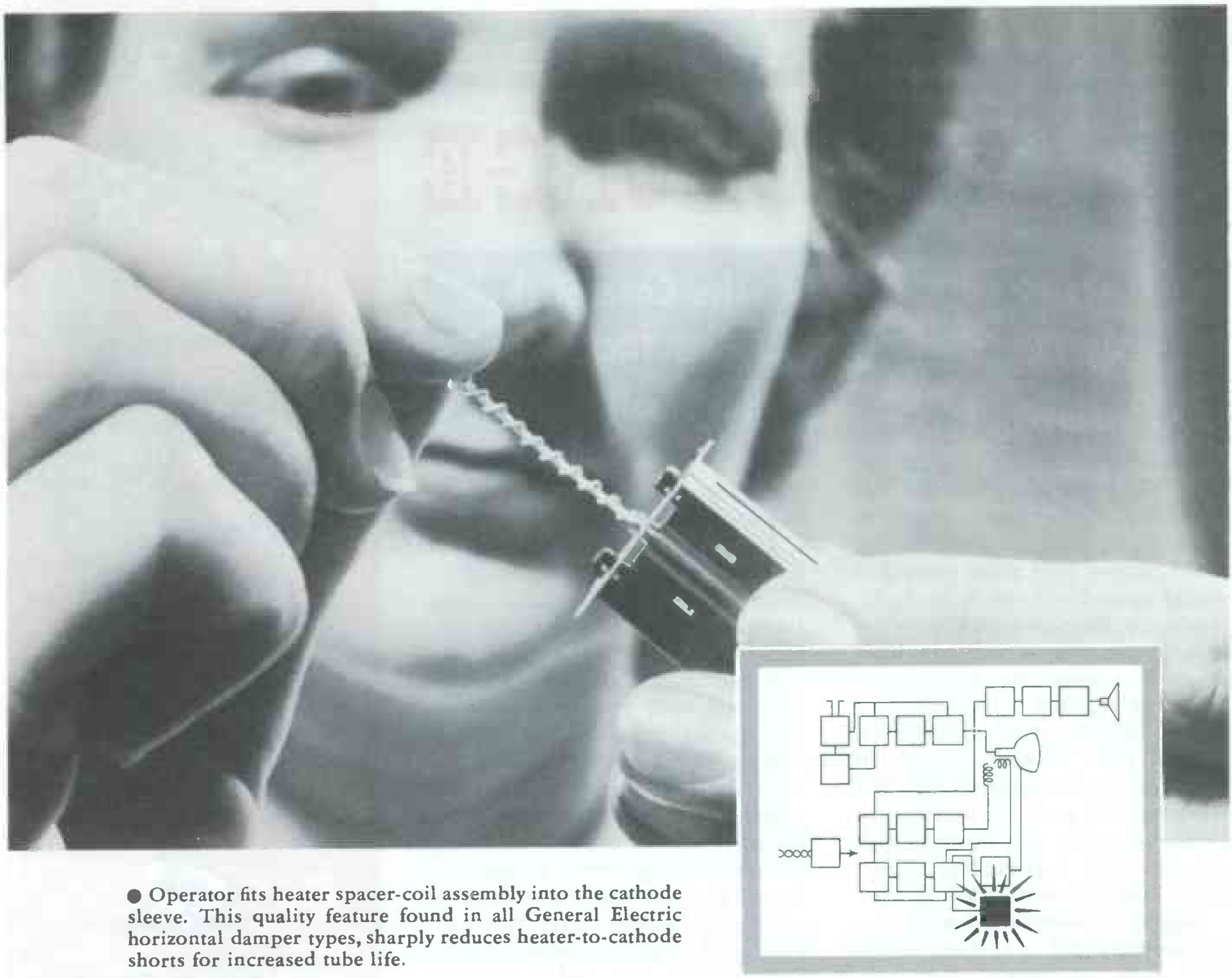
The pentode specifications of the –AW8 group apply also to the –BA8 group. This pentode design is especially suitable for video output stages because of its high transconductance. Like the –AW8A types, the "A" versions of the –BA8 design have a controlled-knee plate characteristic in the pentode. The triode section of any –BA8 tube has a mu of 18 and a transconductance of only 2700 microhmos; contrast these figures with the corresponding data for the –AW8 triode.

△ 6CR8 △ 6CS8

These very-recently-introduced tubes are identical electrically but differ in their basing. Typical characteristics are:

	Pentode	*Triode*
Plate voltage	125	125
Cathode resistor	56	—
Transconductance	7700	4000
Mu	—	22
Cutoff	–6.5 (20 μa)	–13 (10 μa)

With their 450-ma heater rating and low plate voltage characteristic, these last two tubes are well suited for efficient use in small, light TV sets lacking a voltage doubler in the B+ supply. ▲



● Operator fits heater spacer-coil assembly into the cathode sleeve. This quality feature found in all General Electric horizontal damper types, sharply reduces heater-to-cathode shorts for increased tube life.

High quality spacer-coil design cuts heater-cathode shorts, reduces G-E horizontal damper tube failures!

IN all General Electric horizontal damper tubes, a spacer coil permanently centers the heater in the cathode sleeve. This increases electrical insulation between heater and cathode and greatly lessens possibility of heater-to-cathode shorts, the largest single cause of horizontal-damper failure.

Other quality features of General Electric horizontal damper tubes further promote long-life, superior service. Micas are sprayed and slotted to reduce electrical leakage, and improved, highly adhesive cathode coating guards against plate-to-cathode arcs.

Testing is thorough. *All* General Electric horizontal dampers are flyback tested at maximum rated voltages. And, to protect full-life performance under extreme current loads, the tubes are life-tested in actual circuits reflecting severe usage.

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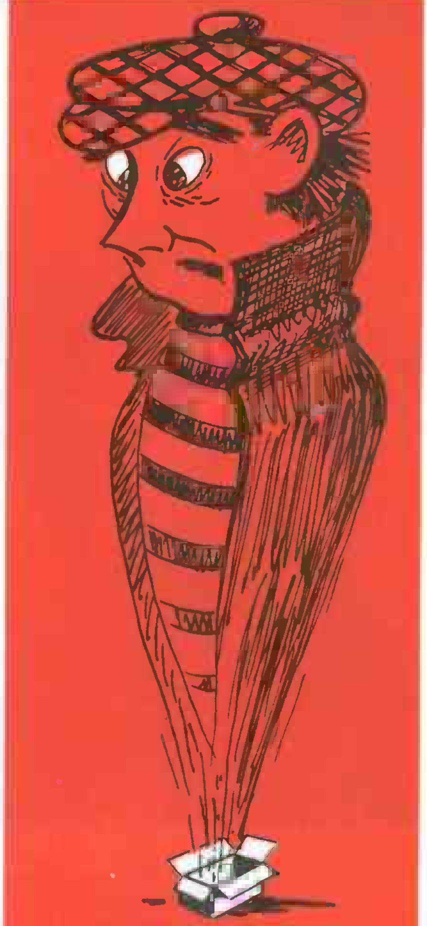
trouble shooting with GEORGE

The Case of the BIG TROUBLE in a Small Package



by Leslie D. Deane

Well, it's been a while since we last looked in on George Fleiback, chief investigator for a thriving new radio and TV service shop. This time, we find George confronted by a problem brought on by his first encounter with a portable transistor radio. Early this morning, it seems, a gentleman walked into the shop with one in his hand and complained that he could just barely hear one local station with the volume control turned up all the way.

The first thing to flash into George's mind was that the trouble might be just a weak battery. He knew that he did not have any of the newer types in stock, so he told the customer he could not get to it right away but would probably have it ready by tomorrow. Being agreeable by nature, the customer left the little set on the counter and walked out.

George was not completely lost on the subject of transistors, for he had read several articles on their theory of operation and had also attended a service meeting on transistor radio repair. Still, this was his first opportunity to actually work on one in the shop.

Eager to investigate the transistor circuitry and to test his detective skill in virgin territory, George immediately removed the chassis from its small plastic case.

The most frequent cause of portable radio failure is a weak or dead battery. Realizing this, George decided to check the battery voltage first. The battery in this particular set was a small 22½-volt unit mounted between two spring clips on the printed wiring board. George knew the only accurate way to test battery voltage is under load conditions. Turning the set on and verifying the symptom described by the customer, he then measured directly across the battery clips. The possibility of an early solution to the case quickly vanished as George

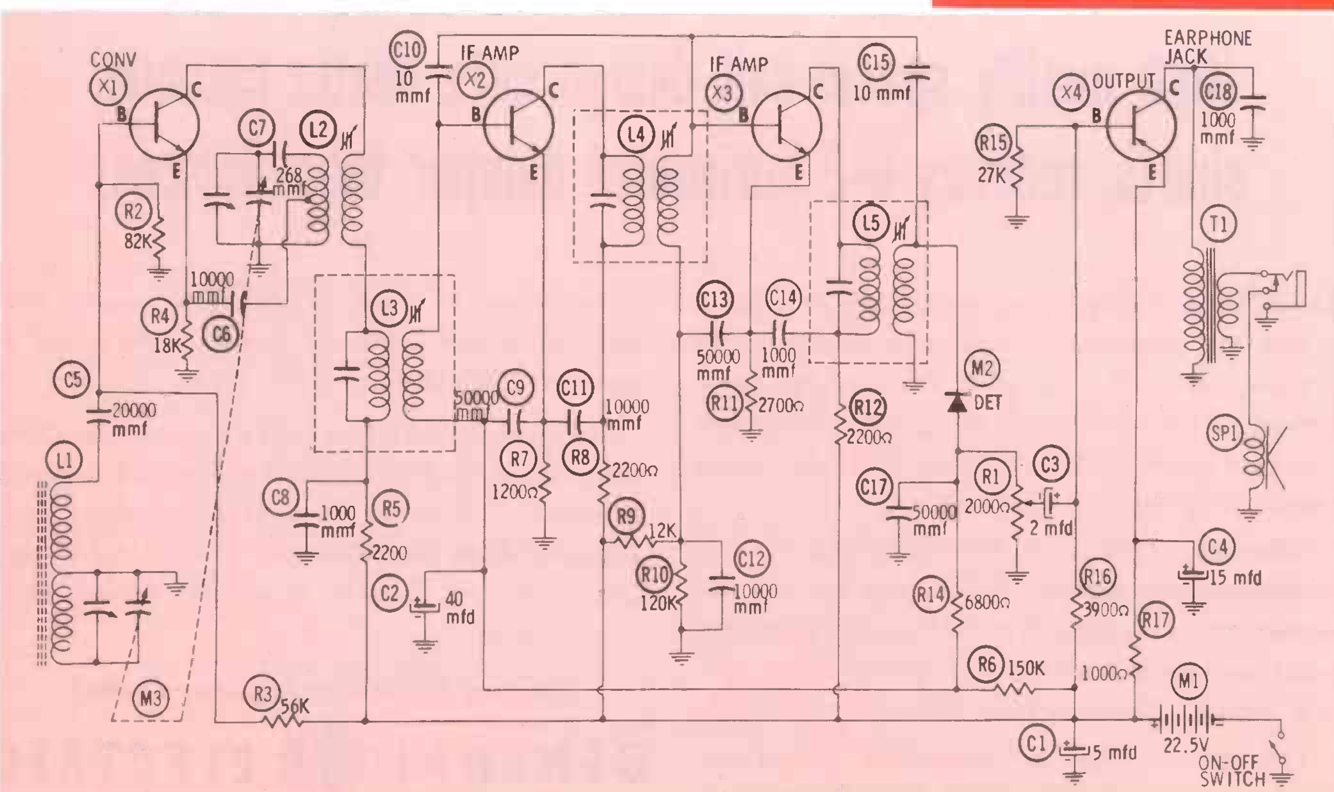
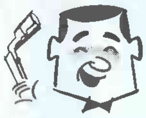


Fig. 1. A complete schematic of the transistor portable radio which was George's problem.

JOBBER SAM: If it's profit you want, get 'em "off the beam"!

DEALER DAN: Huh?



JOBBER SAM: The 120° *sound dispersion* and quality of Electro-Voice CDP® P. A. installations really satisfies customers, sparks your profits!

DEALER DAN: Tell me more, man!

JOBBER SAM: Well it's like this: Conventional P. A. horns throw a hard, straight sound beam, much like this garden hose. See how it concentrates power but sacrifices coverage! The Electro-Voice CDP speakers cover a broad area like the garden hose with a spray nozzle shown in Fig. 2.

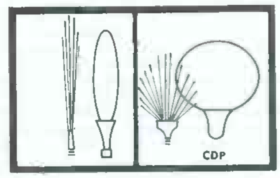


FIG. 1 FIG. 2

ELECTRO-VOICE: Excuse me. *Model 848 CDP* handles the biggest jobs. 25 watts, 16 ohms. Response: 175-10,000 cps, crossover at 1000 cps. Sensitivity rating, 52 db. Size, 10½" x 20½" x 20". Wt., 12 lbs. List, $75.

Model 847 CDP for smaller areas. 12 watts, 16 ohms. Response: 250-10,000 cps, crossover at 1500 cps. Sensitivity rating, 51 db. Size, 11¾" x 7¾" x 10$\frac{1}{32}$". Wt., 6½ lbs. List, $46.33.

DEALER DAN: Great! Great! How about an all-around P. A. Microphone?

JOBBER SAM: Electro-Voice has the mike to do the job. In fact, the E-V Model 664 High-Fidelity Cardioid Dynamic is so good that Electro-Voice GUARANTEES it to outperform any other P. A. cardioid or your money back. Model 664 with unique E-V Variable D® gives you amazing versatility. It provides highly directional sound selectivity, smooth, peak-free response at *all* frequencies from 40 to 15,000 cps, no boominess. Exclusive, indestructible Acoustalloy diaphragm assures dependable, long-life operation indoors and outdoors. It lists for only $82.50 (less stand).

DEALER DAN: Don't say another word—I'll place my order NOW.

JOBBER SAM: You'll make nothing but money, money . . .

Get the complete story, write for the CDP Handbook and ABC's of Microphones

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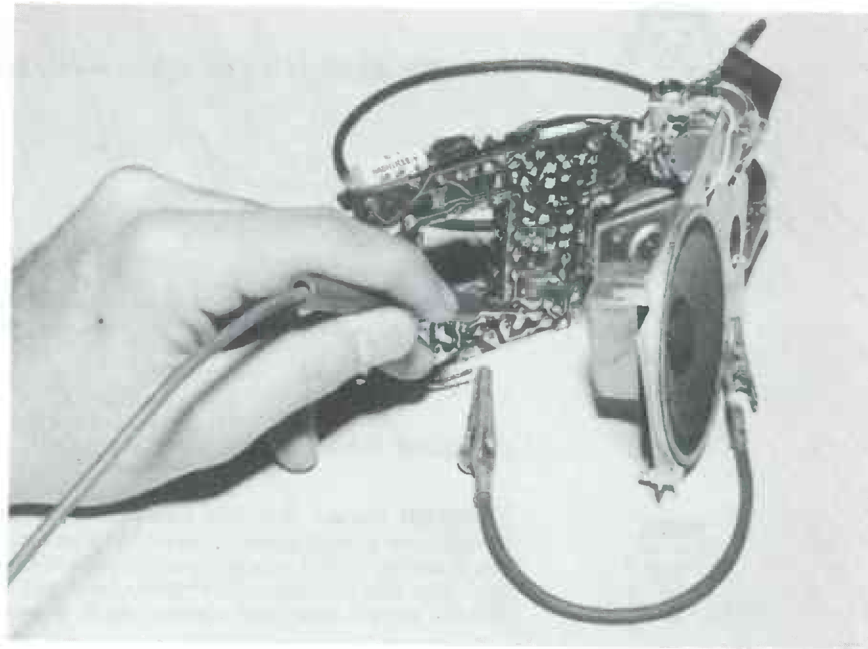

Fig. 2. It was necessary for George to disassemble part of the radio before he could service the miniature chassis.

found the battery voltage to be perfectly normal.

"Let's see now," he thought. "My tube checker will test transistors—but from what I have gathered, transistors are not likely to cause trouble. Besides, each one is soldered in the circuit, and it would take some doing to remove them."

Since George was not too familiar with transistor circuitry, he planned to make use of some service information before going any further. From his literature files he pulled out the folder covering the set, turned to the schematic (Fig. 1), and sat down to study it for a moment.

George thought he would follow a logical procedure by tracing a signal through the set, thus detecting the faulty stage or stages. Firing up his signal generator, he located the output transistor where he intended to inject an audio signal into the base element. Due to the radio's compact design, however, George found it impossible to reach various test points from the top side of the small printed wiring board. Examining the set more closely, he realized that it would be necessary to separate the speaker panel from the main chassis in order to expose the wiring side of the board. To accomplish this, he removed three small screws securing the panel to the tuning gang, straightened two twisted studs which penetrated the wiring board at the opposite end, unsoldered a ground lead from the panel, and carefully pulled the speaker assembly away from the main chassis. In order for the receiver to operate, he also found it necessary to ground the speaker panel and tuning gang with two clip leads as pictured in Fig. 2. After going to all this trouble, George was certainly aware of the complexities connected with servicing transistor portables.

Proceeding with the signal-tracing approach, he reduced the generator output to minimum and connected its leads to the base element of the output transistor X4 and chassis ground. As he slowly increased the generator output, a clear audio tone came from the speaker. This development indicated that the audio output circuit was not harboring the criminal.

In order to check the operation of the IF stages, George set the generator to the receiver's intermediate frequency modulated with an audio signal. Using the generator's RF output cable, he applied the signal to the base element of the second IF amplifier X3. George placed his ear near the speaker and slightly varied the RF frequency of the generator, but the audio tone was not present. As he was about to turn

up the generator gain control, he suddenly remembered that transistor circuits are very delicate and that he might damage something if the signal were too strong. He also knew that if the set were operating properly, the tone would come through loud and clear without increasing the output level of the generator.

Recognizing this as a pertinent clue, George quickly picked up his voltmeter leads and made a few measurements in the second IF amplifier circuit. The voltage readings he obtained at the base, collector, and emitter elements were all within tolerance of those prescribed in the service literature. While the meter was handy, he also proceeded to check voltages applied to the output transistor. Here again, however, he found them perfectly normal.

A little puzzled, George straightened up from his work and once again examined the schematic diagram. "Maybe it's that crystal detector," he said to himself. "I know—I'll feed in an audio signal at its output." Putting his belated thought to action, George placed the audio output probe of the generator on the junction of M2 and R1 in Fig. 1. He could hear no tone from the speaker, so once again he applied the test signal to the base of the output transistor and just as before the tone was loud and clear.

The investigation had now narrowed the case down to only a few suspects. George was reasonably sure that the criminal had to be hiding somewhere between the detector output and the input of the audio stage. Systematically closing in on the suspected components, he turned the set off and measured the DC resistance of the volume control. This was a blind alley for he found the control in good condition. He then checked the 6,800-ohm resistor R14, which also measured its indicated value.

"With normal voltage at the base of the output stage," George thought, "that leaves only the coupling capacitor C3. I wonder why they use an electrolytic in this application?" The answer to this question and a final solution to the case can be found on page 67. ▲

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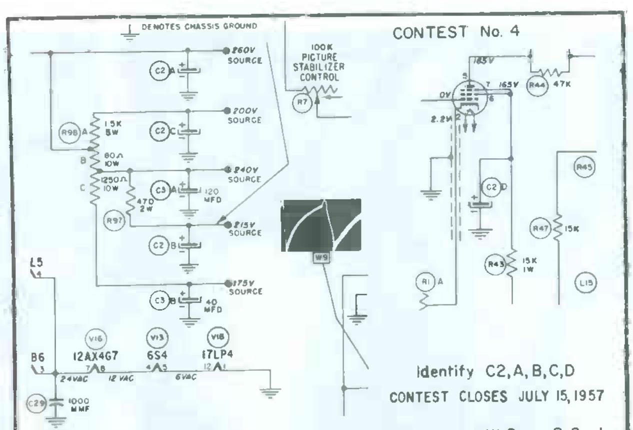

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JUDGES: M. Harvey Gernsback, editor director, Radio-Electronics
Oliver Read, Dsc, publisher, Radio & Television News
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HELPFUL HINTS

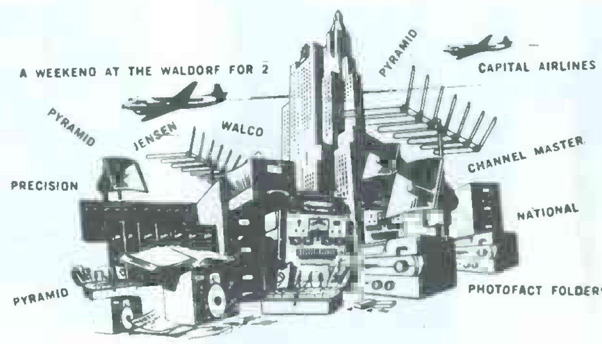
The unidentified capacitor in each entry will be a Pyramid Twist-Mount. All schematics are of TV sets made in the U. S. by a known manufacturer within the past 2 years.

Schematics for reference may be those published by the TV set manufacturers, Howard Sam's Photofacts, or by any other accepted publisher. You may enter as often as you like but be sure to include a box top (showing stock number) of any Pyramid Twist-Mount Capacitor, with your letterhead or business card with each entry.

WHO MAY ENTER

Any Radio-TV serviceman or employee of a Radio-TV service company may enter. Officers, employees, (members of their families) of Pyramid Electric Co. or its advertising agency are not eligible to enter the contest. All entries are limited to residents of the continental U. S. over 21 years of age.

All entries become the property of Pyramid Electric Co., none will be returned and the decisions of the judges are final. In case of ties, duplicate prizes will be awarded. This contest is subject to all federal, state and local laws and regulations.



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Pyramid Twist-Mount Contest, Dept J
Pyramid Electric Co.
P.O. Box 655, Tyler Park Station, North Bergen, New Jersey

Entry No. (1) (2) (3) (4)—(check one)—Is: Pyramid stock No.________

Twist-Mount values________

Set manufacturer's name________ TV set model No.________

I enclose a box top (indicating stock number) of any Pyramid Twist-Mount Capacitor together with my business card or letterhead or my employer's).

Contestant's name________ Position________

Contestant's address________

City________ Zone____ State________

Employer's Firm name________

Employer's address________

City________ Zone____ State________

My jobber's name and address________

ENTER AS OFTEN AS YOU LIKE—FOR ADDITIONAL ENTRY BLANKS SEE YOUR JOBBER.

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alignment of chrominance bandpass amplifiers

by Robert G. Middleton

Alignment of the chrominance bandpass amplifier is one of the basic jobs confronting the color-TV service technician. The purpose of the bandpass amplifier is to separate the chrominance component of the complete color signal from the luminance (Y) component, as shown in Fig. 1. How well it does this job depends upon how well the associated tuned circuits are aligned.

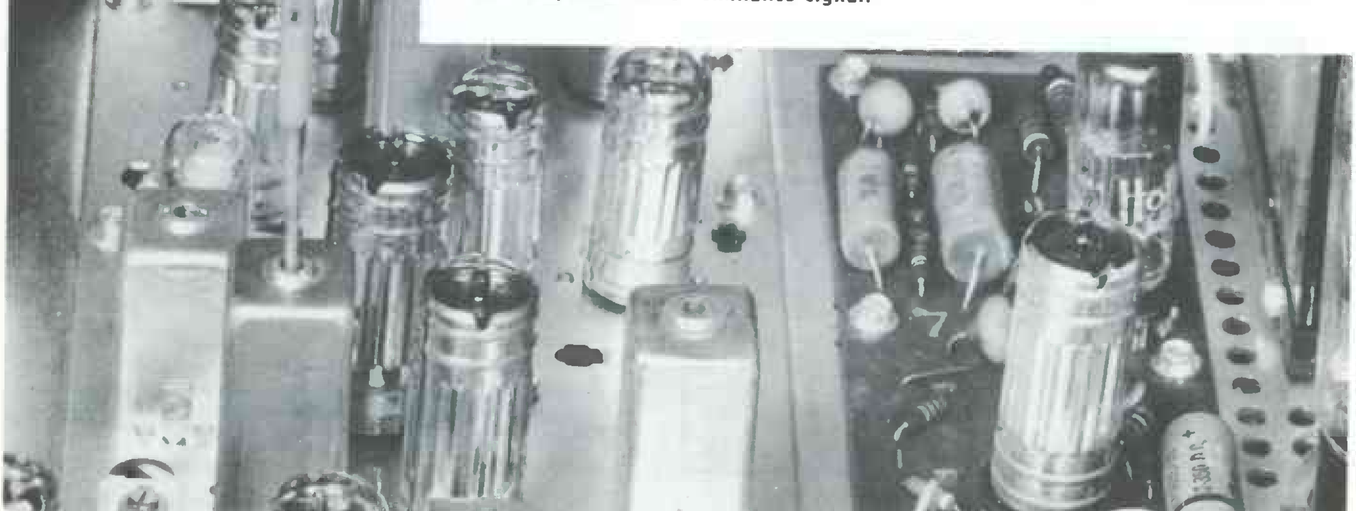
The luminance signal contains important frequency components from 60 cps to 3.5 mc. On the other hand, the chrominance signal contains important frequency components from 3.1 to 4.1 mc. Separation of the chrominance and luminance signals is accomplished, accordingly, through the use of frequency-response characteristics such as illustrated in Fig. 2. Although the curves shown in Fig. 2 are typical, they do not represent the exact shapes and bandwidths used in all color-TV receivers. Receiver service manuals must be consulted for these details.

Test Setup

The basic test setup for bandpass amplifier alignment is shown in Fig. 3. The output from a sweep-marker generator is applied to the input of the bandpass amplifier, and the output of the bandpass amplifier is in turn applied to the vertical-input terminals of a scope through a demodulator probe.

The marker frequency should be variable over the band from 2 to 4.5 mc, and the sweep output should be flat over the same range. The demodulator probe is used to develop the wave envelope of the response curve in standard form, and the scope need not have wide-band response in this application.

The scope should be deflected horizontally with 60-cycle sine-wave voltage which is adjustable in phase. Sometimes the scope has this facility built in, and some



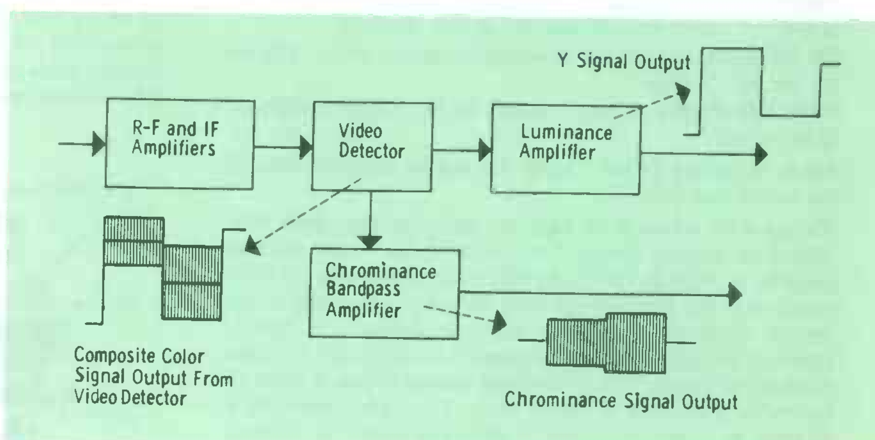
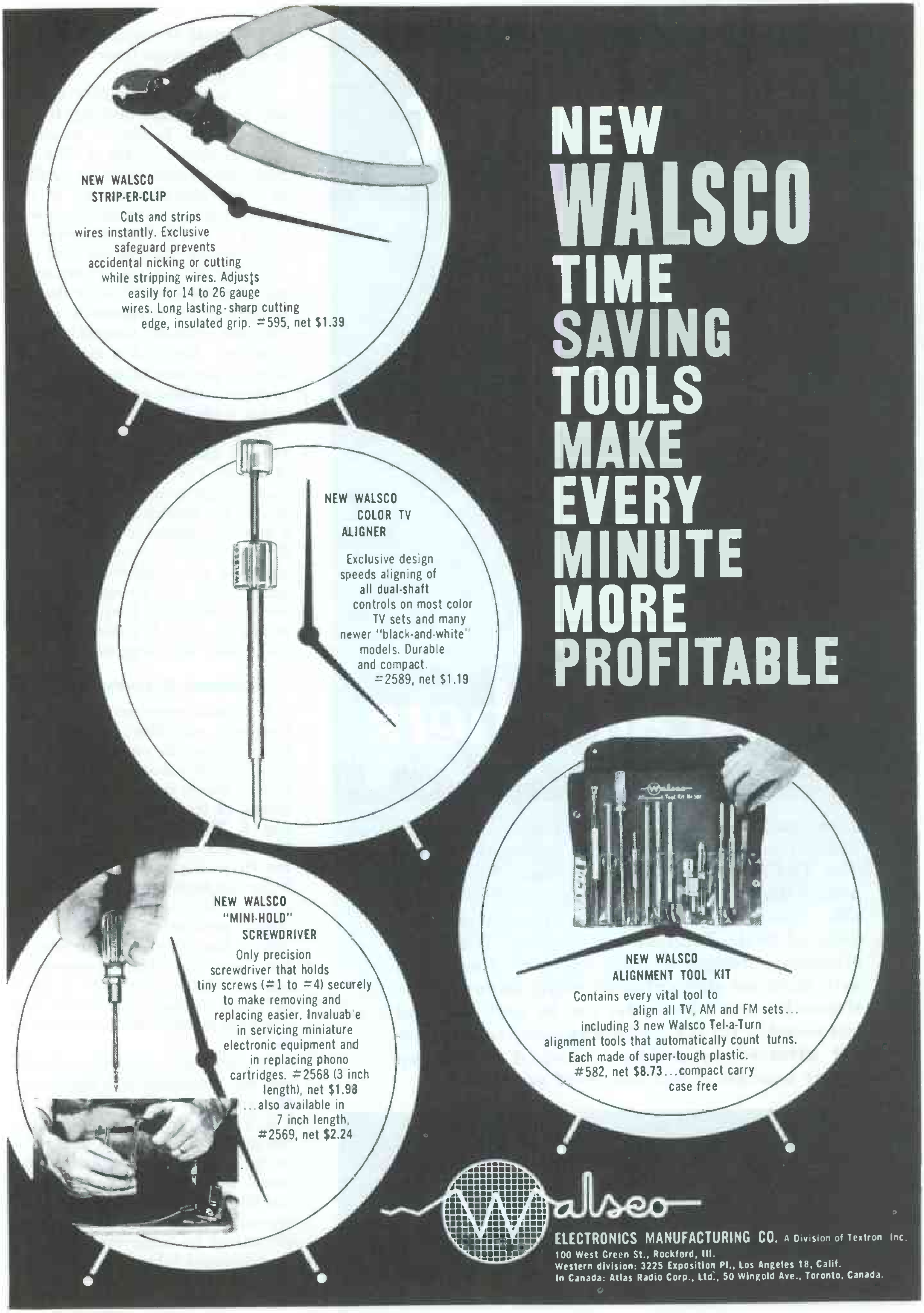


Fig. 1. The composite color signal is applied to the chrominance bandpass amplifier and to the luminance amplifier. The bandpass amplifier rejects the luminance signal and amplifies the chrominance signal.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scopes must obtain the horizontal deflection voltage from the sweep generator.

The sweep and marker signals are often applied directly to the grid of the bandpass amplifier tube, as shown in Fig. 4. The demodulator probe must be applied at a low-impedance point in the output circuit of the bandpass amplifier so that the input impedance of the scope will not load the circuit and thus cause distortion of the response curve. The probe can be applied advantageously across the color-intensity control in many receivers. Again, it is essential to consult the service notes for the receiver, unless you are very familiar with this type of test work.

Ordinary precautions used in general alignment work must be observed. For example, if there is bias voltage present at the control grid of the bandpass amplifier, use a blocking capacitor in series with the generator output cable. The value of this capacitor must be fairly large for sweep-alignment work because the frequencies are relatively low. A 0.1-mfd capacitor should be adequate.

Bandpass Response Curve

A typical response curve for a bandpass amplifier is shown in Fig. 5. When the curve is first displayed on the scope screen, a twin mirror-image response will be obtained at the outset, as shown in Fig. 6. The zero-frequency point is in the center of the display, and the frequency response is accordingly displayed twice. To put the curve into standard form, the sweep generator is tuned to run one of the curves off the end of the base line. The sweep-width control of the generator is then adjusted to make the curve occupy the baseline as illustrated in Fig. 5.

In some cases, noise from the IF and RF amplifiers will appear on the response curve, as seen in Fig. 7. The remedy for this trouble is to pull an IF amplifier tube or to bias the IF amplifier into cutoff. In other cases, pulses from the horizontal sweep circuit may appear on the curve and may be eliminated by removing the horizontal-output tube. Situations will also arise in which cross-talk from the vertical-sweep circuits causes

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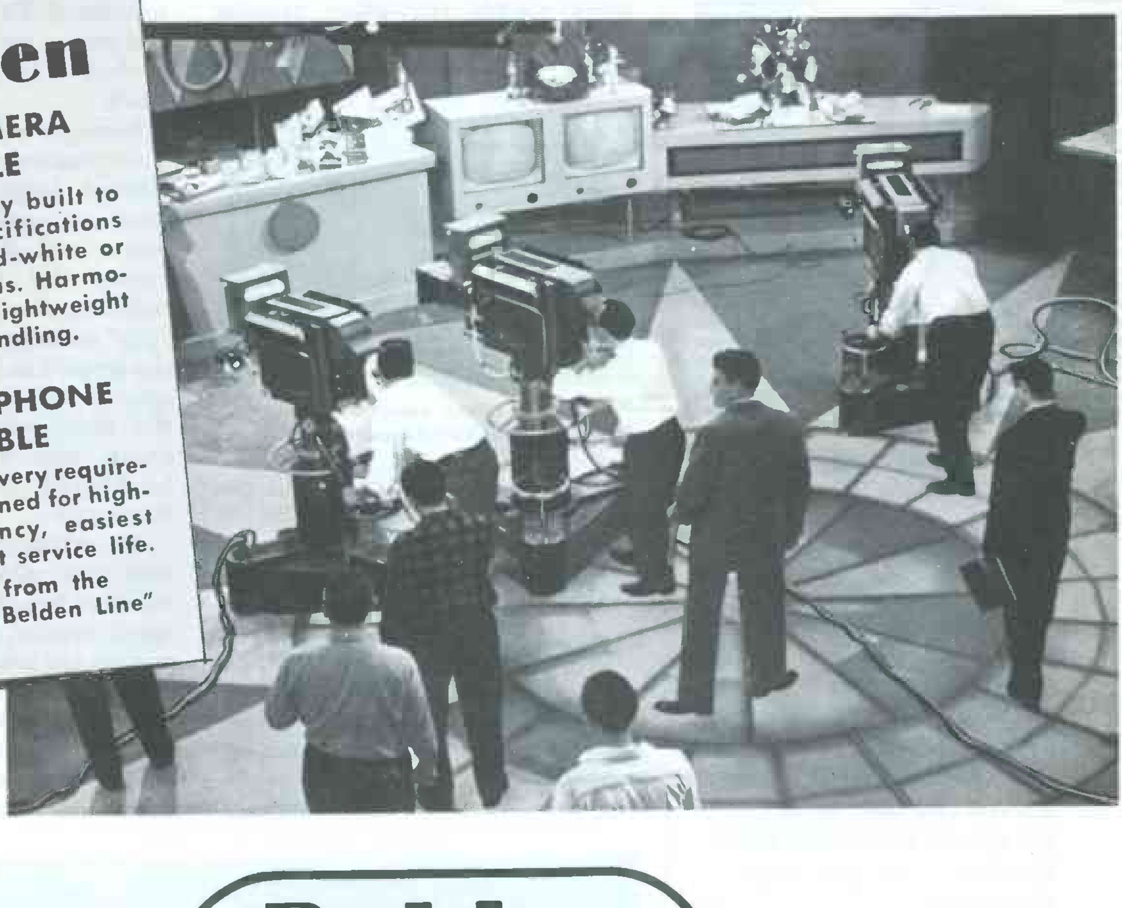

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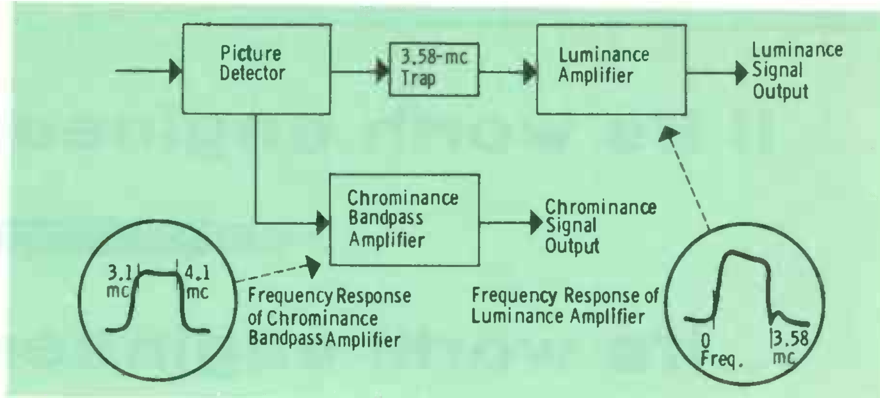

Fig. 2. Typical frequency response curves for luminance and chrominance sections.

a 60-cps pulse to appear at some point along the curve, or to "run" on the curve when the vertical-hold control is not synchronized with the power-line frequency. A spurious signal of this type can be eliminated by pulling the vertical-output tube.

Some receivers may have poor power-supply regulation, causing B+ voltages to rise objectionably when tubes are pulled. In such cases, a suitable wire-wound resistor can be shunted from B+ to ground to restore normal current drain during the alignment procedure.

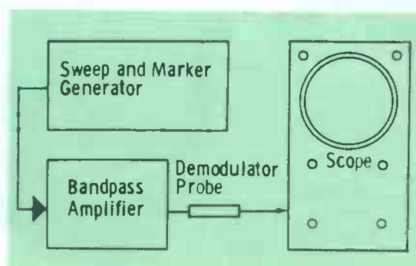

Fig. 3. Basic test equipment setup for bandpass amplifier alignment.

Marking the Response Curve

The response curve can be marked with a beat "bug" marker if desired, just as in IF alignment procedures. Of course, the marking frequency is considerably lower, but the appearance of the marker is the same. Because sweep generators often have appreciable harmonic output in the video-frequency range, spurious markers may appear. If the marker generator also has appreciable harmonic output, more spurious markers may be encountered. To avoid this difficulty, absorption markers are sometimes preferred for bandpass alignment work.

Some sweep generators provide a continuously tunable absorption-marker facility. As the marker tuning control is turned, the operator will observe a "dip," indicating the marker frequency, traveling along the curve. When a "dip" marker is used, be sure that the scope has fairly wide-band response and that the response of the demodulator probe is adequate; otherwise, the "dip" may be filtered out and "wiped off" the curve.

An absorption "dip" marker does not give rise to spurious markers because no marking voltage is applied and no marker harmonics are present. In some cases, minor spurious dips are present due to spurious voltages in the sweep signal, but these are seldom troublesome and usually escape notice. An absorption marker box

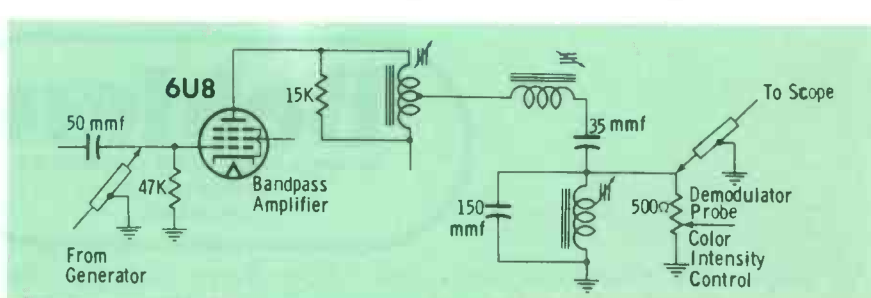

Fig. 4. Typical connection points for generator leads and demodulator probe.

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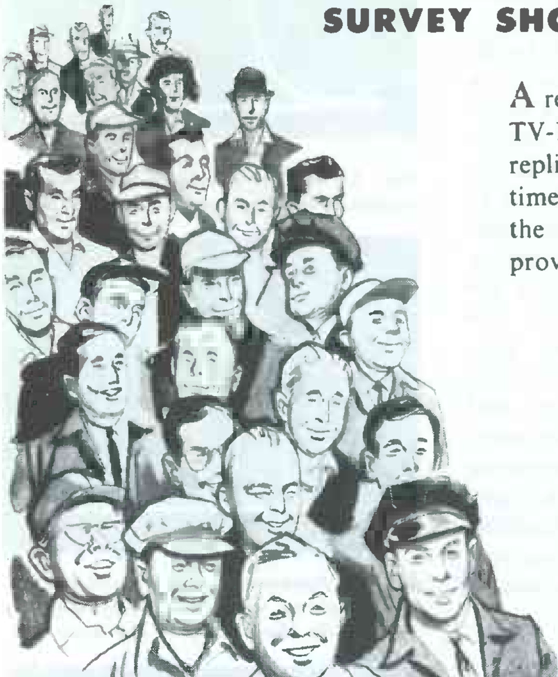
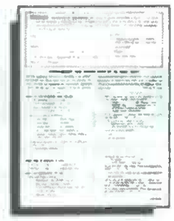


A recent Howard W. Sams survey among the nation's TV-Radio Service Technicians produced over 10,000 replies to an all-inclusive questionnaire. These men took time out to answer over 100 separate questions. Among the many valuable facts disclosed, the following will prove most significant to every Service Technician:



Q. HOW FREQUENTLY DO YOU USE SERVICE DATA IN YOUR WORK?
Answer: Over seven out of ten servicemen (74%) state they use service reference material on all work, including TV, Radio and associated servicing.

Q. WHAT SERVICE DATA DO YOU PREFER?
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COMPLETE Photographic Coverage
Photos of all chassis views are provided for each model (exclusive with PHOTOFACT); all parts are numbered and keyed to the schematic and to the parts lists for quicker parts identification and location.

COMPLETE Tube Placement Charts
Both top and bottom views are shown. Top view is positioned as seen from back of cabinet. Blank pin or locating key on each tube is shown. Charts include fuse location for quick service reference.

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

COMPLETE Tube Failure Check Charts
Shows common trouble symptoms and tubes generally responsible for such troubles. Series filament strings are schematically presented for quick reference.

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City ____________ Zone ______ State ______ may also be used to obtain "dip" markers. These are at spot-check frequencies and are not tunable. Spot checks are usually provided at 2.1, 3.1, 3.58 and 4.1 mc, which are the most important check points.

Traps are often used in bandpass circuits, and these produce a sharp dip in the curve at the baseline level. Of course, it is impossible to mark a trap with a dip marker, and it is often difficult to do so with a conventional beat marker. However, bypass marker injectors (also termed marker adders, or baseline markers) are available. The beat marker supplied by such units does not pass through the receiver circuits, and therefore its size remains the same at any point along the response curve, in a trap, or out on the base line. When you become familiar with bandpass alignment, you will very possibly wish to make use of such a unit.

Shapes of Bandpass Response Curves

There are minor variations in the shapes of bandpass-amplifier response curves for different receivers. The simplest form is flat-topped, representing the bandpass-amplifier response in R–Y/B–Y receivers when the IF amplifier section has a flat response out to 4.1 mc. However, when the number of IF stages is limited and the response is not flat out to 4.1 mc, the curve of the bandpass amplifier is sloped or peaked to provide the necessary compensation for over-all uniform response.

There is another type of IF system that provides what is generally termed "vestigial color-sideband" response, in which the chrominance signal from 3.1 to 4.1 mc falls entirely on the sloping side of the curve. By utilizing a bandpass response with a complementary slope, the over-all gain provided the chrominance signal will be uniform for all sideband frequencies.

Although this latter type of receiver can be aligned section-by-section, some service technicians prefer to use the video-sweep-modulated method of alignment. In this system, a video-frequency sweep signal is used to amplitude modulate a CW signal in the RF range. The combined signal is applied to the antenna-input terminals of the receiver. The demodulator probe is applied, as before, at the output of the bandpass amplifier, and the scope display then shows the over-all RF, IF and bandpass-amplifier response.

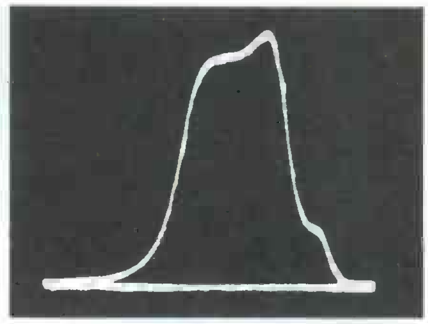


Fig. 5. Typical bandpass amplifier response curve displayed in standard form.

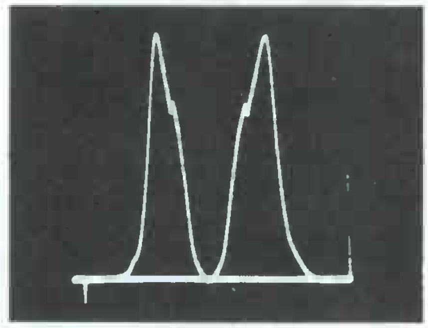


Fig. 6. Appearance of a bandpass response curve when the zero-frequency point is in the center of the base line.

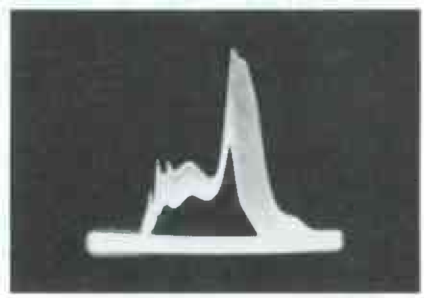


Fig. 7. Spurious noise or sweep voltages may appear on the response curve.

The video-sweep-modulated test is particularly useful in final checks to determine whether the three signal sections of the receiver are properly working together as a team. Small compromise adjustments can be made through the various circuits, if required, to obtain a flat over-all response with the correct frequency limits. ▲

Editor's Note: A complete explanation of the video-sweep-modulated method was presented in "New Alignment Techniques" which appeared in the September, 1956 issue of PF REPORTER.

A STOCK GUIDE FOR TV TUBES

The chart on this page is presented as a guide for the maintenance of an up-to-date stock of television receiving tubes. The figures shown are expressed as proportions based on a total of 1,000 tubes. For example, if the figure 6 is given for a particular type of tube, this means that six out of every 1,000 tubes in television receivers now in service are of that type. The minimum entry is 0.5 per 1,000, rounded off to 1. Tubes which are used more rarely than this are not listed because the objective of the chart is to suggest a tube inventory which will cover as many replacement needs as possible *but will still be of manageable size.*

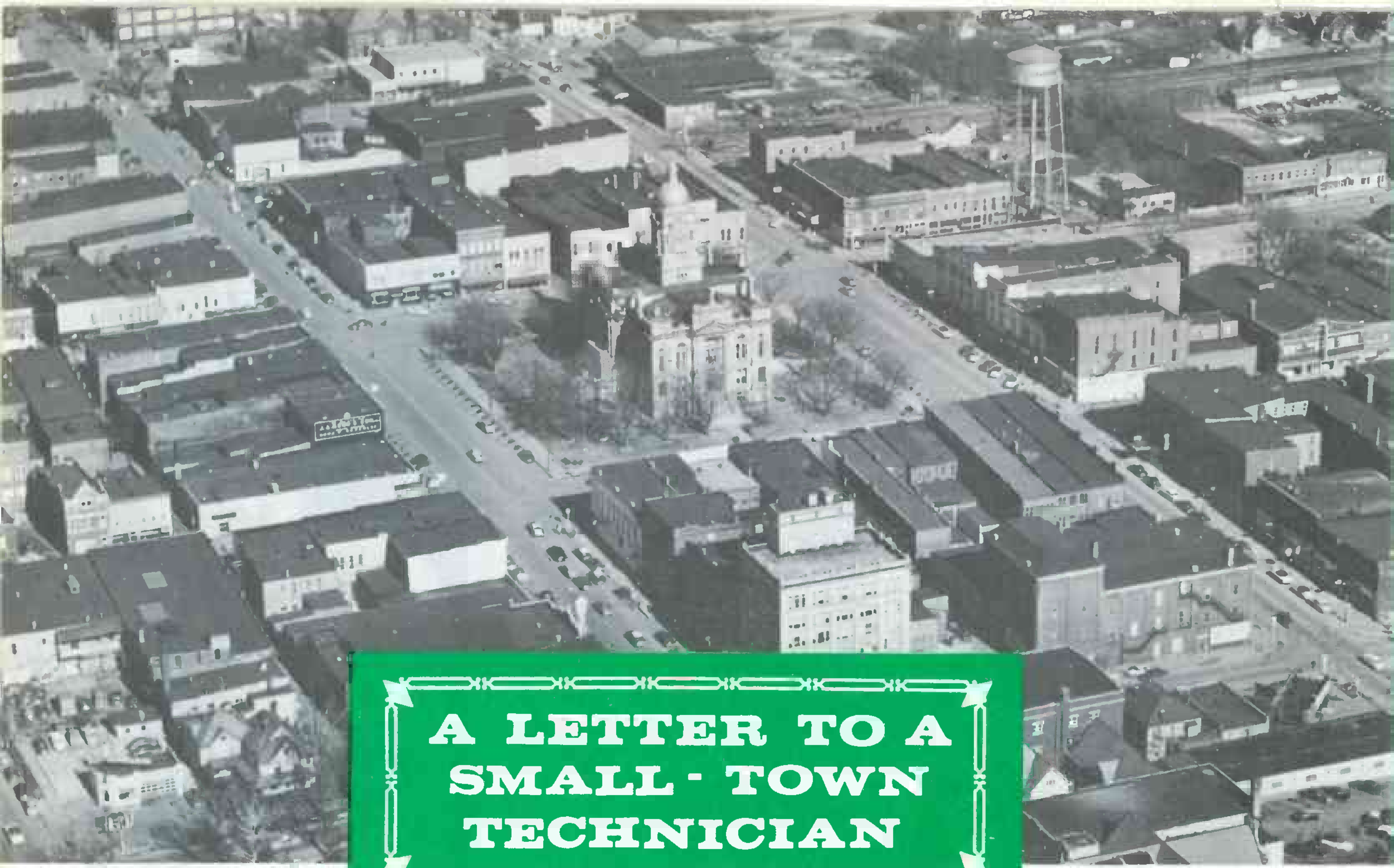
The listing of a large figure for a particular type of tube is not necessarily a recommendation for stocking that number of tubes, but it does indicate that the tube is used in many circuits and should always be on hand in sufficient quantity to fill requirements between regular tube orders. Some consideration should be given to the frequency of failure of a particular tube type when stock requirements for that type are being considered.

This guide is based on all brands of TV receivers, and the frequency-of-use data for tubes represent nationwide averages; therefore, these figures should be adjusted to take into account regional and local conditions. In addition, shops which specialize in servicing particular brands of sets will need to modify their tube stocks to suit the requirements of those sets.

In most cases, combined listings are given for redesigned "A" and "B" tube types and their prototypes. It is often practical to stock the latest version exclusively.

The figures in the Stock Guide are obtained statistically by keeping a cumulative record of the tubes used in new models of receivers. The results are adjusted to take into account the quantities of production of different models and the retirement of old sets at an estimated average age of 6 years.

TUBE TYPES	NO. OF UNITS	TUBE TYPES	NO. OF UNITS	TUBE TYPES	NO. OF UNITS	TUBE TYPES	NO. OF UNITS
1B3GT	44	6AQ5	16	6BX7GT	1	6W4GT	20
1X2A/-B	9	6AR5	1	6BY6	2	6W6GT	11
3A3	1	6AS5	3	6BZ6	3	6X8	8
3AL5	1	6AS6	1	6BZ7	4	6Y6G	1
3AU6	2	6AS8	1	6C4	8	7AU7	2
3BC5	2	6AT6	2	6CB6	130	12AT7	10
3BN6	3	6AT8	1	6CD6G/-A	2	12AU7/-A	33
3BZ6	2	6AU4GT/-A	3	6CF6	2	12AV7	2
3CB6	8	6AU6	98	6CG7	4	12AX4 GT/-A	7
3CS6	1	6AU8	2	6CL6	3	12AX7	5
4BQ7A	1	6AV5GA	3	6CM7	1	12AZ7	1
5AM8	1	6AV6	16	6CN7	1	12B4A	2
5AN8	1	6AW8A	4	6CS6	3	12BH7/-A	13
5AQ5	2	6AX4GT	14	6CU6	3	12BK5	1
5AT8	1	6AX5GT	1	6DC6	1	12BQ6 GTA/-B	1
5J6	1	6BA6	8	6DE6	2	12BY7/-A	11
5T8	1	6BA8A	1	6DG6GT	1	12CA5	1
5U4GA/-B	46	6BC5	6	6DQ6/-A	1	12CU6	1
5U8	4	6BC8	1	6J5	3	12DQ6/-A	1
5Y3GT	2	6BE6	7	6J6	24	12L6GT	2
6AB4	2	6BG6G	4	6K6GT	8	12SN7GT/-A	4
6AC7	5	6BH8	1	6S4/-A	1	25AX4GT	1
6AG5	6	6BK5	2	6SL7GT	2	25BK5	1
6AG7	2	6BK7A	7	6SN7GT/-A	66	25BQ6 GTA/-B	4
6AH4GT	3	6BL7GT	6	6SN7GTB	5	25L6GT	4
6AH6	6	6BN6	7	6SQ7	3	25W4GT	1
6AK5	2	6BQ6G/-A	2	6T8	13		
6AL5	65	6BQ6 GTA/-B	21	6U8	18		
6AM8	3	6BQ7A	17	6V3A	2		
6AN8	7			6V6GT	15		



A LETTER TO A SMALL-TOWN TECHNICIAN

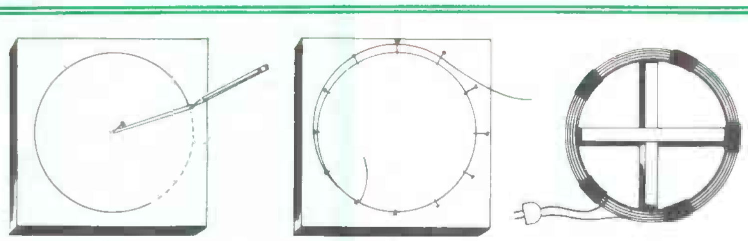
by **H. M. Layden**

Dear Country Cousin:

I hope you are burning the midnight oil these days, getting ready for color TV. If not, you had better get with it. Don't let anyone tell you it's not ready yet, or that an engineer will have to go with every sale. Such rumors are for the birds! Until yesterday, like many others in this business, I thought color wouldn't be out of the laboratory for another couple of years. But that was yesterday! As the song goes, "What a difference a day makes." If you'll lend me your good ear, Cuz, I'll fill it with a tale that goes round and round and comes out in color!

They say a good place to start a story is at the beginning, so here goes! The boss drove up to the shop yesterday and dumped a color set right in our laps. "Get this thing going; we have to deliver it to the Hotel Carlyle in the morning," he says—just like that. It was with grave misgivings as to his sanity that we unpacked his "folly" and set it up for appraisal.

The only thing on the air at the time was in black and white, but it would afford us an opportunity of judging how the set performed in that medium, so we tuned in a local and donned our critics' helmets. After watching the set for fifteen minutes, the consensus was that black-and-white reception was very tiring on our eyes, which were adversely affected by



A B C

INSTRUCTIONS: Obtain a baseboard 15" square. Find its center and drill a ⅛" hole. Insert an ice pick or some other pointed tool to act as a pivot. Cut a piece of string 12" long, and tie the ends together to form a loop. Place one end of the loop over the pivot, and insert a pencil in the other end. Then swing the pencil in an arc and trace out a circle (*A*) on the baseboard. Around the penciled circle, drive ten 3" nails to form a bed (*B*) on which to wind the wire for the coil. To figure out how much wire will be needed for 400 turns on this form, use the formula; $400\pi d = 400 \times 3.14 \times 1' = 1256'$. Measure out this footage plus about 9' extra to allow for the thickness of the coil. If you prefer, you can count the turns as you wind, but it is very easy to lose count so it is best to have the total length marked off before you start. To remove the coil from the form, bend the nails inward. Bind the coil with plastic tape in four or five spots around its circumference. Attach a 10' line cord to the ends of the coil. If a handle is desired, make one out of two ½" pieces of wood 12" long, joined in the middle to form a cross. Insert this into the open area of the coil, and it will afford a useful handle (*C*).

Fig. 1. Making a demagnetization coil.

the absence of definite blacks in the picture. The whites were dull and gave an over-all lackluster effect, made more striking, I suppose, by the side-by-side comparison with a monochrome set equipped with an aluminized tube. The left side of the screen in an area 2" wide by 6" high was tinted a light purple, suggesting "color shading." I found this tint quite annoying, though Joe and the boss felt it was tolerable.

I had read somewhere of a simple cure for "shading," and I racked my memory trying to bring it to mind. I went over to our manual rack and thumbed through some service literature on an RCA set, and there it was. All one had to do was construct a coil of #20 wire, 12" in diameter and with 400 turns! We had the wire in stock, but we needed a circular form 12" in diameter on which to wind the wire. We came up with the construction project in Fig. 1, which is self explanatory. It is the essence of simplicity to demagnetize a CRT with this coil. Plug the coil into the 117V line, and hold the coil flat against the safety glass, moving it slowly over the entire face area of the tube, and then to the sides of the cabinet. Back away from the set for about 6' before removing the power. It may take more than one application to cure the "shading," depending on how severe it was to begin with.

In our case, it worked like a charm and completely eradicated the purplish tint. Black-and-white reception was materially improved, but not to the point we had hoped for. It has been discovered that color sets are very susceptible to "color shading" while in transit. For this reason, demagnetization has become a first step in all installations.

When the color program came on, everyone forgot about the disappointing black-and-white reception, so entranced were we with the breathtaking beauty of the screen. It was lush, it was sparkling, and it lacked that artificiality of technicolor movies. It was natural to the n'th degree! It reminded me of a Da Vinci masterpiece, touched with a magic wand that breathed life into the figures, awakening them from their long stillness! Cuz, if there is anything of that stuff from which artists are made in your soul (and I know there is), color is for you.

We sat there, as delighted as a kid with his first air gun, watching Jimmy Durante. His "schnoz" took on all the majesty of a rose in full bloom. Then it happened. Right before our eyes, his head began to elongate and his chin to disappear, distorting his classic profile horribly. All that remained was his "schnoz" topped by a gigantic forehead. Jimmy as a "highbrow" is what Chester A. Riley would term "a very revoltin' development."

"The vertical linearity has gone out of whack," we mused. But before we could investigate, the picture began to roll very fast from top to bottom. Manipulation of the vertical hold was useless. It had no effect whatever on the frequency. The vertical tubes were located and changed, but to no avail. I looked at the boss, and he read my mind. He said, "Here's the service data," and he handed it to me.

I dug out the schematic and proceeded to give it the once over. The vertical circuit is not what I would call conventional. For easy reference, I redrew the circuit—it looks like Fig. 2. As you will at once note, the hold and linearity controls are interrelated, both being common to the grid circuit. It was quite evident that something had changed value, but what?

We decided that the chassis had to come out of the cabinet. This, in itself, looked like a formidable project, but it turned out to be quite simple when we followed the instructions. Once on the bench, we began probing. From the oscillator grid of the 6CG7, we read only 70K ohms! In the feedback loop, you will note a 39K resistor in series with a .0015-mfd capacitor. The other side of this capacitor goes to ground thru two 15K resistors in series. If this capacitor were shorted, that would account for our reading. In fact, it would account for all the symptoms noted! Capacitor shorts are usually a gradual process, showing first as leakage resistance, then sometimes in a few minutes becoming a dead short. This is what must have happened in this case, for the capacitor was definitely shorted now.

When the working voltage of this capacitor was noted, we were somewhat surprised—it was rated for 400 volts! While there is no DC in that part of the circuit, there is a hefty "spike" voltage to contend with, and experience dictates the use of a capacitor with a more robust rating for such applications.

The capacitor was mounted on a printed wiring board, and its ends were so short that we found it necessary to use cutters right in its middle. We put in a new capacitor with a 1,000V rating. Then we reassembled the set, adjusted the height, linearity, and hold controls, and were back in business again.

Color sets are coming from the factory with the picture tubes installed and the purity and convergence adjustments already made. This is quite a lift to the technician whose experience with color is limited. It allows him to gradually get his feet wet instead

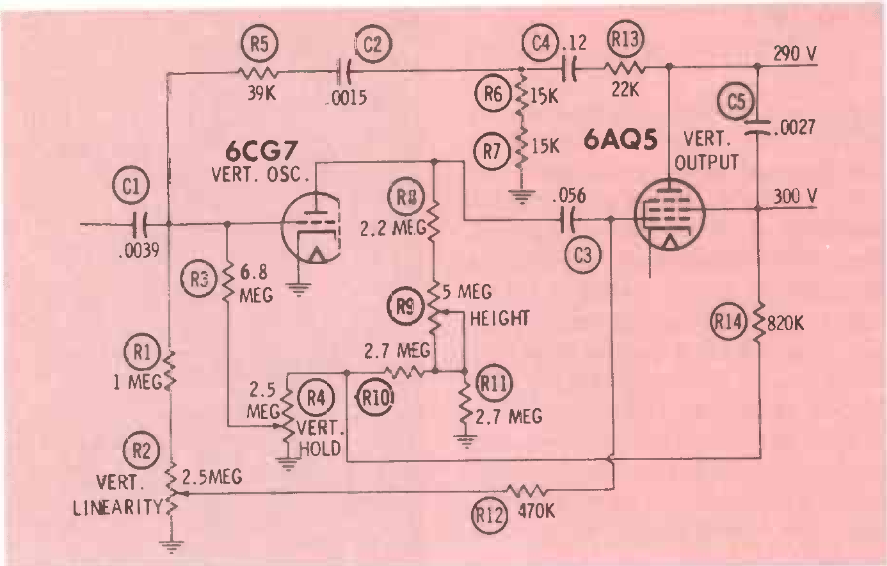


Fig. 2. Vertical oscillator circuit in RCA Victor Model 21CT-7835.

(A) Removing defective capacitor.

(B) New capacitor in circuit.

Fig. 3. Replacing capacitor fastened by short leads to a printed wiring board.

of plunging him in over his head at the very beginning. This one experience has altered my entire thinking on color. I think it should be approached with respect, of course, but with confidence, too. For it is nothing to be afraid of, considering the clarity and lucidity of the instruction material right at the technician's elbow.

But don't forget the lessons you learned from black and white—customer instruction, for instance. Don't neglect this if you want to preserve your sanity. Tuning is easy—so easy that only the tuner, brightness and volume controls need manipulation, once the AGC, contrast, hue, and color-intensity controls have been set. The latter are often hidden behind a hinged panel. The point to stress with the customer is how to properly use the fine-tuning control. If this is misadjusted, complete loss of color will result. The easiest way to explain this point is to demonstrate. The tuning control should be turned clockwise until the screen shows signs of interference, then backed away until the interference just disappears.

The boss is out buying color-bar, crosshatch and white-dot generators. In my next letter I'll give you the lowdown on them.

To reiterate, Cuz, don't let color scare you. Many of us have not yet learned to swim in this brand new pool, but that's no reason for not venturing to wade a little.

Yours for a rainbow in your life,

HANK

Shop Talk

(Continued from page 11)

that flows in the collector circuit of X1. This current is caused by the thermal agitation of the electrons in the collector and is independent of the emitter current. Normally, saturation current is quite small, on the order of a few microamperes, and the small voltage drop which it produces across R2 can be ignored, leaving X2 biased at cutoff. (Note, however, that if the temperature rises significantly, I_{co} can become important enough to seriously disrupt the operation of the second stage.)

Now, if a positive-going pulse is applied to the base of X1, it will bring this transistor out of cutoff, causing a collector current to flow. The pulse will appear amplified across R2 with its polarity reversed (i.e., the top end of R2 will become negative with respect to the bottom end). This voltage is of the right polarity to drive X2 into conduction, producing a still larger pulse at the collector of this transistor.

The essential simplicity of the circuit is quite evident. No capacitors are required and only a few resistors. When no signal is present, no power is drawn from the battery; hence, battery life is limited only by its own ability to withstand internal deterioration, plus the demands made on it when signals are applied.

No comparable situation exists in vacuum tubes because we have no tubes which deal in positive charges—all tubes to date pass current solely by means of electrons. The actions of p-n-p and n-p-n transistors complement each other; hence, the arrangement

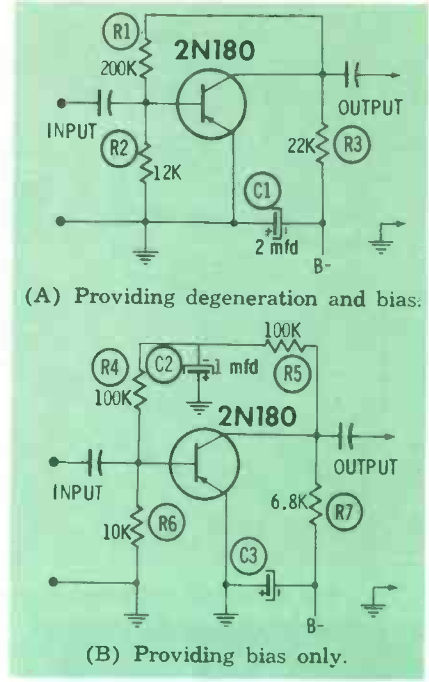


Fig. 5. Collector-to-base feedback.

shown in Fig. 2 could be called complementary amplifiers. Increasing use is being made of this property, an example being the commercially used circuit in Fig. 3. A 2N78 n-p-n detector feeds the demodulated signal to an 2N44 p-n-p power output amplifier. When no signal is being received, the 2N78 is practically cut off because its base and emitter are essentially at the same potential. (The voltage drop across the 220-ohm resistor is negligible; essentially all of the voltage appears across the 47K-ohm resistor.)

Since the 2N78 is cut off, no significant voltage drop is produced across R2 by the collector current (here, I_{co}). Hence, the base and emitter of the 2N44 are both at ground potential and the collector current of this transistor is negligible. The battery drain, under these conditions, is exceedingly low.

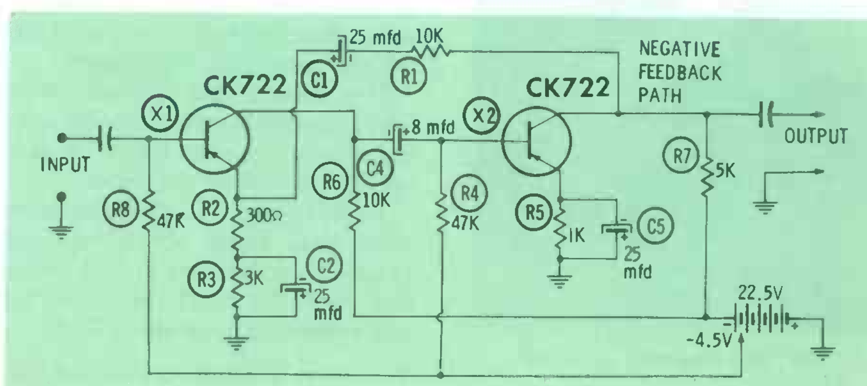


Fig. 6. A two-stage amplifier with negative feedback extending over both stages.

When a signal is received, the collector current of X1, flowing down through R2, makes the top end of this resistor negative with respect to ground. This drives X2 into conduction, and the signal is amplified and fed to the loudspeaker. The position of the volume control rotor, which governs the bias point for X2, should be at the lowest setting consistent with a desired output level. The lower the setting, the lower the drain on the battery. As a matter of fact, General Electric, whose engineers devised this circuit, calls it the "battery saver" circuit.

Note that it is possible to bias a transistor close to cutoff without introducing an undue amount of distortion. This is because transistor characteristics are linear almost down to cutoff. It also explains why the efficiency of transistor amplifiers can be made so much higher than comparable vacuum-tube circuits.

Direct-coupled class A amplifiers are shown in Fig. 4. The first stage is biased conventionally by the voltage divider network R1 and R2. Collector current, flowing through resistor R4, produces a voltage drop which reduces the potential at the collector. This makes the base of X2 more negative than its emitter and establishes a bias for this stage. Variation of the collector current in X1 and of the values of R4 and R5 will influence the operating point of X2. If you follow a signal applied to the input, you will find that each stage inverts the signal 180°. Common-emitter arrangements, using either p-n-p or n-p-n transistors, always invert the polarity of a signal.

The foregoing examples do not exhaust the possible circuit combinations by any means; however, enough have been shown to demonstrate the greater flexibility of transistors compared to vacuum tubes.

Negative Feedback in Transistor Amplifiers

Negative feedback, as a stabilizing influence, is used in transistor amplifiers to the same extent as in vacuum-tube amplifiers. An unbypassed resistor in the emitter leg of a transistor functions in the same manner as an unbypassed resistor in the cathode of a vac-

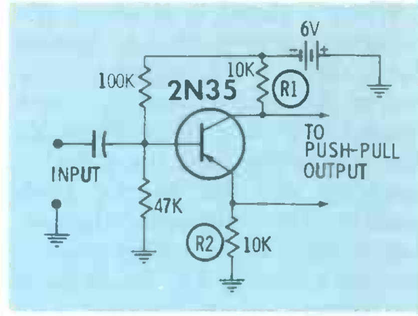


Fig. 7. Simple phase inverter.

uum tube. In another method, a portion of the signal appearing at the collector of a common-emitter amplifier is transferred back to the base. (Note the 100K-ohm resistor R1 in Fig. 5A.) Since the signal at the collector is 180° out of phase with the signal at the base for this type of arrangement, the two will partially cancel, giving the desired action. This feedback method can also be used to bring the proper DC biasing voltage to the base, and usually this is done. If no DC biasing is needed, then a capacitor can be placed in series with the feedback resistor. By the same token, if only a DC bias is desired and no AC degeneration, then the arrangement shown in Fig. 5B can be employed.

The foregoing methods introduce negative feedback in a single stage. To extend the feedback over several stages, a method like that shown in Fig. 6 would be suitable. Capacitor C1 and resistor R1 connect the collector of X2 to the emitter of X1. Note that resistor R2 is unbypassed in order that the feedback signal can be developed across it. R3, being bypassed by C2, serves only for DC stabilization; it does not enter into the AC stabilizing action.

In inserting a feedback system, care must be taken to see that the feedback signal is injected at a point where it works in opposition to the arriving signal. That this is true in Fig. 6 can be seen from the following analysis. A positive-going signal at the input terminals will act in opposition to the normal base-emitter bias present here and hence reduce the current flowing through X1. This will cause the collector to become more negative. At the following stage, this negative-going signal will act in consort with the base-emitter bias and increase the cur-

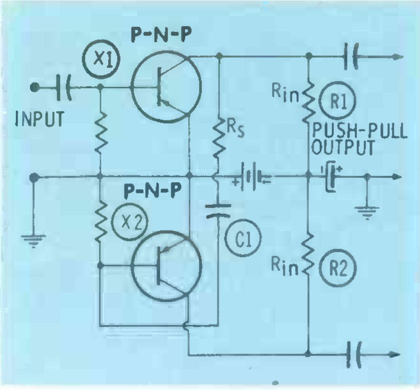


Fig. 8. Two-transistor phase inverter.

rent through transistor X2. As a result, the collector of X2 will become more positive. A portion of this positive-going signal is fed back to the emitter of X1 where it will tend to counteract partially the positive-going input signal at the base.

The effect of such negative feedback is to lower the gain of the stage, but it also keeps it more constant over a greater frequency range and increases the input impedance.

Phase Inverters

For push-pull amplifiers, equal and oppositely-phased signal voltages are required. These can be obtained by using an input transformer with a center-tapped secondary, or by incorporating a phase inverter. One of the simplest phase-inverter circuits is shown in Fig. 7. Equal-value resistors are used in the collector and emitter legs, serving as sources for the two output signals. The input signal is fed to the base in the conventional manner.

This method is simple, reliable, and offers no particular design problems; however, the signal voltages obtained from R1 and R2 are not exactly equal in amplitude. This is because the current which flows through R2 to the emitter is somewhat larger than the collector current flowing through R1. The difference between these two currents flows in the base circuit. By using transistors in which α is on the order of .98 or .99 and by slightly increasing the value of R1, substantially equal voltages can be obtained. Gain of this arrangement is less than 1 because R2 is unbypassed.

Another phase inverter, using

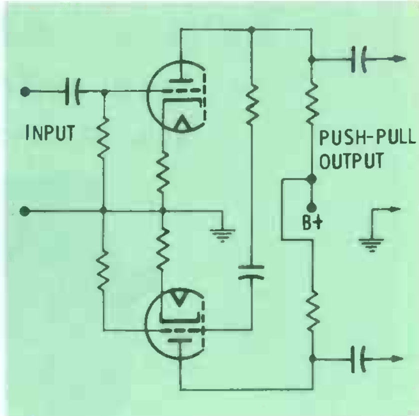


Fig. 9. Vacuum-tube equivalent of phase-inverter circuit in Fig. 8.

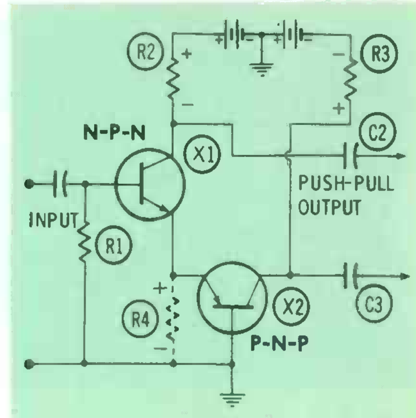


Fig. 10. Complementary phase inverter.

two transistors, is shown in Fig. 8. The signal is applied to the base of X1, amplified, and developed across R1. From here it is passed on to one section of the following push-pull amplifier. At the same time a portion of the signal appearing at the collector of X1 is applied via R_s and C1 to the base of X2. The output signal of the unit appears across R2 and is available to the other section of the push-pull amplifier. Since X2 inverts any signal fed to it, the signals fed to the two sections of the push-pull amplifier will be 180° out of phase with each other.

If the transistors X1 and X2 are identical in all respects, their outputs will be equal when

$$R_s = \frac{a}{1-a} R_{in},$$

where a = the ratio of collector to emitter currents of each transistor, R_{in} = the input resistance of a push-pull amplifier section.

For those readers who might find the foregoing circuit strange, compare it to its vacuum-tube equivalent shown in Fig. 9.

Still another phase inverter is shown in Fig. 10. This circuit is considerably simpler than the preceding arrangement because complementary transistors are employed. To see how the circuit functions, connect a small resistor, R4, from the emitter of X1 to ground. Now apply a sine-wave signal to the base of the n-p-n transistor X1 and for the moment assume that the positive half cycle is active. This will make the top end of R1 positive with respect to ground and increase the current flow through X1. Electrons will flow out of the collector and through R2 and the battery. Since the negative terminal of the battery is grounded, electrons will travel to ground and then up through R4 to the emitter of X1.

Voltage polarities developed across R2 and R4 by this current flow are shown in Fig. 10. The drop across R4 is of the right polarity to cause X2 to conduct more heavily, producing a voltage drop across R3 opposite in polarity to that across R2 because electrons from the battery will flow toward the collector of X2. Thus, we obtain oppositely-phased voltages across R2 and R3, providing the proper signals needed to drive the two sections of a push-pull amplifier. If the resistors are made equal in value, equal driving signals will be obtained.

For the ensuing negative half cycle of the input signal, the reverse action occurs (i.e., currents through both transistors decrease), producing a positive-going voltage across R2 and a negative-going voltage across R3. Again, we have suitably balanced signals to feed to the push-pull amplifier.

R4 was inserted for purposes of explanation. In reality, its presence, as well as the use of two separate batteries, is not necessary. Hence, the actual circuit is a remarkably simple arrangement.

As a footnote, we might remark that the only factor holding back greater usage of complementary arrangements is the difficulty (at present) of producing matched p-n-p and n-p-n transistors. This obstacle is bound to be overcome; when it is, considerable application will be made of this unique transistor behavior. ▲

Do Fuses Confuse You?

(*Continued from page 21*)

wire is utilized for the lower-current fuses (2 amps and smaller), while the metal strip is used for the higher-current fuses.

Technical specifications of the 3AG regular fuses are:

Voltage rating—250 volts or less

Blow characteristics—

% of current rating	Blow time
110	life
135	0-1 hour
200	0-2 minutes

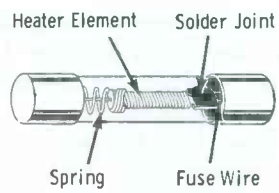


Fig. 4. Fusible element in 3AG time-lag fuses with low rating.

The voltage rating refers to the voltage which can be applied across a blown fuse without risk of arc-over and is a very conservative figure. Any arc-over at a blown fuse would complete the circuit (minus the slight voltage drop of the arc) and thus defeat the purpose of the fuse.

Time-Lag Series

For units rated under 8/10 amp, the fusible element (Fig. 4) in the 3AG time-lag series is made up of a spring, a calibrated section of fuse wire, a heater element, and a solder joint which will unbond if subjected to excess heat. Units rated over 8/10 amp do not use a separate heater element; instead, they depend on heat from the fusible element itself (Fig. 5) to unbond the solder joint under conditions of continued overload.

Time-lag fuses have an advantage over the regular fuses when used in circuits (horizontal output, electric motors, etc.) which are subjected to heavy current surges. When power is first applied and a current surge occurs, the time-lag will withstand it. This feature is made possible by the heater element, which takes a certain period of time to heat and unbond the solder joint even when the surges are 2 to 3 times the rating of the fuse. This time lag is short enough (it is shorter for larger overloads) to provide the proper circuit protection. Thus the time-lag fuse permits a circuit which normally has heavy initial surge currents to be fused very closely to its operating current point and still not be plagued with repeated fuse failure during warm-up time.

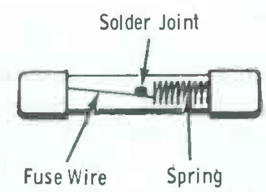


Fig. 5. Fusible element in 3AG time-lag fuses with high rating.

Technical specification for the 3AG time-lag fuses are:

Voltage rating—125 volts or less

Blow characteristics—

% of current rating	Blow time
110	life
135	0-1 hour
200	5 to 60 sec.

Instrument Types

Fuses in the 8AG series are intended primarily for instrument protection; however, there are two ranges (1/4 and 3/8 amp) which are used in some TV receivers. As mentioned earlier, the 3AG series is 1¼" long while the length of the 8AG series is only 1".

Technical specifications for the 8AG instrument types are:

Voltage rating—250 volts or less

Blow characteristics—

% of current rating	Blow time
100	life
150	0-10 seconds
200	0-5 seconds

Automobile Types

SFE Standard fuses are used in automobile radios. These fuses, unlike those previously mentioned, are supplied in different lengths for different current ratings; i.e., a 4-amp fuse is 5/8" long, a 6-amp fuse is 3/4" long, a 9-amp fuse is 7/8" long, a 14-amp fuse is 1 1/16" long, a 20-amp fuse is 1¼" long and a 30-amp fuse is 1 7/16" long. The fuse holders used with these fuses are designed so that only the proper fuse will complete the circuit—a fuse that's too short won't reach between the contacts of the fuse holder and one that's too long won't permit the holder to be closed.

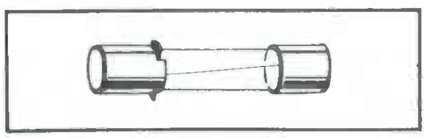


Fig. 6. Metal tabs on Type C or N fuse.

Technical specifications for the SFE Standard fuses are:

Voltage rating—32 volts or less

Blow characteristics—

% of current rating	Blow time
100	life
125	0-½ hour
200	0-25 seconds

New Types

Two new series of fuses, Type C and Type N, have been recently introduced. Electrically, these fuses are equivalent to the 3AG regular and the 3AG time-lag types, respectively, but they differ mechanically. These new types come in different lengths with metal tabs (Fig. 6). The lengths and tab widths are designed so that only fuses of the correct size and type may be installed in a given holder. The Type N fuse is available in a range of 2/10 to 7 amps, and the Type C in a range of 3/10 to 10 amps.

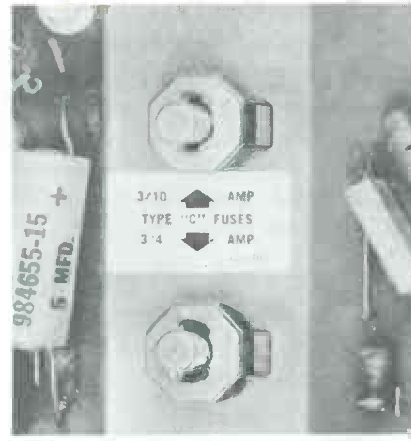


Fig. 7. Exposed end of Type C or N fuse can be used as voltage test point.

The fuse holder used with the Type N or Type C fuse is so constructed that the tab end of the fuse is exposed when the correct size is installed. This makes a handy test point (Fig. 7) for whatever voltage is being fused. It also makes it necessary that the fuse holder be located somewhere besides on an exposed rear chassis panel. Since vertical chassis are almost universally used on new and currently produced receivers, this isn't a problem. In color receivers and others that still employ a conventional type chassis, the fuse holder is mounted through the top of the chassis-pan or in the high voltage cage itself.

Conclusion

Although one fuse may differ from another in physical and electrical characteristics, its primary function is to protect a piece of equipment from damage which would otherwise result from a short circuit or a continued overload. The installation of any fuse with a rating or size other than that specified in service literature defeats or reduces the effectiveness of this protection. It has always been our experience that continued fuse blowing is an indication of some trouble condition and not an indication that a larger fuse is needed. ▲

TROUBLE SHOOTING WITH GEORGE

The Solution

Confirming his suspicions, George checked capacitor C3 and found it to be open. Had George continued a little further with his initial signal-tracing procedure, perhaps he would have located the faulty component immediately. Many of us, when trouble shooting, attempt to quickly investigate all the possible circuits we can before completely eliminating the more logical ones.

George answered his own question concerning the use of an electrolytic in this application when he substituted a miniature .01-mfd disc capacitor as a temporary replacement and encountered insufficient volume and very poor low-frequency response. Actually, a larger capacitance is required because of the relatively low input impedance of the output stage. The base resistor R15 is only 27K ohms, and therefore a large value coupling capacitor must be used to pass the lower audio frequencies.

Luckily, George did not attempt to use a conventional electrolytic with a high voltage rating as a temporary replacement. In a transistor circuit, the DC leakage characteristic of an electrolytic is as important as its capacity. Without a high enough leakage resistance, an electrolytic in this particular application may permanently damage the output transistor.

George eventually restored the set to normal operation by replacing the subminiature electrolytic with one of a like nature. Although the case could have been solved much more quickly, it did teach George that sizable troubles can sometimes come in very small packages.

Pix-Tube Sign

If you have been looking around for an eye-catching sign to advertise your service business, a round metal 16" or 24" CRT dud will make a good one. To construct a sign like the one shown, put the tube in a shipping carton for safety and very carefully drill a small hole into the base of the tube so that air is let in very slowly. Then tie an oil-soaked string around the glass neck and light it. As soon as the fire dies down, wrap a cold wet rag around the neck, and the base together with the electron gun should snap off cleanly.

The letters cemented on the face of the tube are the red plastic type available in dime stores. A long, thin counter-display light bulb can be slipped into the pix tube through the neck to provide illumination at night. To attract even more attention, add a flasher unit.

—Henry J. Dobias

Servicing New Designs

(Continued from page 23)

April PF REPORTER will prove helpful.)

Let's find out why the transistor is connected to the battery in the manner shown. In describing current flow through p-n-p transistors, the term "holes" instead of "electrons" is used. All we need know about holes for the purpose of this discussion is that they are essentially positive charges and are attracted to a source of negative voltage. Practically speaking, they behave just like electrons except that they are reversed in polarity.

We want a current to flow from the emitter to the collector of the transistor, just as output current goes from cathode to plate in a tube. In order to attract hole current to the collector terminal, we must make the collector negative with respect to the emitter. This polarity is most easily established in automobiles by placing the collector at or near ground potential, and connecting the emitter circuit to the plus or "hot" lead of the car battery. It is then practical to mechanically attach the collector to a heat sink of large area and thereby dissipate much of the heat generated by the heavy current in the output circuit.

For class A operation of a p-n-p transistor, the potential at the base terminal should be slightly less positive than the emitter potential. Base voltage is usually obtained from a tap on a voltage divider placed across the battery. Most of the divider resistance is between the base and ground, establishing the difference potential between emitter and base at only a fraction of a volt.

The base voltage is made adjustable so that the current flow within the transistor can be controlled. The effect is somewhat the same as that of a variable grid bias on a tube, but with an important difference. In the p-n-p transistor, an increase in bias—that is, a negative swing of base voltage—causes increased conduction in the base-emitter circuit, and that in turn causes an increase in the collector or output current. Contrast this behavior with that of a tube circuit, where the bias is decreased in order to increase the output current.

Figs. 3, 4, and 5 are diagrams of actual circuits developed by different manufacturers along the lines of the basic layout given in Fig. 2. Note: Voltages marked on the schematics are nominal values, or are based on an arbitrary value of input voltage. Keep in mind that the supply voltage from the car battery or generator will vary.

Chevrolet Model 987575

The Chevrolet Model 987575 radio has a single-ended output circuit (Fig. 3) using a Delco 2N173 transistor. The output signal is developed across a transformer connected between the collector and ground; therefore, a signal voltage and also a DC potential of approximately 0.8 volt are present on the collector during operation. Physically, the collector terminal is a mounting stud bolted securely to a large heat sink, as shown in Fig. 1. The entire transistor-sink assembly is mounted to the radio chassis by means of insulating grommets so that the collector will be above ground. During installation or servicing of this type of radio, the heat sink must be kept clear of shielded cables and metal parts of the car so that the transistor will not be damaged by accidental operation with the collector grounded. Incidentally, the heat sink serves as a convenient test point for checking collector voltage.

Notice that an autotransformer is used in the output circuit. The absence of a high B+ voltage at this point makes it possible to connect the speaker voice coil directly to a tap on the transformer to obtain the proper impedance match.

A small amount of self-bias is developed across the 0.47-ohm resistor R4 in the emitter circuit. This component tends to limit any excessive current which might attempt to pass through the transistor; in this respect, R4 has somewhat the same function as the cathode resistor of a horizontal output tube. But the most probable causes of excessive current in the transistor would be either an overly negative base voltage or too high an operating temperature—not a loss of driving signal.

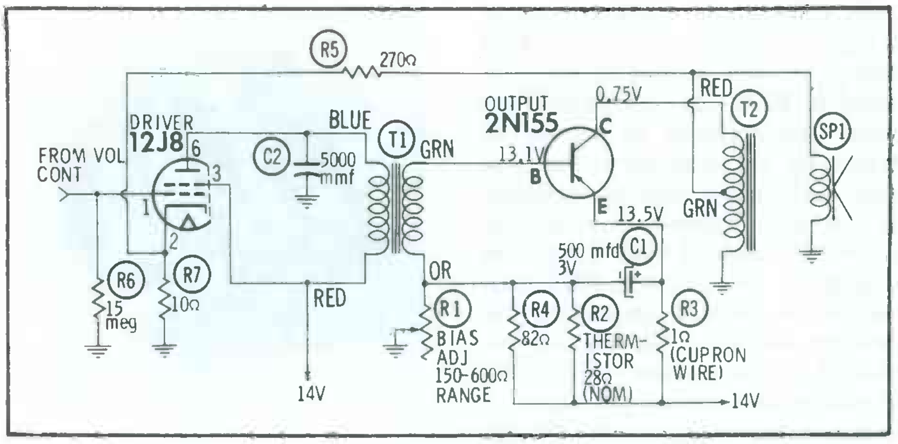


Fig. 4. Some 1957 Ford radios use this output stage, in which emitter current can be measured with a voltmeter—thanks to Ohm's Law and precision "Cupron" resistor R3.

The voltage divider in the base circuit includes fixed resistors R2 and R3 and a bias-adjust potentiometer R1. The control should be readjusted whenever the transistor is replaced or when other repairs are made to the circuit. The first step in this adjustment is to turn R1 to the position of maximum resistance so that the forward bias on the base (and thus the collector current) will be at a minimum. With an ammeter inserted in series with the collector lead, 12 volts of battery power applied, and no signal to the radio, the control is adjusted for a collector current of 930 ma. In order to avoid damage to the transistor from excessive collector current, it is essential that a meter be used while adjusting R1.

Ford Model 75BF

The Ford Model 75BF radio, the output circuit of which is shown in Fig. 4, uses a CBS 2N155 transistor. The collector circuit is similar electrically to that in Fig. 3 except for the use of degenerative feedback to the cathode of the 12J8 driver tube through R5. Mechanically, there is a considerable difference between the Chevrolet and Ford transistor mounts. In the latter, the collector is insulated from the heat sink by a special washer of anodized aluminum (an electrical insulator but an excellent heat conductor) making it possible to mount the heat sink directly to the chassis.

The voltage divider in the base circuit is composed of paralleled resistors R2 and R4 and the bias adjustment R1. Effect of temperature on the operation of the transistor is minimized by R2 which is a thermistor (resistor having a negative temperature coefficient). The emitter resistor R3, a 14½" length of special "Cupron" wire, provides the technician with a convenient means of measuring

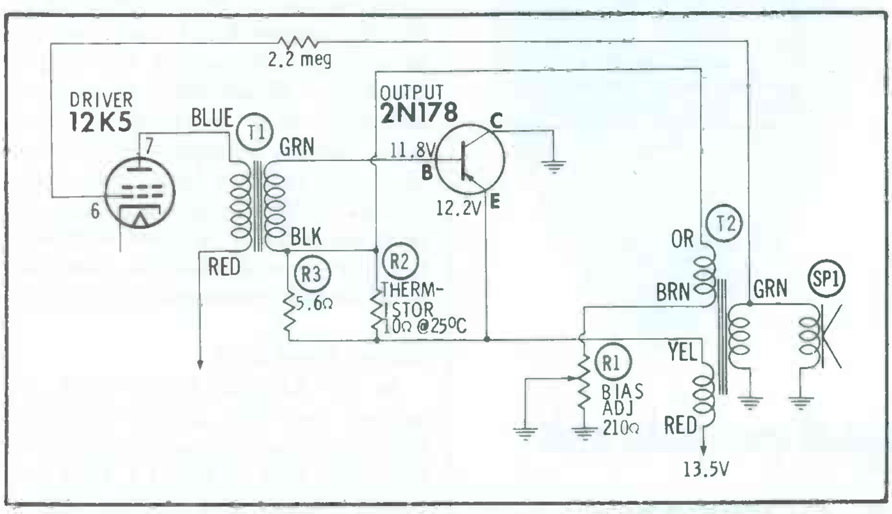


Fig. 5. Transistor output circuits in Motorola radios characteristically have the collector grounded and the output transformer in the emitter circuit.

emitter current without having to unsolder any leads for the insertion of an ammeter. The resistance of R3 is exactly 1 ohm. When a voltmeter is placed across its terminals, a reading of 0.42 volts indicates an emitter current of 420 ma, the correct value for this circuit. (Input to the radio should be 14.4 volts during the check.) An incorrect reading calls for an adjustment of R1.

Motorola Model 397X

Still another class A output circuit is found in the new Motorola radios, the Model 397X version of which is presented in Fig. 5. This circuit is very similar to one first used in Motorola equipment last year. The collector of the 2N178 transistor is grounded to the heat sink and chassis, and the primary of the output transformer is connected in the lead from the power supply to the emitter. This connection is feasible since both the emitter and the collector are included in the output circuit; the amplifier can still be considered a common-emitter type even though the collector is grounded. The

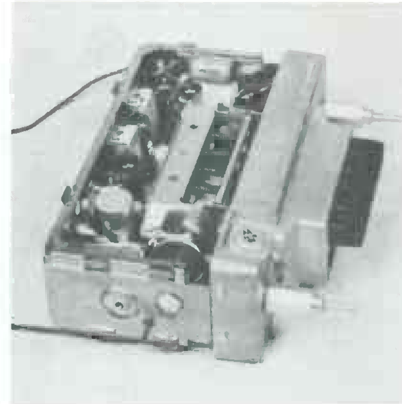


Fig. 6. The front panel of a car radio is a large chunk of metal. It serves as a good heat sink for the transistor in this Motorola Model 597X auto radio.

speaker voice coil is connected to an isolated secondary winding of the output transformer, and feedback is returned from this point to the grid of the 12K5 driver tube. A tertiary winding (with orange and brown leads) supplies degenerative feedback to the transistor input. Besides this winding, the voltage divider in the base circuit includes bias adjustment R1 and paralleled resistors R2 and R3. Notice that R2 is a thermistor which has the same function as R2 in Fig. 4. Base bias in this circuit is adjusted with a supply voltage of 14 volts. With an ammeter inserted in the emitter lead, R1 is rotated to its maximum counterclockwise position (maximum resistance) and then cautiously turned clockwise until a reading of 500 ma is obtained.

The Motorola type of grounded-collector circuit lends itself to considerable variation in heat sink construction. In Model 597X (Fig. 6), the whole front panel serves as a heat radiator for the 2N178 transistor. Whatever type of construction may be used, a good solid contact between the transistor body and the heat sink is essential. If this is lacking because of loose bolts or warped surfaces, the transistor is likely to overheat and become irreparably damaged.

Allstate Model 6268

In the Allstate Model 6268 receiver, the first audio amplifier tube drives a single-ended transistor stage (X1 in Fig. 7.) This circuit is a great deal like the others we have described except that it is not an output stage. Instead of driving a speaker, it furnishes power to a push-pull output stage utilizing two 2N176 transistors. A study of this latter circuit will reveal that it is basically a pair of single-ended p-n-p circuits placed back to back. Output current of each transistor passes through the emitter, the collector, half of the output transformer primary, the power supply, and a pair of 1.2-ohm emitter resistors (R3 and R4, or R5 and R6). The input circuit includes the combination of R7 and R8 and half of the input transformer.

Each base is returned to ground through either R1 or R2 and one half of the output transformer. No adjustment for the base bias is provided; however, if such adjustment should ever be necessary, different values of fixed resistance could be tried in place of R7 and R8. The heat sink is at ground potential, and the collectors are separated from it by thin sheets of mica which provide satisfactory heat transfer and at the same time insulate the collectors from ground.

Chevrolet Corvette Radio

The circuit in Fig. 8 is another push-pull arrangement used in the Chevrolet Corvette radio. But this one is a fooler—it is not an audio stage at all. Instead, it is a blocking oscillator which replaces the vibrator as a source of B+ voltage.

Oscillation is maintained by a feedback winding on the output transformer. At any given time, one of the 2N174 transistors is conducting and the other is cut off. The collector current of the active transistor passes through one-half of the center-tapped primary winding of the transformer, and an expanding magnetic field is created. The voltages induced at opposite ends of the feedback winding drive the conducting transistor into heavier conduction and the other transistor further into cutoff.

When the current becomes heavy enough to saturate the primary of the transformer, the magnetic field stops increasing and the feedback voltage is no longer generated. Then the base of the conducting transistor loses most of its forward bias, and the output current begins to fall off rapidly. The magnetic field around the primary winding collapses, and the voltage pulses at each end of the feedback winding reverse in polarity. The first transistor receives a positive-going pulse at its base and is cut off, and the second transistor receives a negative-going pulse that drives it into conduction.

The transistors conduct alternately at about a 20-kc rate, and an AC voltage with an amplitude of more than 200 volts is produced in the secondary winding of the output transformer. This secondary circuit is much like that of an ordinary vibrator transformer except for the unusually low value of the buffer capacitor C3. The secondary voltage is rectified by a 12X4 tube and is used to supply B+ voltage to several tubes—including those in a "Wonder Bar" search tuning system.

In addition to the 2N174's in the power supply, this same radio uses two 2N173 transistors in a push-pull audio output stage which is generally similar to the one shown in Fig. 7. All four tran-

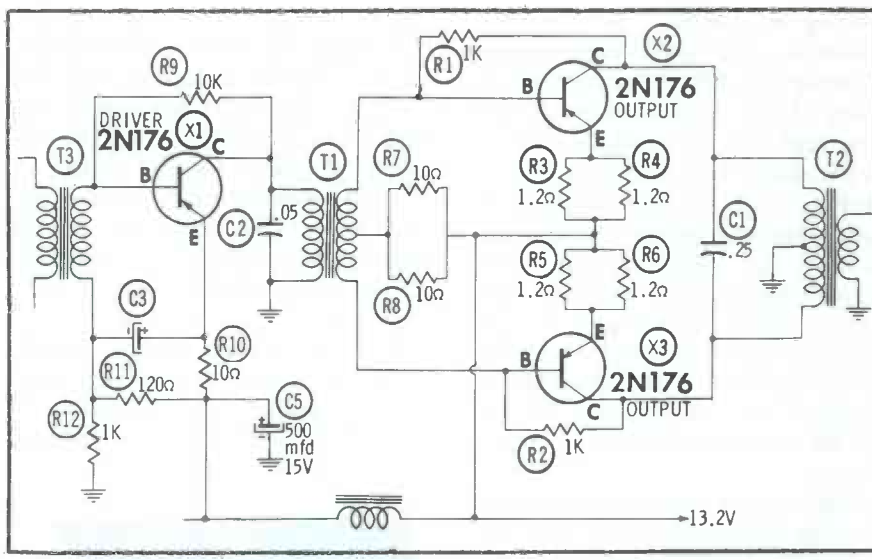


Fig. 7. Three transistors—a driver and a push-pull output stage—are used in the Allstate Model 6268 auto radio.

sistors are mounted on a large subchassis that serves as a heat sink, and they are insulated from it by mica wafers.

Servicing Precautions

The power transistors being used in auto radios are husky brutes by semiconductor standards, but they can be damaged by some kinds of rough handling. Here are three quick ways *to ruin a transistor:*

1. Increasing the forward bias on the base will cause both input and output currents to zoom upward. This tragedy will happen instantly if the base is grounded with a screwdriver or test prod, or more gradually if the bias-adjust control is set for a bit too much bias. (Values of output current recommended for each particular model of radio should be adhered to. Not enough current means a weakening of output power, and too much current results in a well-cooked transistor.)
2. Taking the load off the collector circuit will cause trouble. Once again, this act of sabotage can be done in a razzle-dazzle manner by shorting across the output transformer—or more subtly by operating the radio without the speaker connected.
3. Using power supplies or test equipment which put out occasional high peaks or pulses of AC voltage will endanger the transistor. Although the thin base region can handle considerable current at low potentials, a spike of more than 20 to 30 volts (depending upon the transistor type) can punch right through the base and cause an emitter-to-collector short. ▲

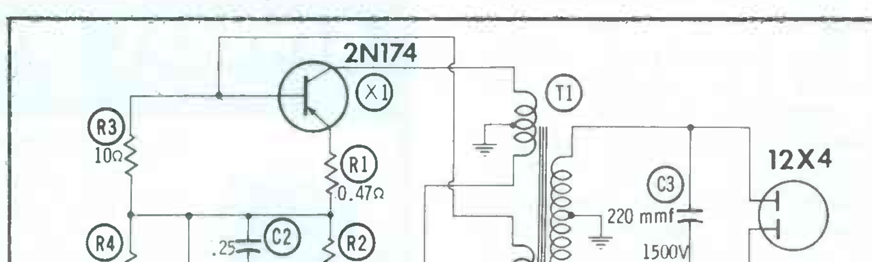


Fig. 8. This push-pull circuit in the Chevrolet Corvette radio is a blocking oscillator used to replace the vibrator.

Transistor Radios

(*Continued from page 25*)

put transformers. The volume control may be located just about anywhere, depending upon the design of the portable case.

Fig. 2 represents the component layout for a typical 6-transistor radio chassis. In this example, the component arrangement is similar to that in Fig. 1 with the exception of an additional IF amplifier and a two-transistor audio output stage. Receivers employing push-pull output transistors will have the matched pair mounted side by side. In some designs, audio output transistors may have small metal shields surrounding them. These shields are for cooling purposes and will immediately identify the output stage.

Because so many different transistors are now being used in portable radios, we will not attempt at this time to list or catalog their type numbers according to stage function. It may interest the technician to know, however, that the only major difference between audio and RF-IF transistors is the cutoff frequency characteristics of each.

Trouble-Shooting Hints

When a customer leaves a portable transistor radio for repair, you might inquire if the set has ever been exposed to excessive heat. If it has, then you may have reason to suspect failure of one or more of the transistors. Normally, transistors will cause little trouble unless they are overheated or subjected to abnormal voltages. About the best way to check the operation of a transistor is by direct substitution. There are, however, specially-designed transistor test instruments, and some tube checkers incorporate transistor-test circuits.

If a suitable test instrument is not available, the technician can sometimes locate a defective transistor by removing the units one at a time from the chassis and measuring the total current drain of the receiver. This is accomplished by placing a milliammeter in series with the chassis return of the battery, and monitoring the current drain as each transistor is removed.

Normally, a transistor will draw

Fig. 3. In checking a printed board for shorted or broken conductors, an excess gob of solder may be located.

a certain amount of current from the battery supply, so as each unit is removed, the total current drain should drop proportionately. Should the current remain unchanged as a transistor is taken from its circuit, then you can suspect that the unit is either defective or improperly biased. This test is especially suited for sets employing plug-in type transistors. CAUTION: Surge currents can permanently damage a transistor, so once a unit is removed never reinsert it while the set is operating.

Trouble in a transistor radio can sometimes be located by merely examining the printed wiring board (Fig. 3). Any excess solder or foreign material on the board can cause a short between the closely spaced conductors. Since these radios are portable, they occasionally undergo rough treatment and should be checked for damaged or broken wiring. These possibilities should never be overlooked, for a close examination of the wiring may save precious trouble-shooting time in the long run.

Signal Tracing

The old "finger probing" method of isolating trouble in conventional radios can also be used when servicing transistor portables. With the volume turned up in a typical transistor radio, one can expect to hear a buzzing sound in the speaker whenever a finger is placed on the antenna trimmer capacitor — provided, of course, the signal path is intact. If a station signal can not be received, but the buzzing sound can, then the trouble may be in the

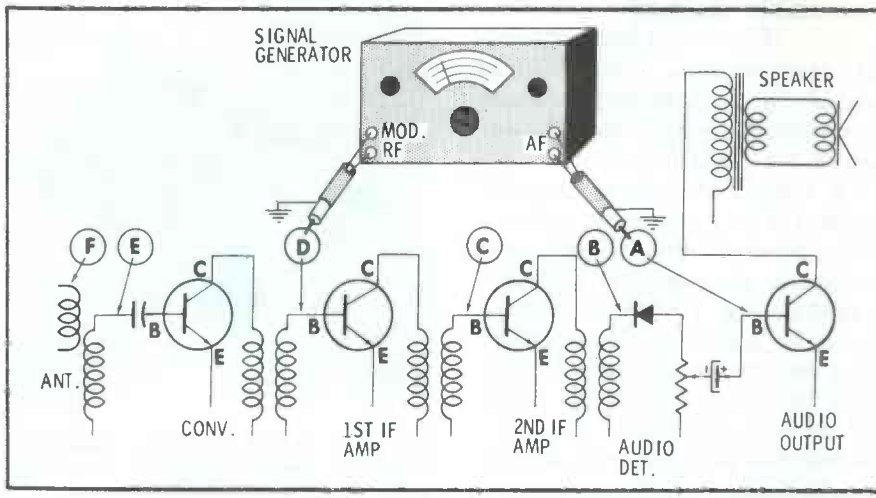


Fig. 4. A typical example of the signal injection points in a transistor radio.

antenna or oscillator circuits. By placing a finger on a metal probe and touching the probe to any element lead of the converter transistor, the technician should also hear the buzzing sound. In most cases, this method of signal tracing can only be used from the antenna input to the 1st IF amplifier stage. The base element of the 1st IF transistor will usually respond to this test but other elements of the unit, as well as all following stages, normally refuse to produce the buzzing sound. A contact click, however, can usually be detected from the antenna input to the audio output stage in a transistor radio chassis. The clicks can be produced by touching a metal probe to any conductor making up any part of the normal signal path. These clicks can thus be used to locate a completely dead or inoperative stage in a receiver.

When trouble shooting a dead receiver, the technician might first follow these simple steps:

1. Touch the metal probe to the volume control terminals. If a click is not heard, the trouble may lie somewhere between the volume control and speaker. If a click is heard, proceed to step 2.
2. Touch the metal probe to the leads of the crystal diode (audio detector stage). If a click is not heard, the trouble is most likely between this point and the volume control. If a click is heard, proceed to step 3.
3. Touch the metal probe to the antenna trimmer—located on the tuning gang. If a click or buzz is not heard, the fault is probably between this point and the detector stage. If a click or buzz is heard, check the antenna and oscillator circuits.

Regardless of how many preliminary steps are taken, the only accurate way to signal trace any radio is by using a signal generator. As in conventional radios, one should start at the audio output stage and work back toward the antenna until the test signal can no longer be heard from the speaker. A dead stage or one introducing serious distortion should be detected immediately.

Connecting the ground lead of the generator to a convenient B-minus point on the chassis, inject the signal into the set at various key points. In Fig. 4, these points are shown for a simple 4-transistor chassis. When signal tracing the audio circuits, the generator should be set to produce an audio output frequency. Always begin with a low generator output so as not to overdrive the particular stage being tested. If the trouble is not located in the audio section of the receiver, the 400-cycle tone should be reproduced when the test signal is applied to the volume control side of the detector circuit.

As you proceed ahead of the detector stage, the output signal of the generator must be changed from the low audio frequency to an audio-modulated IF frequency. Approximately 90% of transistor radio designs now use an IF frequency of 455 KC. The others employ an IF frequency of 262 KC. When signal tracing this section of the receiver, the generator

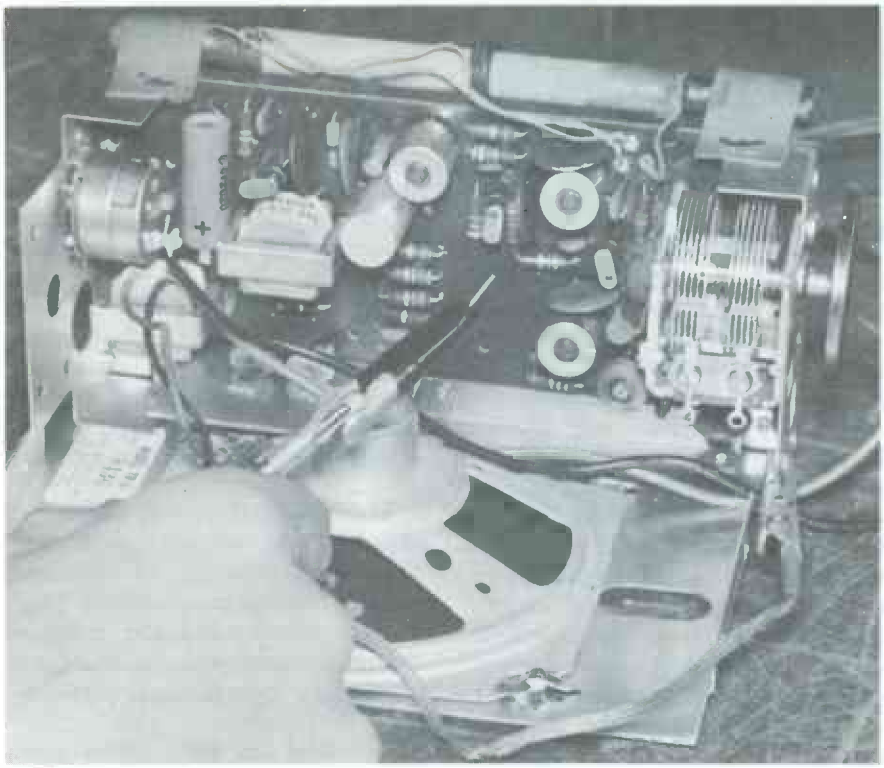


Fig. 5. A small tip on the end of the generator lead will minimize the danger of causing a damaging short.

should be adjusted for the appropriate IF frequency and internally modulated at 400 cycles. See test points B, C, and D in Fig. 4.

The IF signal from the generator will also pass through the set when it is applied to either points E or F given in Fig. 4. To check the operation of the antenna and oscillator circuits, however, a modulated RF frequency should be injected at these points. The RF tuning range of a transistor radio may extend from 530 KC to 1650 KC. Thus, with the tuning gang fully closed, the signal generator frequency should be somewhere around 530 KC. With the tuning gang fully open, the generator frequency should be about 1650 KC.

Remember to keep the output level of the generator as low as possible, particularly when testing the RF and IF stages. In some cases, the signal may radiate through a dead stage if the test signal is too strong.

If the generator output level is too high even at a minimum output setting, an indirect method of coupling is recommended. By clipping the hot generator lead to one of the small circuit components, the signal will be introduced by means of radiation and stray capacitive coupling. Due to the miniature components and limited space in a transistor portable, the technician may find it helpful to place a small wire-like tip on the end of the generator lead as pictured in Fig. 5. It's also a good idea to insulate all but the very end of the tip to minimize the possibility of introducing a short.

When feeding the signal into the RF and IF stages, it's best to use a series coupling capacitor. Any value from .01 to .5 mfd should do the trick. To inject the signal into the antenna circuit, connect the hot lead of the generator to a 4 or 5 turn coil of wire and place the coil close to the antenna loopstick. If too much 60-cycle hum is introduced to the receiver, try bypassing certain points and grounding the test equipment. Battery-operated test instruments are ideal for servicing transistor radios for they will not produce any AC hum.

In tracing various troubles in different transistor radios, the author has successfully used all of the preceding servicing suggestions. In the near future, we intend to cover such topics as alignment, voltage and resistance measurements, and the replacement of circuit components. ▲

Let's Talk Business

PREPARING THAT LOAN APPLICATION

A much larger percentage of business men would obtain the bank loans they seek, bank executives tell us, if only they would prepare their loan applications in advance, provide the essential data the bank must have, and give the bank executive a true picture of their businesses.

The bank executive must be a realist in granting any loan; facts and figures are more his guides than any emotional desire to help a personal friend. This applies to the service shop owner as much as any other business man. In most cases, since the average bank executive has almost no knowledge of the radio and television service business, it is particularly vital that any loan application the shop owner may make be as complete and thorough as possible.

We've talked with several bank executives about this and have asked what specific items they prefer to see in such presentations, what data they must have and what facts concerning the borrower are necessary to help them decide whether or not a loan will be granted.

Here are their suggestions:

1. Factual information as to the character and integrity of the shop owner is important. The more complete the information, the easier it will be to expedite the bank loan. Such information should be made up of facts and data which may be checked and verified. Unfortunately, how good a church member the borrower may be, how many clubs he belongs to or how many contributions he has made to charity are of little value in the respect.

Data as to credit records, past borrowing experience, resources, securities and other assets owned is required by the bank executive.

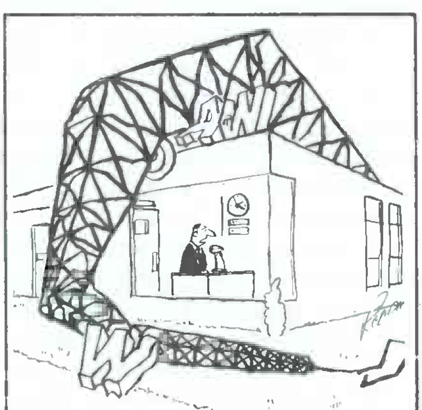
2. The truthful financial situation of the firm at present should be given. Such a detailed financial report should be complete and thorough; information omitted or disguised tends to arouse suspicions which can usually be confirmed by a few discreet inquiries.

3. The ability and know-how of the shop owner in his particular field should be presented in detail. The safety of a loan will depend in large measure on the experience and ability of the shop owner to continue profitable operation of his business. The bank executive will seriously consider whether or not such experience and ability are sufficient to carry the firm safely through a possible depression during the life of the loan.

4. The position of the shop in the local business community is of vital importance. The application should contain a factual report of the estimated volume of total business done in the field locally and the percentage of that business being done by the applicant's firm. If the record is a good one, this can well be extended back over recent years to show steady growth.

Continued success of a business depends on its reputation and the demand for its services. These are factors which the bank executive must take into account, and any and all information the applicant can supply will be of direct help in securing the loan speedily and with a minimum of red tape.

5. The competition within the applicant's field of business is also of concern to the bank executive; thus a brief paragraph outlining the company's position in this respect will be of help.



. . . . . AND SO WOAW CONCLUDES ITS BROADCASTING ACTIVITIES FOR THIS DAY. .

6. In addition to the conventional financial statement, financial reports presented as part of the loan application should include a profit-and-loss statement covering the last five years of operation.

Bank executives tell us most businessmen tend to be incomplete in making such reports. They must therefore inquire for further details which take up much time and delay the granting of loans.

The financial report submitted should show not only profit-and-loss but volume of business broken down into various categories; actual itemized costs of doing business, salaries, insurance coverages, promotional expense, etc.

7. What are the future prospects of the shop? This is a question the bank executive must always ask. In forming an opinion, he will always welcome an outline from the shop owner giving these prospects as he sees them.

Such an outline should be factual—not a list of hopes and ambitions.

8. What does the shop owner plan to do with the money he requests? A terse statement that funds are desired for "future expansion" means nothing to the bank executive who is required by law, and the stockholders of his bank, to make his decision on facts alone.

A detailed outline of what the shop owner plans to do with the funds requested should accompany any such loan application. These should be presented in generalized terms rather than specific dollar-and-cents items, in order to give one the chance to change details of the over-all plan after the loan has been secured.

It goes without saying that the chance for any shop owner's loan application being approved will increase considerably when it is shown that the money is to be used for expansion of the existing assets of the company.

9. How is the loan to be repaid? Bank executives take a dim view of the loan applicant who seeks to borrow money without any plan as to how it will be repaid.

"Oh, increased profits will make it easy for me to repay this loan," is a statement too often made. This does more harm than good. But if the loan application is backed up with specific dollar-and-cents outlines of exactly how the borrower has planned to repay the money, it has much more chance of speedy acceptance.

Too many borrowers view repayment planning as of little importance since they feel the security they are putting up amply covers any eventuality. Bank executives, however, tell us that security is only a minor factor (necessary because of legal requirements and to protect the capital of stockholders and depositors).

"I'm in the banking business," one executive explains it, "and not a used business dealer. The sole thing that interests me is repayment in dollars of the money being loaned. If the only hope of that repayment lies in taking the security and selling it, you may be sure neither I or any other bank executive would ever approve any loan."

So it pays to remember that how the loan is to be repaid is of far more importance than any security offered.

10. Is the proposed business expansion for which the funds are to be used too abrupt a step for its present management to handle? Bank executives have seen many a small businessman expand so fast that he has found his executive resources inadequate at the increased level.

Where loans are desired for considerable business expansion, the bank executive should be shown that the problems involved have been thought out carefully by the shop owner. As a rule, bank executives tend to favor slow and gradual expansion through bank credit—their cumulative experience has proven to them that such expansion is the safest and soundest for all concerned.

The foregoing ten points should be covered in detail with any shop owner's application for a bank loan. For, while they won't absolutely insure a loan being granted, they will assure more thorough and careful consideration by the banker. ▲

Outdoor Theater Speaker

Quam-Nichols Co., Chicago, Ill., has announced a new outdoor theater speaker with a weather-resistant "Humi-Gard" cone made of a plastic-impregnated synthetic fabric. According to the manufacturer, this cone has almost exactly the same frequency response characteristics as an untreated paper cone. The company has made the new cone material standard in all its outdoor speakers.

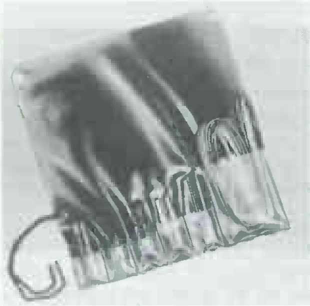
New Test Equipment Kits

Paco Electronics, Inc., a newly-formed division of the Precision Apparatus Co., 70-31 84th St., Glendale, L.I., N.Y., is producing a new line of competitively-priced test instruments in kit form. Currently available are the first 5 kits in the line: Model B-10, 6- and 12-volt battery eliminator at $31.50; Model C-20, resistance-capacity-ratio bridge at $20.95; Model S-50, 5" oscilloscope with 1-mc bandwidth at $47.50; Model T-60 tube checker at $37.75; and Model V-70 VTVM (pictured) at $31.50. The next 3 kits planned for the line will be: Model G-30 RF signal generator; Model Z-80 AF-RF signal tracer; and Model M-40 high-sensitivity VOM.

RC Substitution Box

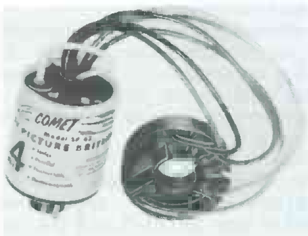
Service Instruments Corp., 171 Official Road, Addison, Ill., is now manufacturing a new RC substitution box, the Sencore "Handy 36." Not a conventional decade box, the unit has 24 separate resistors and 12 capacitors in commonly used values such as 33K ohms and .02 mfd. A 12-position, 3-range selector switch is provided. On the R-OHMS range, 1-watt resistors ranging from 10 to 5.6K ohms are selected. The R × 1000 range provides a choice of ½-watt resistors in values from 10K ohms to 5.6 megohms. The capacitance range includes 10 values from .0001 to 0.5 mfd, plus two electrolytic units in values of 10 and 40 mfd. Dealer net price of the "Handy 36" is $12.75.

Test Prod Kit



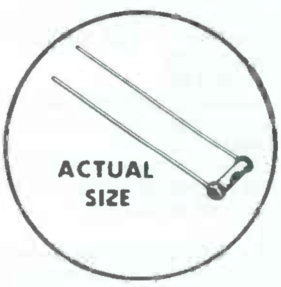
Self-holding "Klipzon" test prods, which fasten themselves to a test point by spring action, are featured in the "G-C Klipzon KK Kit" (Catalog number 6037) being introduced by General Cement Mfg. Co., 400 S. Wyman St., Rockford, Ill. In addition to a basic pair of test leads with the "Klipzon" tips, the kit includes 5 pairs of adapters—3 extra pairs of "Klipzons" that can be slipped over other types of test prod tips, plus 1 pair each of alligator clips and banana plugs for adapting the test leads to various situations.

Picture Tube Brightener



The "Comet" Model SP43, manufactured by Anchor Products Co., 2712 W. Montrose Ave., Chicago, Ill., is a picture tube brightener intended to be used for improving the performance of old, dim cathode ray tubes. It will work with either electrostatic or electromagnetic focusing systems without alteration and is easily adapted for either series or parallel heater operation by the change of one connection.

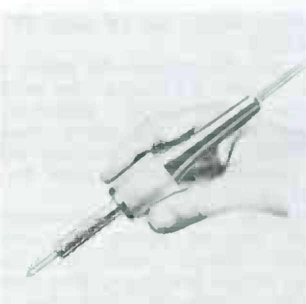
Miniature Globar Resistors



Workman TV Inc., Teaneck, N.J., is distributing a new line of miniature "Globar" resistors for use in hearing aids, transistor radios, and other miniaturized units. These components measure ¼" in length by 1/16" in diameter and can dissipate as much as ⅕ watt. Ohmic value is indicated by a RETMA body-end-dot color code.

A display card holds 200 units of 40 different values, and the resistors are sold singly at a dealer net price of 39¢ each.

Soldering Pencil



Hexacon Electric Co., 589 W. Clay Ave., Roselle Park, N.J., announces a new soldering pencil equipped with a long-life ¼" tip rated at 50 watts. This iron is ruggedly built and efficiently ventilated, making it suitable for continuous use. The tip and heating element are independently replaceable in the field.

This soldering pencil (Catalog No. 24S) operates on either AC or DC and is available for either 110- or 220-volt operation.

PF REPORTER

INDEX TO ADVERTISERS

June, 1957

PF REPORTER — CATALOG and LITERATURE SERVICE

valuable manufacturers' data available to our readers at no charge.

1F. AMPEREX
8-page catalog on Hi-Fi tubes. *See ad page* 55.

2F. B & K
Bulletin 500 describes "Dyna-Quik" dynamic mutual conductance quick-check tube tester. Bulletin 1000 on new "Dyna-Scan" picture and pattern video generator. Also Bulletin 750 on new lab-type test equipment calibrator Model 750 that checks instrument accuracy and Bulletin 400 on CRT cathode rejuvenator tester. *See ad page* 10.

3F. BELDEN
Electronic wire and cable catalog #857. *See ad page* 51.

4F. BUSSMANN
Television fuse chart Form TVC. Shows components protected and proper fuse for all TV and auto radio sets. *See ad page* 37.

5F. CHICAGO STANDARD
STANCOR TV Transformer Replacement Guide and catalog sheets. *See ad page* 27.

6F. CLAROSTAT
C-Line controls—composition element and wire-wound—2, 3 and 4 watts—for lab, equipment builders and prototype use. Form 753394. *See ad page* 33.

7F. CLEVELAND INSTITUTE
Booklets showing how to increase income by installing and maintaining equipment like: 2-way radio, microwave relay, industrial electronics, radio, etc.

8F. CORNELL-DUBILIER
Catalog XTR200D-3T on tubular capacitor replacements. *See ad page* 58.

9F. EICO
12-page catalog shows how to save 50% on electronic test instruments and hi-fi equipment in both kit and factory-wired form. *See ad page* 44.

10F. ELECTRO-VOICE
Bulletin #211, a 2-color brochure containing the complete story on CDP's—coaxial P. A. projectors. Including data on how diffraction horns work, getting increased coverage with fewer units, variable polar patterns, and many other specifications and features of the CDP line. *See ad page* 43.

11F. ERIE RESISTOR
New D-57 Electronics Distributor Catalog. *See ad page* 78.

12F. E-Z HOOK
A convenient reference sheet titled "How to Build the Five Most Useful Scope Probes" gives the schematic, mechanical component layout, and a brief description of five scope probes you'll find most useful in your servicing. *See ad page* 54.

13F. GENERAL CEMENT
G-C catalog S-58. *See ad page* 71.

14F. IRC
Form 5-035-DLR-57 replacement parts catalog. *See ad* 2nd cover.

15F. JACKSON
Condensed catalog sheet listing all products. *See ad page* 65.

16F. JENSEN INDUSTRIES
1957 "Jenselector" and wall chart for easy identification of correct needle for you and your customer. *See ad page* 64.

17F. KEDMAN
Catalog sheet describing 4 screwdriver displays and lists specifications of 14 kinds of screwdrivers in the company's line. *See ad page* 74.

18F. LITTELFUSE
Price sheets showing pictures, descriptions, part numbers and list prices of company's products. *See ad* 4th cover.

19F. MERIT
Auto radio replacement guide and catalog #3-1957. *See ad page* 44.

20F. PHAOSTRON
Illustrated catalog lists complete line of custom panel meters. Includes comparison chart of Phaostron instruments vs. other brands plus dimensions and features. *See ad page* 57.

21F. QUAM
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22F. RADIART
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23F. RCA ELECTRON TUBE DIV.
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24F. SIMPSON
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25F. SOUTH RIVER
1957 catalog of antenna mountings and accessories. *See ad page* 75.

26F. SYLVANIA
Brochures on receiving and picture tubes and all industrial products. *See ad pages* 6-7.

27F. TACO
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28F. TRIAD
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29F. TRIPLETT
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30F. WALSCO
New 1957-58 catalog—62 pages of over 1,500 TV-radio servicing products including phono-recorder drives, alignment tools, electronic hardware, service aids and chemicals. *See ad page* 49.

31F. WEN
Illustrated folder AL-1 describing entire line of handy, low-cost, electric power tools—soldering guns, sander-polishers, kits, saw, saw-table, new 3/8" drill. *See ad page* 4.

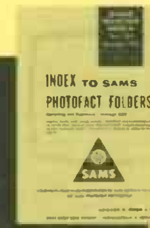
32F. XCELITE
New illustrated general catalog covers nutdrivers, screwdrivers, pliers, reamers and combination kits. *See ad page* 65.

JUNE 1957

SUPPLEMENT to SAMS MASTER INDEX No. 102

File this Supplement with your 36-page SAMS MASTER INDEX. Together, they give you complete PHOTOFACT coverage.

For models and chassis not listed in this Supplement, refer to SAMS MASTER INDEX No. 102. If you haven't a copy, send for it today. It's FREE . . . just write to HOWARD W. SAMS & CO., INC., 2201 East 46th Street, Indianapolis 5, Indiana.



This Supplement is your handy index to new models covered in the latest **PHOTOFACT Sets 346 through 361.** It's your guide to the world's finest service data coverage of the current output of the new TV and Radio receivers, as well as models not previously covered in PHOTOFACT. It keeps you right up to date.

ALWAYS USE YOUR LATEST ISSUE OF THIS SUPPLEMENT *WITH* THE SAMS MASTER INDEX . . . TOGETHER, THEY ARE YOUR COMPLETE INDEX TO OVER 28,000 MODELS.

IMPORTANT: THIS SUPPLEMENT REPLACES MAY SUPPLEMENT No. 102-D

Discard prior supplement, since this issue includes all previous listings *plus* latest models

FILE WITH YOUR SAMS MASTER INDEX No. 102, DATED FEBRUARY, 1957

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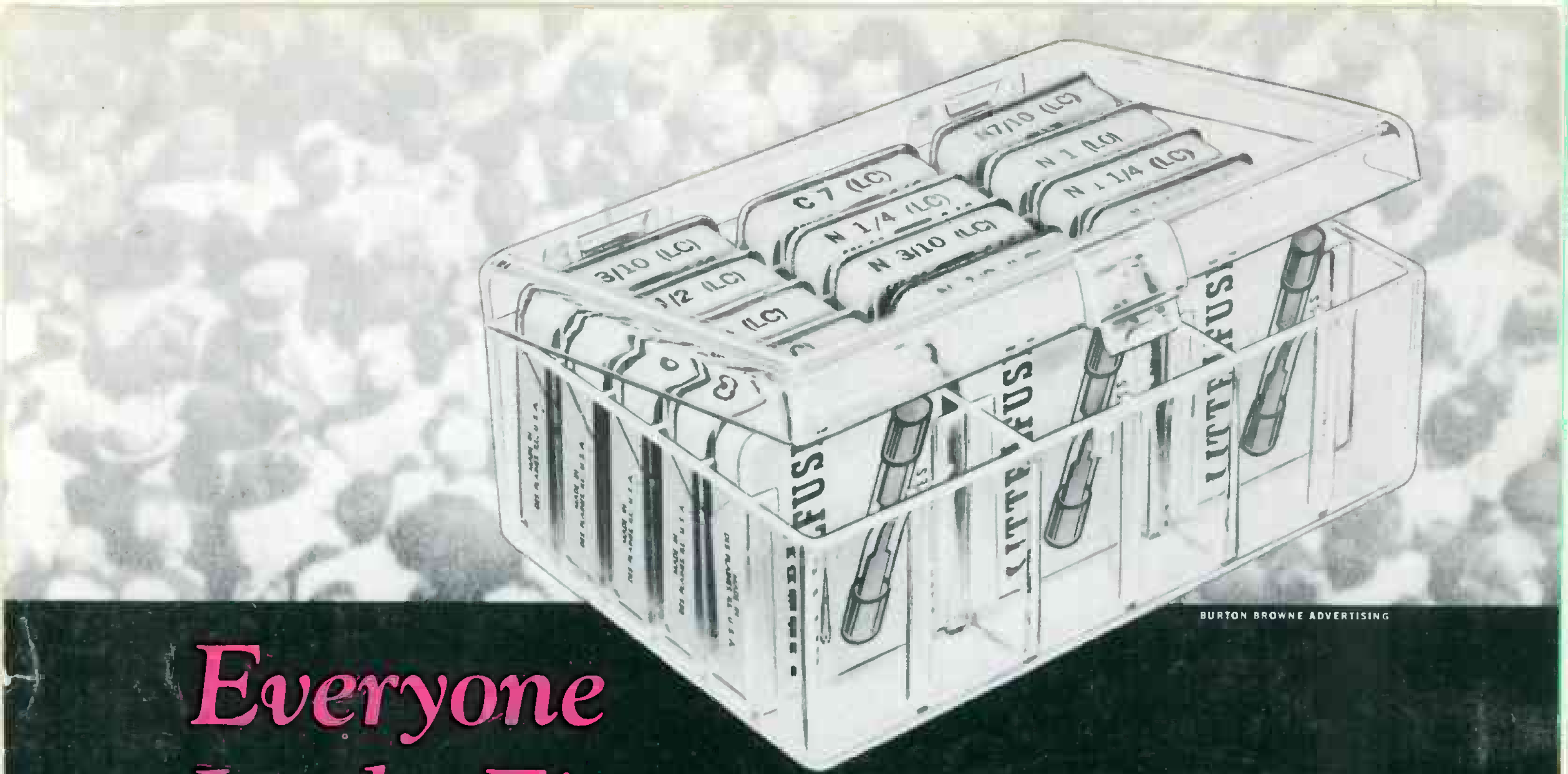

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