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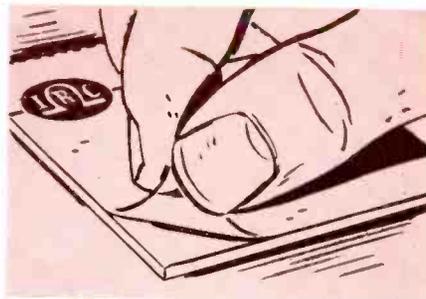
Stock No.  
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5.6 ohms

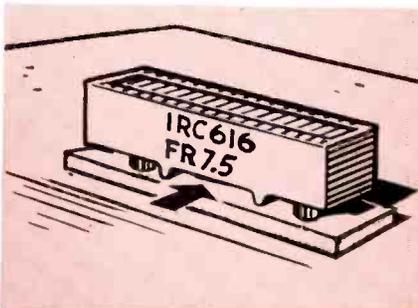
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**Circuit Digests**

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June, 1957

## FRONT COVER

With electronic product designs going from miniature through sub-miniature to microminiature, the choice of proper tools to reach components becomes increasingly important. In addition to standard hand tools, we are learning to use devices from the jewelry, dental and engraving trades, some of whose tools are shown. For details, see article starting on page 24.

## FEATURES and ARTICLES

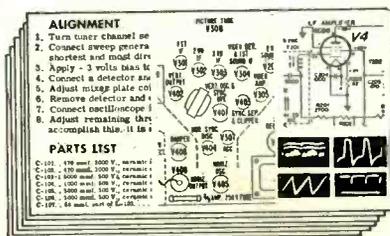
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## CIRCUIT DIGESTS

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by Dr. Alexander Schure

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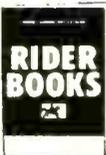
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Personnel Dept.

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(Continued on page 6)

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Model SA-HF



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# 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.

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. 11506, 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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(Continued from page 2)

## Business For Sale

**FOR SALE OR RENT** complete radio TV service business. Owner (engineer) seeks to relocate in factory. BS651, ELECTRONIC TECHNICIAN.

"Business for Sale" and "Help Wanted" listings are available in this section to aid shop management and owners in obtaining qualified personnel or selling their business. This section is not open to manufacturers.

Cost for an announcement in this section is 25¢ per word, with numbers and address words counted. Remittance must accompany insertion order.

Those service shops wishing to have a box number listing instead of including their names and addresses may have one assigned for an extra charge of \$2. All inquiries directed to such box numbers will be routed directly to the shop inserting the announcement.

## LETTERS

To the Editor

### Tube Test Boomerang

Editor, ELECTRONIC TECHNICIAN:

I deplore those brilliantly lighted tube testing machines in drug stores. It is to be hoped that this new form of competition will prove a boomerang when set owners find out that changing tubes in the tuner and video strip may call for realignment. And when they receive a bite from the pix tube, high voltage section or hot chassis they should renounce the free tube testing machine. Trade magazines should denounce this form of competition, and manufacturers should inform the public of the hazards involved.

G. Warren Heath

Brooklyn, N.Y.

### Reprint Pussyfoots

Editor, ELECTRONIC TECHNICIAN:

The Milwaukee Association of Television Servicemen would like permission to reprint "An Abundance of Pussyfoots and Pioneers" from your March 1957 issue.

Helen S. Bessert  
Editor, MARTS News

Milwaukee, Wis.

• Permission cheerfully granted to reprint with usual copyright credit.—Ed.  
(Continued on page 14)

*Mr. Service Dealer...*



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ET-657



AR-22



TR-2



TR-4

# CDR ROTORS



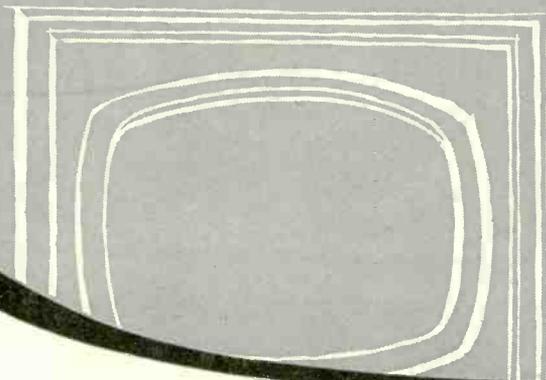
TR 11 and 12



AR 1 and 2

## 5-star feature...

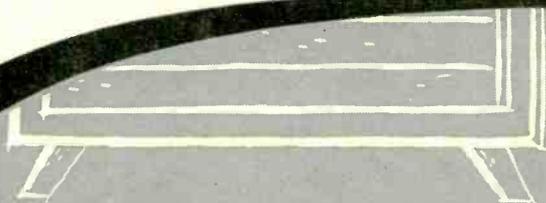
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the growth of color TV means an even greater demand for CDR Rotors for pin-point accuracy of antenna direction.
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CDR Rotors add to the pleasure of TV viewing because they line up the antenna perfectly with the transmitted TV signal giving a BETTER picture . . . and making it possible to bring in MORE stations.



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thousands and thousands of CDR Rotors have proven their dependability over years of unflinching performance in installations everywhere in the nation. Quality and engineering you know you can count on.

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the greatest coverage and concentration of full minute spot announcements on leading TV stations is working for YOU . . . pre-selling your customers.

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a model for every need . . . for every application. CDR Rotors make it possible for you to give your customer exactly what is needed . . . the right CDR Rotor for the right job.



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# TAKE YOUR CHOICE



**WITH EVERY CLAROSTAT  
PICK-A-SHAFT\* CONTROL YOU  
GET YOUR CHOICE OF SHAFT  
AT NO EXTRA COST!**

Select the control you want— $\frac{1}{2}$ -watt composition-element, regular, tapped or dual; 2-watt wire-wound; 3-watt wire-wound; or 4-watt wire-wound. Then choose from any one of the 13 types of shaft. There's one for every need.

*Ask your Clarostat distributor...*

\*Reg. U.S. Pat. Off.



for **P**erformance... **D**ependability... **Q**uality...

*Controls and Resistors*

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In Canada: **CANADIAN MARCONI CO., LTD., TORONTO 17, ONT.**

## Editor's Memo

look what **\$24<sup>50</sup>** buys  
in test equipment!

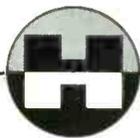


**HEATHKITS  
GIVE YOU  
TWICE AS MUCH  
equipment for  
every dollar  
invested**

The famous model V-7A Vacuum-Tube-Voltmeter is a perfect example of the high-quality instruments available from Heath at  $\frac{1}{2}$  the price you would expect to pay! Complete, only **\$24<sup>50</sup>**



Get the most out of your test equipment budget by utilizing HEATHKIT instruments in your laboratory or on your production line. Get high quality equipment, without paying the usual premium price, by dealing directly with the manufacturer, and by letting engineers or technicians assemble Heathkits between rush periods. Comprehensive instructions insure minimum construction time. You'll get more equipment for the same investment, and be able to fill your needs by choosing from the more than 100 different electronic kits by Heath. These are the most popular "do-it-yourself" kits in the world, so why not investigate their possibilities in your particular area of activity! Write for the free Heathkit catalog now!



Contains detailed descriptions of Heathkit models available, including VTVM's, scopes, generators, testers, bridges, power supplies, etc.



Also describes Heathkit ham gear and hi-fi equipment in kit form. 100 interesting and profitable "do-it-yourself" projects!

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A SUBSIDIARY OF DAYSTROM, INC.,  
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Not all knowledge comes out of books, as many a successful business man, entertainer, artist, salesman or what-have-you can testify. However, in a technical field such as TV-electronics it's almost impossible to learn the intricacies of the science without digging into books, articles and manufacturers' literature.

Some folks have an almost intuitive good sense for handling people, for saying the right thing at the right time, and for reacting to another person's actions in an effective manner. But rare is the bird who can intuitively sense a circuit or a theory of electronic operation.

Yes, if you want to get ahead from a technical viewpoint, read all you can. If you wish to make progress in your roles of salesman, promoter, business man, administrator and public relations man (almost all technicians play one or more of these roles), reading will also be a big help, particularly with respect to record and accounting procedures.

But all the reading in the world won't help if you don't have, or refuse to develop, that spark of understanding, horse sense, common sense, intuition or call it what you may, which adds business success to technical achievement.

There's an entertaining story which illustrates this. A college professor meets a man in a resort town. "I know you," he tells the fellow.

"I don't remember you," is the reply.

"Sure," says the prof, "twenty-five years ago you were a student in my math class."

"Amazing," exclaims the man. "How could you remember so long ago?"

"That's easy. In forty years of teaching you were the worst student I ever had. By the way, what are you doing nowadays?"

"Oh, I just docked my yacht. I'm going to my summer estate to meet some oil well owners I plan to buy out."

"Are you in the petroleum or manufacturing fields?" asks the prof.

"Oh nothing as complicated as that. In my business I simply buy and sell paper boxes," replies the man.

"You mean to tell me you amassed your estate and yacht, and make all your money just from that?" queries the prof.

"Yes, I buy the boxes for ten cents each, and sell them for fifty cents. And from this five percent I make a living!"

*Al Foman*

*here's  
another  
Independent  
Service Ad  
to grow on*

We're telling the advantages of your *independent* service in advertisements like this every month . . . pre-selling for you the millions of readers of all 44 local editions of TV Guide.

**Ask your distributor how you can profit.** Get the free PA-131 folder giving complete details about your Independent Service campaign.



*For your TV repairs  
call the man who cares*

**THE INDEPENDENT  
SERVICE-DEALER**

He'll do a better job for you because he wants to. He's your neighbor. He pays taxes in your town. He has the same common interests and problems. He cares what you think of him and the service he gives you . . . because it's important to *his* business success.

So when your radio or TV needs repairs, call the man who cares. Call your independent service-dealer . . . the skilled technician who is trained and equipped to service promptly *all* makes of radio and TV sets at fair prices.



And if your set needs new tubes, ask him for CBS tubes. They have the Good Housekeeping Guaranty Seal . . . and there are no better tubes made.



Look for this emblem to identify your independent radio and television service-dealer.

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A Division of  
Columbia Broadcasting System, Inc.



Ask also for this free decalcomania . . . for free window display and ad mats. And for other special tie-in material: Postal cards, doorknob hanger and consumer booklet selling your service.

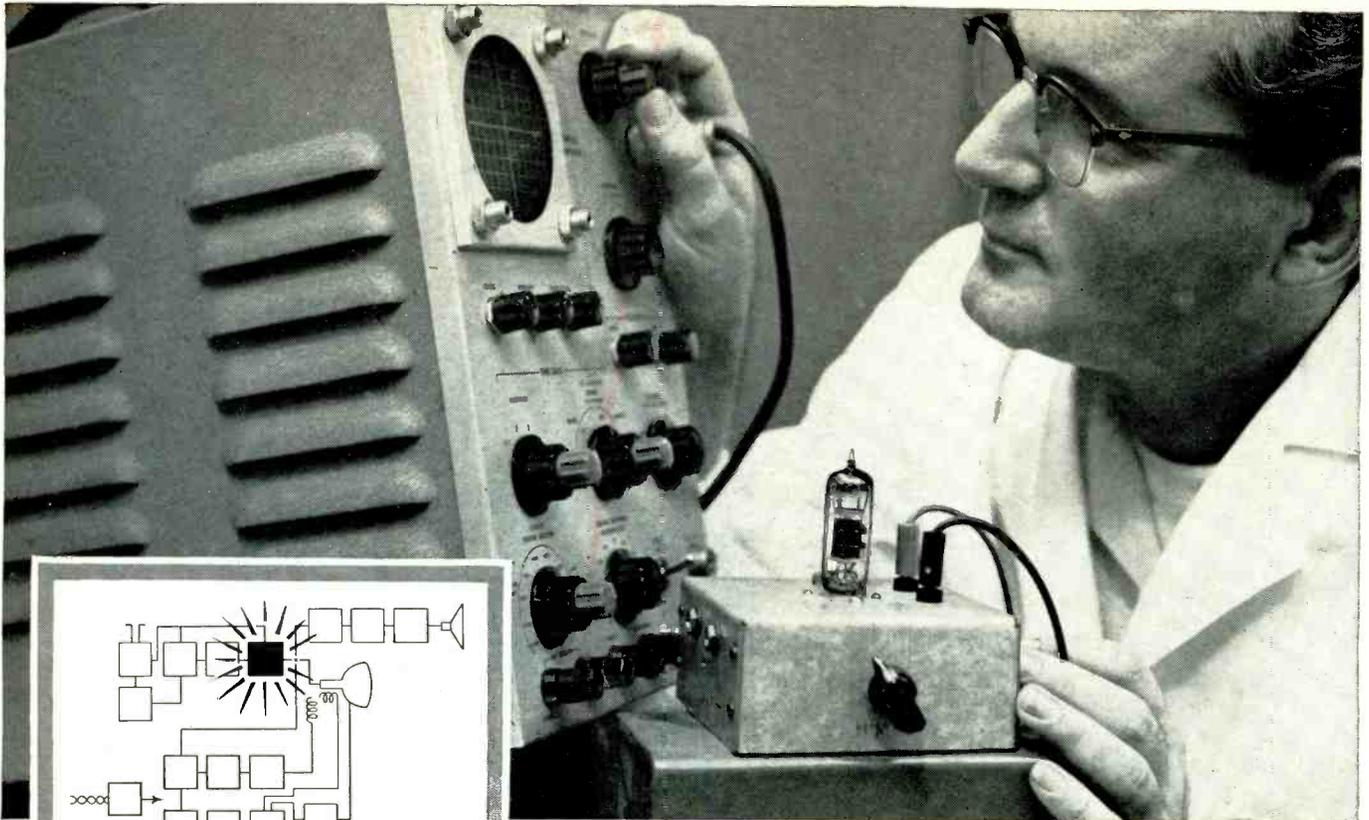
Help us help you. Join with other independent service-dealers . . . your independent parts distributor . . . and CBS Tubes to make independent service strong.



**CBS-HYTRON**  
DANVERS, MASSACHUSETTS  
A Division of  
Columbia Broadcasting System, Inc.

**Remember.**

*The more you say, "I want CBS Tubes!", the greater support you give to your independent service-dealer campaign. Keep saying it. It will keep paying you business dividends.*



To verify tube's high output, a General Electric applications engineer operates a G-E video-amplifier tube in mock-up of a typical video circuit.

## Install high-quality G-E video-amplifier tubes for maximum TV sharpness and contrast!

**Plated grids and special-alloy cathodes keep down grid emission, increase video output!**

● General Electric video-amplifier Types 6AU8-A, 6CX8, and 12BY7 feature plated grids and special-alloy cathodes. These reduce grid emission to an insignificant level, and mean sharp, full-detail TV pictures for your service customers.

Further, the new dual-function 6AU8-A includes new-design shields that bar cross currents between tube sections, effectively preventing picture distortion and erratic sync. Also, the tube's increased permeance and controlled knee location provide

more video output without white compression.

Similar high-quality characteristics mark *all* General Electric video-amplifier tube replacements. Stringent control of mica holes for support rods makes for tight-fitting tube elements and reduced microphonics. Rigid testing for zero-bias plate current encourages electrical uniformity . . . life tests promote full-length, top-value operation.

Always replace with high-quality G-E tubes! Your customers will enjoy better TV . . . your list of satisfied clients should grow steadily. *Distributor Sales, Electronic Components Division, General Electric Company, Schenectady 5, New York.*

*Progress Is Our Most Important Product*

**GENERAL  ELECTRIC**

161-1A6

# Now from the maker of the famous TOBE "Filterettes"... a new quality line of replacement capacitors

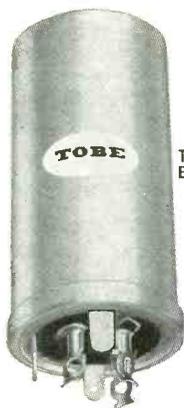
Metalized Papers



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As the leading manufacturer of high-quality industrial capacitors for over 33 years, Tobe has the know-how and the facilities for producing capacitors that must stand up under tough commercial usage.

Now Tobe is building the same ruggedness and long service life into a complete line of standard replacement capacitors that will stand up under the beating of modern TV circuits. And they'll cost you no more!

You owe it to yourself to try Tobe capacitors on your next job. And Tobe is going to make it easy for you to do just that. See your Tobe Jobber today for full details.

TOBE DEUTSCHMANN CORPORATION,  
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Capacitors • Pioneers Since 1922

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## Servicemen's favorites in wire-wound controls

You're sure of giving your customers the best when you use Mallory wire-wound controls. The choice of servicemen and manufacturers everywhere, they have set the standards of the industry for value and performance.

**They're conservatively rated**—to assure you of cool operation without need for using over-sized units.

**They're compact**—fit readily into crowded chassis locations.

**They're long lasting**—give years of stable, dependable service.

**They're uniform**—made to strict specifications to meet or exceed original equipment requirements.

Mallory 2-watt and 4-watt controls are available in resistance values and tapers to match every replacement need. Your local Mallory distributor has a complete stock—see him today!

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**MALLORY**

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- Capacitors
- Controls
- Vibrators
- Switches
- Resistors
- Rectifiers
- Power Supplies
- Filters
- Mercury Batteries

(Continued from page 6)

### Block That AC!

Editor, ELECTRONIC TECHNICIAN:

As an electronics instructor, I wish to register a gripe. You have published articles which lead the novice to believe that ac current can flow through a capacitor. This is a difficult idea to correct when a student reads it in a most reputable publication. We teach the hydraulic analogy of a flexible diaphragm distorted by water pressure in alternate directions, the reciprocating pump being the generator, and the energy being stored in the flexed diaphragm. This is easy for the student to accept until they read of the capacitor passing ac. If the dielectric is intact, it cannot pass.

F. LEE ARMSTRONG

San Antonio, Texas

• Fortunately, almost all of our readers are experienced professionals who understand that we refer to the effective charge transfer through the capacitor as measured by an ac ammeter. They know that electrons do not actually jump across the dielectric. Such practical technical shorthand is commonly accepted. For example, all of us (probably including reader Armstrong) talk about "direction of current." To be hair-splitting about it, current is a scalar which has a plus or minus sense, but no direction. However, we still understand each other when we say a current travels this-a-way.—Ed.

### Award Nomination

Editor, ELECTRONIC TECHNICIAN:

I am taking the liberty to place ELECTRONIC TECHNICIAN in nomination to receive the NATESA "Friends of Service Management" plaque. This will be voted on at the National Alliance of Television Electronic Service Associations convention in Chicago, August 16-18. This is in consideration for your splendid editorials in the February and March 1957 issues, and for your stand in using the term technician instead of serviceman.

J. P. GRAHAM

Editor, ARTSD News

Associated Radio & Television Service Dealers  
Columbus, Ohio

### Pix Tube Conversion

Editor, ELECTRONIC TECHNICIAN:

I have a set using a 21EP4, and would like to change to a 24CP4 I have on hand. What is the effect of deflection angle and other factors?

A. R. DELANDE

New Orleans, La.

• The 21EP4 horizontal deflection angle is 65°, the 24CP4 is 85°, so the most predictable effect will be insufficient horizontal sweep, although you may also run into non-linearity, blooming, etc. The vertical output should be adequate in most sets. While this conversion can be made, it is not generally recommended.—Ed.

(Continued on page 16)

# FREE



## BARBEQUE GRILL with "FASTEST FIFTY" TUBES!

this portable, foldaway Charcoal Grill is just the thing for enjoying delicious grilled steaks, hamburgers and hot dogs all year round! Use in fireplace, back yard barbeque or at the beach. Gives big 17½" cooking area. Built of strong, sturdy steel yet weighs only 5 lbs.

**\$4<sup>98</sup> Value**

## Westinghouse RELIATRON® Tubes Special Offer *with Fifty Fastest-Moving, High-Profit Tubes*



Starting June 1, 1957, for a limited time, with your order of the "Fastest Fifty" Westinghouse Tubes, you get a free barbeque grill packed right in the special container! What's more, you get the fifty tubes with the fastest turnover and highest profit. Westinghouse RELIATRON Tubes—the tubes that are still standing up under the grueling Locked TV "Torture Test"—proving they work better and last longer to reduce call-backs!

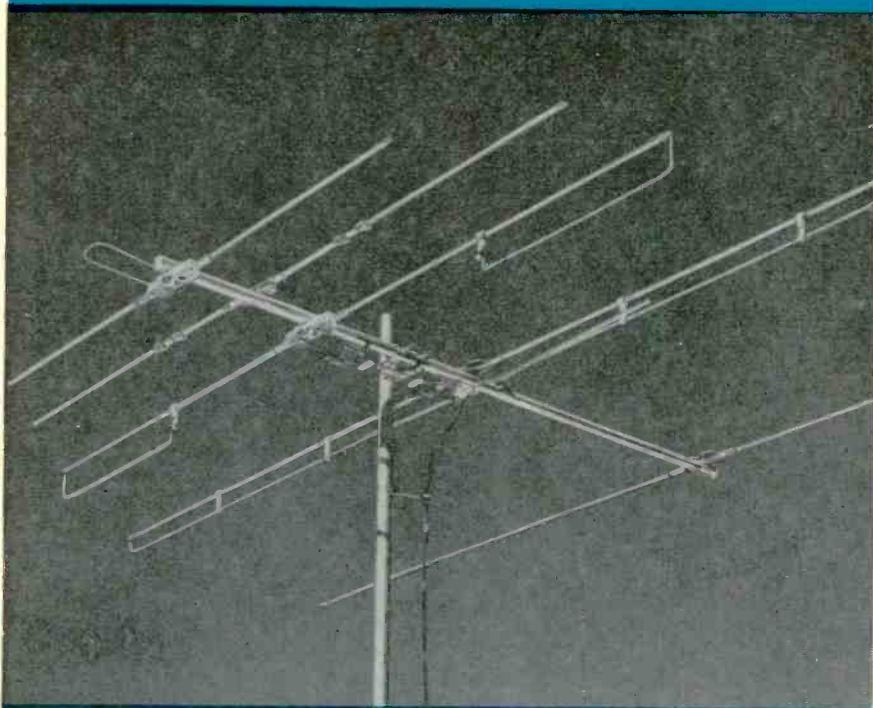
**PLACE YOUR ORDER WITH YOUR WESTINGHOUSE DISTRIBUTOR TODAY!**

**HERE'S WHAT YOU GET**  
in the special "Fastest Fifty" Tube Kit of RELIATRON Tubes...

QUANTITY	TYPE NO.
5	1B3GT
5	5U4GB
6	6AU6
3	6AX4GT
6	6BQ7A
3	6BZ7
7	6CB6
7	6SN7GTB
5	6U8A
3	12AU7A

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

# DEPENDABILITY



## above all others

The TACO Topliner has been proved the finest performer—in side-by-side comparisons. In actual installations the Topliner provides the day-in, day-out performance so necessary to maintain *your* reputation with the customer.

Seeing is believing—use a Topliner on that next installation. See for yourself just how much better the Topliner works.

TACO

*Topliners*

Trade-mark

TECHNICAL APPLIANCE CORPORATION, SHERBURNE, N. Y.

IN CANADA: Hackbusch Electronics, Ltd., Toronto 4, Ont.

(Continued from page 14)

### Using Tube Seconds

Editor, **ELECTRONIC TECHNICIAN**:

Cheap tubes will always be with us. During World War II they were all one could buy. Tubes stamped MR, for manufacturer's reject, are still on my shelf. They worked fine. Somewhere along the line their use attached a stigma. If the big tube companies started sand blasting to mark their seconds, and sold these usable rejects as such to competent TV technicians, everyone would benefit. Here is a plan: All the tube companies who would sell their rejects at a reduced price could turn the resulting profits over to a RETMA—supervised program providing scholarships for potential electronic technicians. A byproduct result would be to bypass those "tube supermarkets" who advertise 50% off.

Melvin Levinson

R & M Television  
Elizabeth, N.J.

### Repugnant Creatures

Editor, **ELECTRONIC TECHNICIAN**:

I have been reading with a great deal of interest letters pertaining to that most repugnant creature, the "night crawler." Some of the views, however, just don't add up. Some advocate licensing to put an end to part time servicing. To be fair, a man's technical ability should be the prime factor, not number of hours in the job. For comparison, the licensed teacher often takes a part time job. Even lawyers and doctors need not have a private practice; they can work for corporations.

If anyone wonders where I stand on this, I am employed at one of the largest aircraft plants on Long Island, N.Y., as head of communications. I carry commercial phone license P2-2-6504, and have a part time shop that is completely equipped not only for TV, but also for communications.

HARRY THOMAS, JR.

Central Islip, N.Y.

### Pardon Our Slip

Editor, **ELECTRONIC TECHNICIAN**:

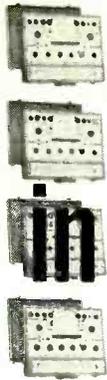
There are two points in the April article "Troubleshooting and Linearizing Oscilloscope Deflection Circuits" that should be corrected. Fig. 1 shows 3 cycles of a 60-cycle sine wave, so the sweep frequency should be 20 cycles instead of the 30 in the article. Also, I don't see how the distorted sawtooth in Fig. 2 could cause the distorted sine wave in Fig. 1. This sine wave shows crowding on the right, while the sawtooth would cause expansion on the right, assuming the sweep is from left to right as it apparently is judging by the left portion of the sine being linear with the linear part of the sawtooth.

Robert G. Donnell

Rockville, Md.

• Reader Donnell is right on both counts. The sweep is 20 cycles. The sawtooth was accidentally reversed in printing the negative.—Ed.

# 4



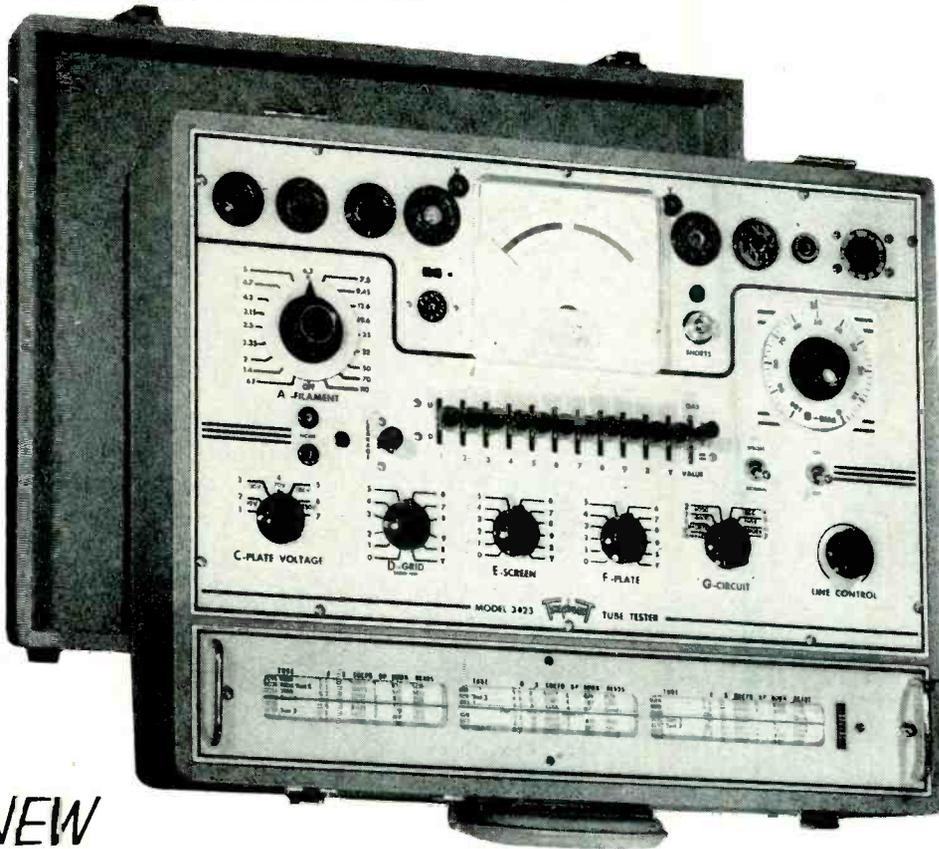
# 1

# TRIPLET

- mutual conductance tube tester
- transistor checker
- germanium diode tester
- selenium rectifier tester

MODEL 3423

\$199.50



MODEL 3413-B ... \$79.50

The first low priced tube tester to provide  
• dual sensitivity for short test

Triplet model 3413-B combines provision for conventional short test (0.25 megohms) with high sensitivity leakage test (2.0 megohms)—will test series string tubes without adapter. No one piece of equipment can do more for you. As the electronic field expands your tube tester must do more. TRIPLET TUBE TESTERS meet this demand. More heater voltages including 3.15, 4.2 and 4.7 volts for 600 mill series string heaters. Quickly locating the bad tubes saves time. Tube sales can be a profitable business in itself.

## NEW

Triplet Tube Tolerance Computer—permits model 3423 users to check tubes for critical circuits closer than the approximately 35% below tube manual value as shown on the roll chart.

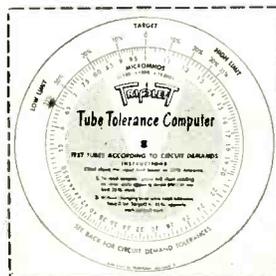
Simple use quickly determines micromho reading required for selecting applicable tubes for such as oscillator circuits that call for tubes within 10% of the manual value.

Available to all present and future users.

Burton Browne Advertising

Here is the ultimate in a tube tester for today and tomorrow. A 4 in 1 value that checks for accuracy as the circuit demands depending on the tolerance of the circuit.

Model 3423 will give you no false readings to waste time. The patented circuit for the tube testing ensures actual



signal (4KC) for grid and DC bias voltage making it independent of line voltage hum. It also has a complete coverage of all tube types—six plate voltages (including 0-10 variable). Micromhos scales read 0-1800, 0-6,000, 0-18,000 and 0-36,000. Leakage measured directly on meter 0-10 megohms.

Quick development of new types of tubes can obsolete any tester tomorrow that does not have the multiple switching arrangement of Model 3423 which allows making any combination of tube connections. Ask your parts distributor to demonstrate the many other extra features of this foremost tube tester. ... Triplet automatically furnishes revised, up-to-date roll charts regularly if you promptly return registration card. (Included with tester.)

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# You Have More TO SELL WITH A Winegard

The more sound selling facts you can put before a customer, the more chance you have of closing a sale! And the Winegard Color'Ceptor gives you selling points no other antenna can offer . . . exclusive buying appeals that clinch 9 out of 10 sales!

## They See the Gold and They're Sold

The gold-anodized finish of the Color'Ceptor gives it a rich, quality appearance not found in any other antenna. When you show the Color'Ceptor alongside competitive models, the Color'Ceptor is so distinctive, so finished-looking that it is invariably selected by your customers. Gold-anodizing has a practical sales advantage, too. It provides immunity to corrosion—prevents deterioration in performance.

If the Winegard Color'Ceptor won't bring in a station you want to see . . . nothing will! Proof of performance was dramatically illustrated when Robert Seybold of Dunkirk, New York—using a Winegard Antenna—broke all long-distance reception records in 1956 (see Radio-Electronics Magazine Jan. '57). Equipped with optional signal-boosting Power-Pack and patented "Electro-Lens" focusing, the Color'Ceptor is second to none for long-distance reception and clear watchable pictures in both black-and-white and color!



## The Sign of Better Business

The Winegard Authorized-Dealer decal (pictured above) is proving a real business-builder for every dealer who displays it. Heavily promoted in Winegard's national advertising, the decal tells the world that "here's the place to buy the gold-anodized Color'Ceptor."

## Want More Details?

Mail coupon below for all the facts on Color'Ceptor's spectacular success story! Winegard gives you everything you need to make antenna sales boom—the product, free display, national advertising, proven sales techniques. Join the swing to Winegard—it's the best move you can make!

**WINEGARD COMPANY**  
Dept. C-6, 3000 Scotten Blvd., Burlington, Iowa

Name .....

Please rush me free 4-color descriptive literature on your gold-anodized Color'Ceptor and information on display material.

I'm interested in the complete line of new 1957 Winegard antennas.

Company .....

Address .....

City ..... State .....

**Color'Ceptor Model CL-4X — \$44.90**      **Color'Ceptor Model CL-4 — \$29.95**

If Color'Ceptor won't bring in a station you want to see . . . nothing will!

## Exclusive Color'Ceptor features

- Completely non-corrosive gold-anodized finish.
- Power-Pack—up to 47.1% more sensitivity.
- Pat. "Electro-Lens" — clearer pictures at greater distance.

 **Winegard Co.**

3000 Scotten Blvd., Burlington, Iowa  
Cable Address: Western Union JWCO

Gold Anodized

# Winegard Color'ceptor TV Antenna

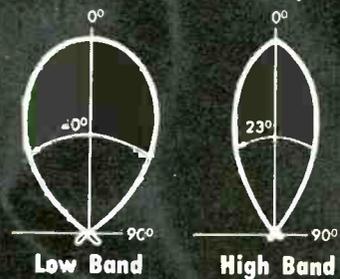
all 12 VHF Channel  
Reception For Both  
Black-and-White  
and Color

## Color so bright they sell on sight!

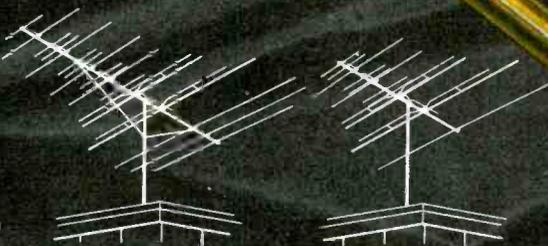
### Note:

Each gold Color'Ceptor you install helps sell another. Once folks see these bright gold antennas sprouting up in their neighborhood, they won't be satisfied until they own the gold antenna, too!

### Horizontal Directivity



Gain Chart  
CL-4X with Power-Pack

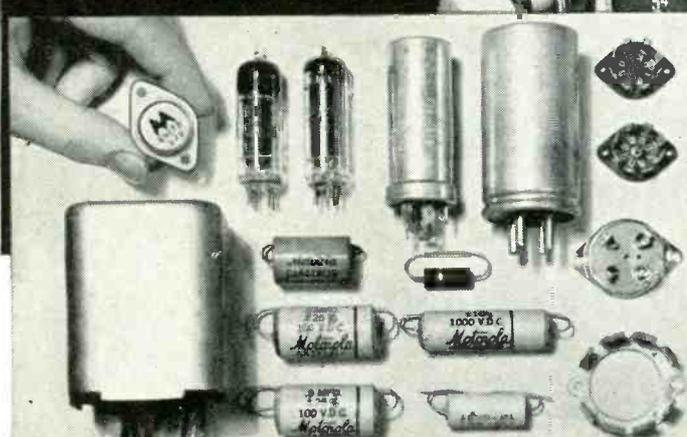


Winegard Color'Ceptors are consistently advertised in leading national magazines your customers read!



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# NEW Transistor-Powered MOTOROLA® CAR RADIOS



**GOLDEN TRANSISTOR HEART . . .** replaces 20 parts that wear out in conventional car radios.

## Best Car Radio Profit Opportunity in 27 Years

**C**AR RADIO sales rose 30% last year. And this year—with the most revolutionary car radio improvement in 27 years—Motorola Car Radios are rising even faster!

*\$1,040 plus-profits for you.* Every fourth car on the road today needs a radio. This means one out of every four people who come into your place of business is a good car radio prospect.

Even if you sell only one Motorola Car Radio a week, your yearly profit will amount to at least \$1,040! And you'll find you can close sales in five minutes or less—just by giving prospects these facts:

**Most trouble-free car radio ever built.** Motorola transistor-powered car radios replace 20 parts that cause 75% of the trouble in conventional car radios.

**Cuts battery drain 50% or more.** Transistors use far less power than vacuum tubes . . . play for hours with no appreciable battery drain.

**Ends all mechanical noise and vibration.** Now all the rich tone produced by Motorola's Golden Voice® speaker and exclusive Volumatic® control comes through with no mechanical distortion.

**Custom-designed to fit most any dash**—like it came with the car. Installation takes as little as 20 minutes and adds extra profit. Or your Motorola installation depot will handle it for you.

And Motorola Car Radios retail at prices your customers are ready to pay—low as \$39.95, with a big profit for you.

So why not get all the facts on your opportunities in this plus-profit business? Just mail this coupon today. No obligation, of course.

**MOTOROLA**  
World's Largest Exclusive Electronics Manufacturer

**Motorola, Inc., T-6**  
4545 W. Augusta Blvd., Chicago 51, Illinois

Please give me all the facts about the Motorola Car Radio business. Thank you.

Name \_\_\_\_\_

Firm \_\_\_\_\_

Street \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

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When you buy **RAYTHEON** ALUMINIZED PICTURE TUBES  
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because they enjoy:  
**WHITER WHITES**  
**BLACKER BLACKS**  
**CRISPER PICTURES**  
**SHARPER CONTRAST**  
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Receiving and Picture Tubes, Reliable Subminiature and Miniature Tubes, Semiconductor Diodes, Power Rectifiers and Transistors, Nucleonic Tubes, Microwave Tubes



*Excellence in Electronics*

# ELECTRONIC TECHNICIAN

Including  
Circuit Digests

## Watch Those Costs!

An electronic service business, or any other business for that matter, operates to make a profit. Presumably every shop owner knows that the difference between gross income and expenses is his profit . . . or loss.

Yet we regularly run across otherwise intelligent men, competent electronic-TV specialists, who neglect to examine their costs critically. It's not only a matter of reducing expenses, but more important, spending effectively. Sometimes it's less expensive in the long run to spend more now.

Large corporations can afford to hire experts for each specialized function. Small companies, which comprise almost all electronic service businesses, require that one or two men be nearly expert in many functions. Typically, a shop owner might be the combination of trouble shooter, purchasing agent, personnel manager, sales director and public relations man. All too often, he neglects to be a controller or accountant.

For example, let's look at a simple case of how cost control operates.

A forward looking shop is considering the purchase of a \$300 color bar generator. Say the depreciation (but not actual) life is 5 years, or \$60 per

year. Further, suppose this instrument made possible the servicing of as few as 10 color receivers per year. If the profit on repairs amounted to only \$15 per set, the return on the color bar generator investment would be at least 10 times \$15, less \$60 depreciation, or \$90 net. It would pay to buy the generator.

This elementary example is presented to highlight this one important point in business management: Don't make your decisions by pure guesswork. After a conservative evaluation of intangibles, and an experimental trial if possible, figure all your known costs. Only then can you make an intelligent decision on the feasibility of a particular expense.

One more important point. Our studies of the servicing industry over the years have shown that a great many shop owners neglect to include their own salary as a regular expense. They have the mistaken attitude of picking up whatever money is left in the till, looking upon their salary as if it were profit. The proper business practice is to figure what your skills are worth working elsewhere. If you can not draw that plus an additional amount as a return on your investment before counting up your profits, perhaps you should consider. . . .

## A Helping Hand

In an industry as dynamic as electronics, it is necessary that there be sufficient mobility of skilled personnel from company to company, as well as from one type of work to another. The same applies to the sale and purchase of operating businesses.

Early this year we started a free employment service for our readers. The results to date have been most gratifying. Not only has the industry at large benefited from this aid to employment mobility, but more important to us, we have helped many individuals in their search for better careers.

If you are satisfied in your present position, as most of our readers fortunately are, and if the learning and earning potentials are promising, we urge you to stick with it.

However, if you are unhappy with your current association, if you wish to relocate, or if you believe your know-how can be more effectively used by another company or another segment of the industry, avail yourself of our free employment service as many others have. For details, see Employment section, page 2.

# Tuning In the

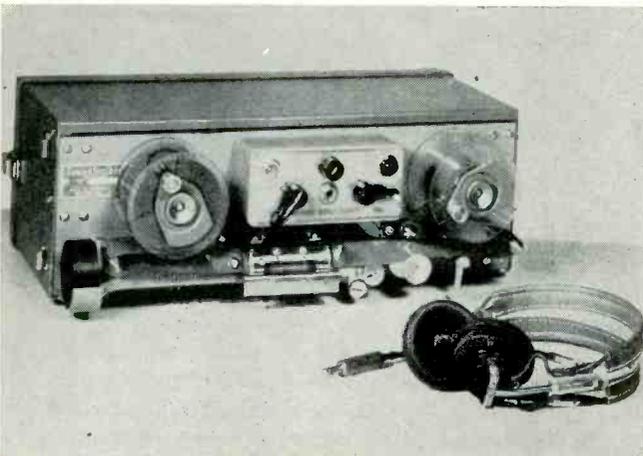
**ANNUAL SALES** for the electronic industry should hit \$23.2 billion by 1965, predicts RETMA. For 1956, factory sales in TV-industrial-military electronics amounted to \$5.9 billion; distribution-servicing-broadcasting \$5.7 billion.

**DO-IT-YOURSELF** financial casualty reported to us describes a set owner who complained that his TV was issuing some unpleasant odors. Had he done anything to the receiver? Not at all, he assured the technician on the house call. The set had to be pulled to the shop, and there it spent considerable time on the bench until the culprit was discovered. It seems the customer had pulled a few tubes himself for testing. To keep track of the proper sockets he stuck some tape on the tubes, and this tape was not readily visible, particularly when checking under the chassis for a burning part. When the tube heated up . . . you guessed it. Well, the charred and odoriferous tape finally was removed. The bill for pickup, delivery, and labor came to a neat \$20.

**COLOR TV** manual, the RCA Pict-O-Guide, is reportedly coming off press shortly. This substantial servicing handbook is expected to play the same practical role for color as the original Guide did for black-&-white some years ago.

**HARNESSING THE SUN** can be as important as atomic energy, say some scientists. One company, Hoffman Electronics, has set up a Solar Division to operate as part of the Semiconductor Division. The firm makes silicon solar cells, which convert light into electricity, and these have been applied to power transistor radios and Army flashlights.

## LONG-LONG-PLAY COMMUNICATIONS RECORDER



Tape recorder for recording 24 hours of radio communications transmissions unattended stores the information on 300 ft. of 2-in. wide tape. Made by Soundscriber, operates at the slow speed of 2½ ips.



**PROJECT VANGUARD**, which concerns radio tracking of the earth satellite during International Geophysical Year, employs a complex system called Minitrack. Now a simplified version called Mark II Minitrack has been developed to allow individual and other non-engineering groups to participate in the tracking project. An interesting and informative booklet on antenna requirements for Project Vanguard is available free upon request to Technical Appliance Corp., Sherburne, N.Y.

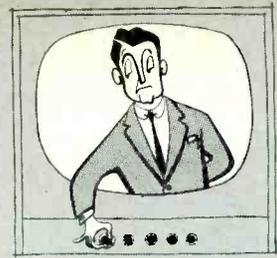
**NORTHERN CALIFORNIA** electronics industry is growing by leaps and bounds, reports WESCON. In the San Francisco Bay area, 1957 sales are expected to rise 42.2%, and employees 33% for a total of 26,000 persons.

**A CLEVER PLAN** to provide FCC-licensed technicians for employers, without hiring new personnel, has been announced by Cleveland Institute of Radio Electronics. The employer picks the man or men in his organization, and they are enrolled in the Institute's special home study course, which guarantee to train him to pass FCC license exams. No man-hours are lost. For more information write to Employer's Plan (Electronic Technician), Cleveland Institute of Radio Electronics, 490 Euclid Ave., Cleveland 3, Ohio.

**UNCLE SAM** could save \$72 million a year in national defense costs, claims one experienced engineer, if the government would only adopt standard specifications for electronic equipment.

**ALLEN B. DUMONT LABS.** has entered the receiving tube field with 435 tube types, in addition to the picture tubes it has provided since 1938. As announced on May 18, the tube line will be marketed through parts jobbers to service technicians.

# Picture .....



**BETTER BUSINESS BUREAU** reports that during 1956 it received 72,341 inquiries and 32,513 complaints relating to Radio-TV-Music. The total, 104,854 contacts, was 2.7% under 1955, and placed this category sixth among top problem classifications. The "leaders" were, in this order, Home Improvement, Home Appliances, Automotive, Solicitations and Insurance. TV-Radio sales and service dropped from the number four spot it held in 1953 to the sixth position held last year.

**LOLLIPOP-SHAPED** radar antenna which is inflated like a balloon makes it possible to set up a transportable radar station in less than two hours, reports Westinghouse. Its fabric sections are zipped together, inflated and mounted on a magnesium base.

**RADAR-EYE** is a new motion detection instrument which detects any movement within 25 feet from the unit's antenna. The initial installed price is between \$400 and \$500. It's used for burglary and fire protection.

**HOW BIG** is commercial radio? Perhaps the following statistics tell the story best. There are close to 365,000 radio station authorizations, though moderate percent are not in actual use. In three categories alone, Public Safety, Industrial and Land Transportations, well over 900,000 transmitters are authorized. More than 1,000,000 commercial operator permits have been issued. Have YOU investigated the opportunities in two-way radio repair?

## CALENDAR OF COMING EVENTS

- Aug. 2-4: Texas Electronic Association Clinic and Fair, Hotel Texas, Fort Worth, Texas.
- Aug. 16-18: National TV-Radio-Electronic Service Industry Convention, sponsored by NATESA, Sheraton Hotel, Chicago, Ill.
- Aug. 20-23: Western Electronic Show & Convention (WESCON), Cow Palace, San Francisco, Cal.
- Sept. 24-25: Sixth Annual Industrial Electronics Symposium, Morrison Hotel, Chicago, Ill.
- Oct. 7-9: 1957 National Electronics Conference, Hotel Sherman, Chicago, Ill.
- Oct. 16-18: Institute of Radio Engineers' Canadian Convention Automotive Bldg., Exhibition Park, Toronto, Ontario.
- Nov. 11-13: Radio Fall Meeting, King Edward Hotel, Toronto, Canada.

**ELECTRONIC "HOT BOX DETECTIVE"** is being tried out by the Chesapeake & Ohio Railway to detect overheated journal boxes on railroad cars before they cause an accident. The Servo Corp. system used contains an infra-red pyrometer located along the rails to record the temperature of every journal box on tape. Dangerously high temperatures actuate a mechanism which signals the train to a stop.

**CRYSTAL** oscillator arrangement at Bell Labs put out a signal at 9000 mc, portending new advancements in the microwave field. It operates on the spin oscillator principle, whereby electrons shift from one energy level to another.

## RANDOM NOISE

**ELECTRONICS IS PREVENTING FOOD SPOILAGE - RAYTHEON RADAR PROCESS IN COLD VACUUM ELIMINATES WATER UP TO 95% OF WEIGHT, WITHOUT AFFECTING TASTE - ANOTHER METHOD USING VARIAN ELECTRON ACCELERATOR DESTROYS BACTERIA BY RADIATION WITHOUT DEHYDRATION**

**MAN MADE IONOSPHERE WILL BE MADE THIS SUMMER IN "OPERATION SMOKE PUFF" AT ALAMOGORDO, N.M. ROCKET 70 MI. HIGH WILL DISCHARGE GAS-RADIO SIGNALS WILL BE BOUNCED OFF IONIZED LAYER**

**DORMIPHONICS IS AN AUDIO APPLICATION WHERE RECORDER TEACHES WHILE YOU SLEEP. --- SCIENCE IS BASED ON BRAIN REMAINING ACTIVE DURING SLUMBER**

YEAR	NO. OF TV MFRS.
1950	140
1951	110
1952	94
1953	90
1954	83
1955	72
1956	51
1957	??

# Tools for Servicing

## Special Medical and Watchmaker's Type of Tools

JAMES A. McROBERTS

• Servicing subminiature electronic equipment is greatly facilitated with the aid of proper tools. With only a modest outlay, the technician may profitably repair these tiny devices, including transistor radios, hearing aids, remote controls, test instruments, etc. Doctors, dentists, jewelers, watchmakers, and now the technician, have to rely on a special set of tools which extend the vision, aid the reach, and sometimes lend a third hand.

### Lighting

Unless adequate light reaches the work area, it cannot be seen properly. An artist's fluorescent lamp, consisting of two 15-watt tubes, is a very desirable light source for small work as well as for larger radios and TV sets. These lamps may be swiveled into almost any position. In addition, a small spotlight provides concentrated light on the immediate section being worked on. A swivel clamp arrangement leaves both hands free.

A light box consisting of a light source and a piece of ground glass enables the observance of the underside of a printed-circuit board, while working on the topside, or while tracing a particular path. This is also an excellent way to find minute breaks in the foil. In the solder dipping part of the production process, it has been found that in most cases of a hairline break, the solder will not completely bridge the gap.

Fig. 1—Mirror & magnifiers aid inspection.

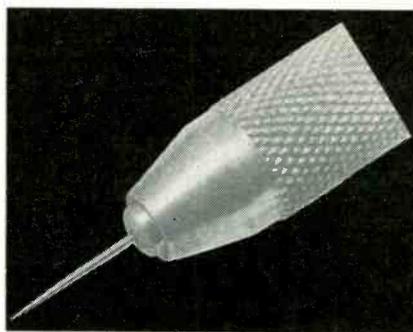
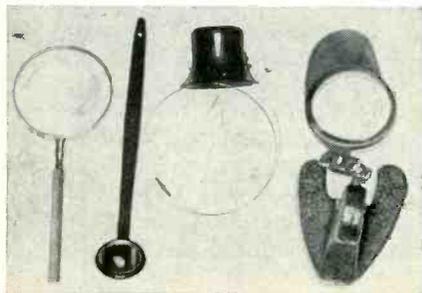


Fig. 2—Pin vise holds drills, hooks, etc.

This fortunate characteristic makes it that much easier to service these units. However, breaks due to excessive flexing may be very difficult to locate. A fluorescent light in the box is more desirable than the incandescent type because of better light distribution and less heat. Easier viewing is obtained if a mask is used to block out any light spilling over the sides of the work. Some commercial light boxes have provision for concentrating the light on any given area by having a movable light. These boxes are easy to construct.

### Magnifiers

One or two magnifying devices are helpful. To help keep the hands free one should be stand mounted. Do not choose a glass that has too high a magnification. About 3 or 4 times is adequate. You can't get close enough with a high powered job. A small magnifier mounted on a stand having a universal joint is very handy. The one shown in Fig. 1, has a lens with a magnification factor of 4. To prevent reflections, fashion a small paper shield from cardboard or fiber and mount it on the magnifier. The jeweler's loupe, equipped with a head band or clips to fit over glasses, if you wear them, may also be used. The kind that screw into the eyeball cavity are a nuisance unless you can learn the trick from a watchmaker. Loupes are available in various powers. Another useful type is the conventional hand held magnifier which may be placed over or

under the lens on the stand magnifier for a better look.

A small type dental inspection mirror is also shown in Fig. 1, and is quite useful for viewing hidden wiring and components. The all plastic handle and mirror holder is recommended, especially when performing inspections while the set is on. An accidentally grounded terminal in a transistor device may necessitate replacing the transistor.

### Holding Tools

A pin vise can hold a small hook needle, or jeweler's saw. It can also hold a small drill. Rotation between the fingers will drill through thin plastic and bakelite with minimum stalling and cracking. Hand twisting of the drill is preferable in breaking through. The majority of the troubles develop at that time. Fig. 2 shows a pin vise holding a needle. Various hooks can be fashioned from spring wire and held in this manner. Many styles and sizes of pin vises are available. Jeweler's supply, hardware and your local distributor's catalogs should provide abundant additional information on this tool.

Many types, shapes and sizes of surgical hemostats are available and are a great aid for reaching into tight places, and can be used for retrieving or holding tiny parts. The handles have a catch and a series of serrations to lock the grip. See Fig. 3.

Long nosed tweezers may be made self holding with a rubber band. Tweezers and hemostats may be straight or offset. It will be found worthwhile to have several different sizes and shapes handy.

### Cutting Tools

Other dental tools come in handy for cutting and probing. A dental explorer can be used to remove bits of foreign matter, scrape and clean tiny areas. A dentist's chisel or an engraver's burin can neatly cut the foil on a printed board. The burin is also good for digging out excess solder which may become imbedded. A tiny pair of diagonals for cutting and a

# Subminiature Electronics

## Speed Servicing of Modern Miniature Electronic Equipment

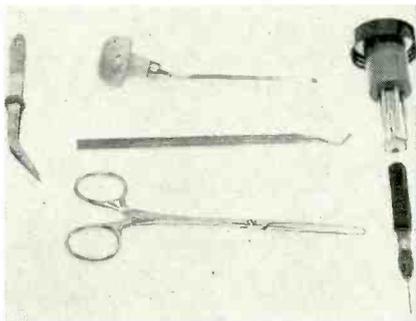


Fig. 3—Medical, jeweler's & printer's tools suitable for servicing subminiature parts.

pair of needlenose pliers for forming constitute the minimum in such equipment. A pair of end nippers may be added. Use reasonable care with these miniature tools. They can be broken or sprung out of shape by an excessive squeeze of the hand. They are not intended for heavy duty applications.

### Soldering Aids

Miniature soldering irons and instruments are easy to use. Some require a transformer or battery for power. In an emergency, larger irons can be pressed into service on sub-miniature equipment as shown in Fig. 4. A length of heavy copper wire is wrapped around its tip and then bent to form an extension. The new tips should be properly tinned. Some heat will be lost but not enough to prevent it from working with 60-40 solder. Too much is not desired. Clamping the soldering tool in a vise and bringing the work to it will free one hand. Small solder dispensers with 60-40 multicore solder loads are handy. Solder pots are almost a must for removing multi-terminated components from a printed board. The savings in time and reduced damage more than compensate for the small cost of this piece of equipment.

### Other Handy Tools

A set of jeweler's screwdrivers, Fig. 3, is indispensable. These sets

have a holder with several detachable bits. In use, the index finger is placed on the swivel top to guide the tool and apply a slight pressure. The barrel is rotated between the thumb and middle finger. The top pressure and twist are easily controlled. Thread stripping and head chewing of tiny screws is kept at a minimum. When starting small screws, place a piece of cardboard under the work and bend it up so that a dropped screw will not land on the floor. A lost screw might seem like a minor calamity, since a new one (just a tiny screw) may take a lot of time and trouble to replace.

A drawer just under the regular work bench top may be easily converted to a special working area. Remove the solid bottom and attach a piece of fairly strong white cloth, as shown in Fig. 5. An old sheet or piece of sailcloth will do nicely. Leave a little slack so that the cloth sags a bit in the middle. If a tiny part should fall accidentally, it will find its way to the center by gently tapping the cloth. An adjustable jig can be fashioned and secured to the sides of the drawer to hold small units or parts being worked on.

Small hand or power driven drills are labor saving devices and add to the pleasure of working. The many attachments enables sanding, grinding, polishing, drilling, cutting, shaping and other operations. Ask your dentist to show you his assortment of drills, burs and other accessories.

Fig. 4—Modifying a small soldering iron. Different shapes may be fashioned to fit over a group of terminals to remove major comp.

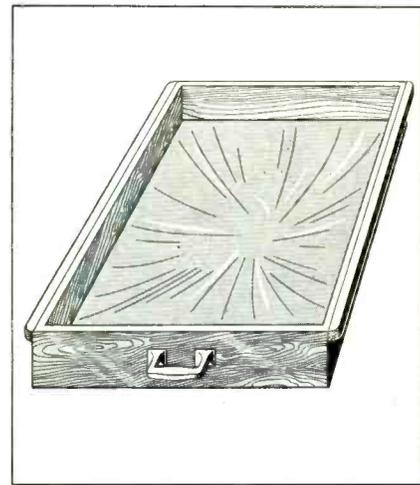
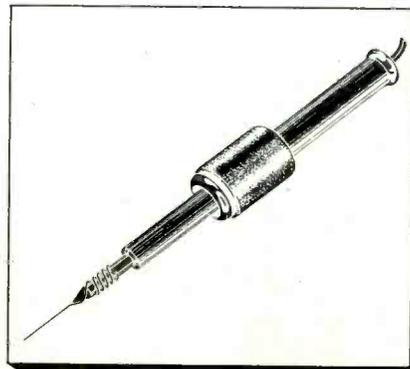


Fig. 5—Special work area fits under bench. Sides of drawer may be fitted with brackets or clamps to hold special tools. An adjustable jig can be built in to hold work. Cloth bottom traps fallen parts.

He may give you some slightly used drills, on the house. Horizontal or vertical drill stands extend the utility and frees a hand. A lathe-like arrangement can be set up with some of these stands.

Swiss needlepoint files come in a variety of shapes and cuts. One round, one flat and one triangular should be minimum equipment. Complete assortments are available.

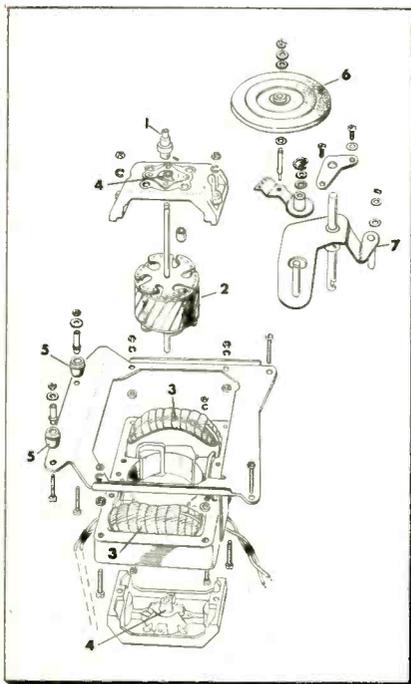
### Chemicals

Jewelers rouge with a drop or two of light machine oil makes a good polish for metal parts. It is a conductor and all trace of polish should be removed when used in the vicinity of an electronic circuit. Duco cement and similar adhesives are used by many subminiature manufacturers to hold parts together. It is speedy and saves drilling and punching for hardware fasteners. Vinyl, acrylic and acetate plastics in spray or liquid form are excellent insulators and are easy to apply. It is exceptionally good for close quarters where exposed metal parts may contact each other or the case. Solvents and other cleaning compounds not only wash away some troubles, they help make the job look like it was serviced by a professional. •

# How To Service The

*Understanding Basic Functions Simplifies Servicing Procedure.*

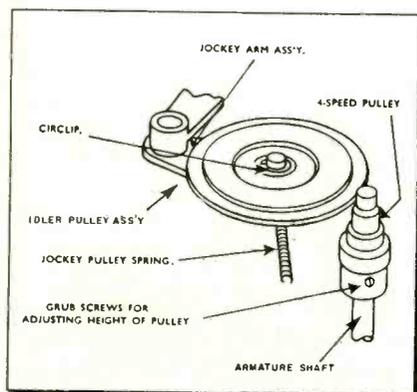
ROBERT CORNELL  
TECHNICAL EDITOR



- 1—Pulley: 4 sizes available  
60 cycles 3 speed  
60 cycles 4 speed  
50 cycles 3 speed  
50 cycles 4 speed
- 2—Rotor and shaft: 3 sizes available for 3 or 4 speed operation.
- 3—Field Coils
- 4—Bushings
- 5—Rubber grommets
- 6—Idler wheel two sizes available for 3 or 4 speed operation (size of idler does not effect speed)
- 7—Idler support lever assembly

Fig. 1—Motor and drive components found in some types of 3- and 4-speed automatic record changers.

Fig. 2—Typical drive, idler wheel assembly.



• The automatic record changer is a remarkably complex device that can sense when to change a record, where to set the needle down, how high to lift the arm, and when to shut itself off. The precision and action is quite discouraging to the inexperienced repairman. However, the most complicated machines are usually nothing more than a series of simple levers, gears or pulleys. There is nothing in the changer that is so complex as to justify turning down an opportunity to repair and profit.

Like any fine mechanism, it should be treated with a light hand. The greatest cause of trouble is dirt and deterioration of rubber drive components. Rubber parts become glazed, hardened and crazed with a resulting loss in the coefficient of friction. More simply stated, the rubber parts lose their ability to transfer power from the motor to the turntable. This may result in loss of speed, uneven speed and stalling, especially during the change cycle. Another defect often encountered in rubber drives and idler wheels is uneven wear. High spots and low spots may develop. In most cases the culprit is dirt and other impurities on the drive components. A stalled turntable will also cause uneven wear. This is a very good reason why the table should not be stopped by hand. The manufacturer's instructions for starting and stopping should be observed. Not only will the player's useful life be prolonged, tone-arm positioning and other adjustments will not become upset.

Before getting into the nuts and bolts of the machine, by all means first ascertain what is or is not happening. Trace the action by observing the actual operation. Listen carefully to the customer's complaint. Regardless of how you improve the action, unless the customer is satisfied, your efforts will not be appreciated. A better idea of what is taking place can be observed by having the turntable rotate at its slowest

speed. If the action is still too fast, the turntable can often be rotated by hand. One word of caution, watch the drive components while doing this, for unless they also rotate, flat spots may develop. If the unit does not rotate and jams, do not use force to complete the cycle. Investigate first. The use of undue force may cause damage and complicate what might have been a simple and routine job. On some units it is possible to remove or otherwise disengage the rubber drives and cycle the changer by rotating the turntable by hand.

## Lubrication

"Oil not, neither will ye spin," is as true an adage in this field as it is in the automotive industry. Just like a fine watch, the lubricant must be correct as to grade, quality and quantity. Excessive oil can cause two basic difficulties. It does no good on external non-bearing surfaces and makes an excellent trap for dirt and other foreign matter. So apply sparingly and remove excess. Another common fault due to excess oil is slippage. Should even the barest trace of lubricant come in contact with the drive wheels the turntable will slip, stall and act erratically. Remove the excess with carbon tetrachloride. So far as the oil itself is concerned a light grade of fine machine oil, about SAE 10, may be used on the motor bearings and pivots on light moving parts. A heavier grade lubricant, (e.g., Lubriplate) should be used on the heavier components, such as gears and push rods. In the case of the lighter oil it is best to select a type used by the watch maker, which won't congeal or change its viscosity too readily. Incorrect type of oil may cause such symptoms as failure of the motor or turntable to start by itself and stalling in the middle of a change cycle, especially when the changer is cold. If in doubt, it is better to under lubricate; rotating parts make excellent oil slingers.

## Motor Considerations

The life of the motor is rated at more than the life of the machine, so when trouble develops do not jump at conclusions. Remove the

# Automatic Record Changer

Find and Eliminate Trouble by Tracing Mechanical Action.

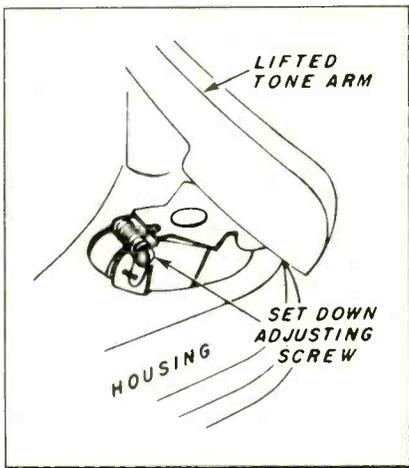


Fig. 3—Tone arm set down adjustment. Clockwise rotation of the adjusting screw causes movement away from the spindle.

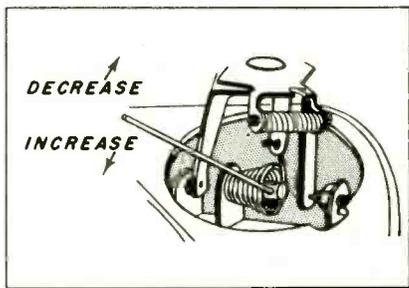
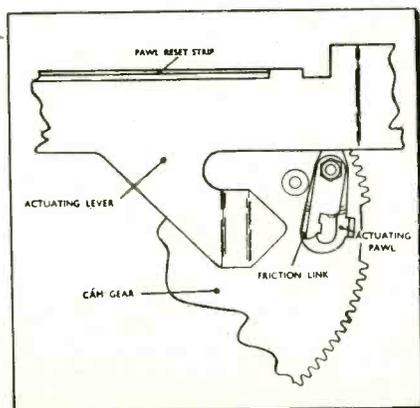


Fig. 4—Needle pressure adjustment. Slight movement of stud has a large effect on pressure. For best results use an accurate gauge to obtain a setting of 8 to 11 grams.

Fig. 5—Pawl, lever and mutilated gear assembly.



turntable and disengage any drive wheels or belts from the armature and turn on the power. The motor should run smoothly and quietly. Check for a bent armature shaft or any other abnormalities. Some shafts are machined to size, others have pulleys and still others have a spring-like drive which is friction fitted. At times this spring may work itself up or down. It can be dressed or shifted by properly applying pressure with a knife blade. The spirals or windings should be tightly spaced. It takes a little practice to develop this dressing technique. The overall speed of the turntable depends on the gauge or thickness of this winding. For example, if the changer had to be operated on a 50-cycle supply instead of 60 cycles, the motor itself would run slower. A fatter drive on the shaft would compensate for this condition. See Fig. 1 and 2. Unless such a change in power supply is encountered in the field, do not attempt any such modification, especially if the unit has been functioning properly at one time. The next important thing is to carefully watch the armature when the power is removed. It should coast to a stop. Any sudden cessation of rotary motion indicates that something is binding. Some motors have self-centering bearings which may not be properly aligned. Tapping the bearing assembly with a screw driver handle while the motor is running may remedy this condition. Bearing misalignment is more likely to be present on a brand new unit. Avoid disassembly as much as possible.

If for any reason the motor will not run, the troubleshooting procedure is simple and straightforward. Check the line cord, plug, switch and field coils. The field coils may become open, shorted to the frame or internally shorted. Internal shorts or shorted turns will cause loss of power and excessive current drain. If this occurs the motor should be replaced.

## Drives and Idler

Having ascertained that the motor is functioning properly, the next consideration is the power transferring  
(Continued on page 28)

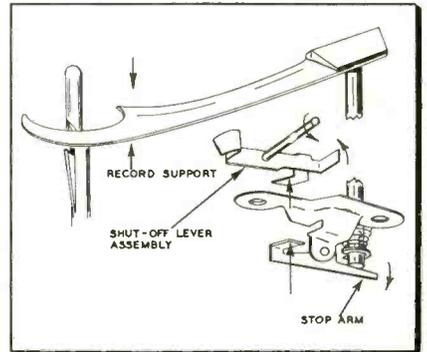


Fig. 6—Final downward motion of the record-support arm causes the changer to shut off.

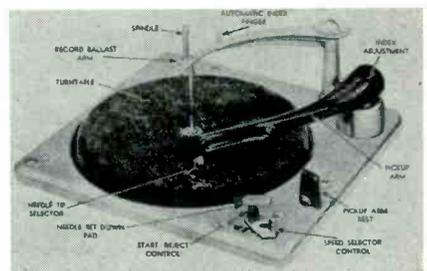
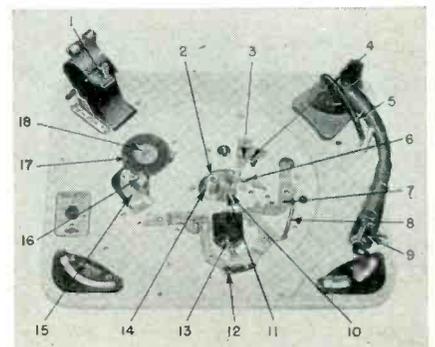


Fig. 7—Automatic index finger signals presence & size of record sitting on spindle.

Fig. 8—Top view, with turntable removed, of the Garrard Model RC98.

- 1—Record pushing pawl
- 2—Turntable spindle
- 3—Adjusting screw for height of auto trip operating lever
- 4—Friction plate
- 5—Record-size selector & switchoff arm
- 6—Stop lever
- 7—Catch lever
- 8—Spring for catch & switch levers
- 9—Turnover pickup
- 10—Auto trip operating lever
- 11—Felt pad
- 12—Turntable brake
- 13—Switch
- 14—Striker
- 15—Support lever
- 16—Motor pulley
- 17—Idler wheel
- 18—Spring clip



and other speed controlling devices. Some use wheels and belts and some use just wheels; the underlying principles are the same. The idea is to get the power from the motor to the turntable in the proper manner. The high school physics teacher spent at least 3 days teaching the relationship between the diameter of the pulley and its speed. Direction reversals were also covered. The general rule is to use exact replacement parts and avoid the calculations. There are situations where oversized or undersized drives may be used to speed up or slow down the turntable. The size of the idler wheel in Fig. 2, does not effect the speed; it is there to transfer power in the proper direction.

A record changer is also called upon to operate at different loads. Most units are designed to run at the proper speed with a medium load, slower with a full load and faster with a light load. A stroboscopic disc in conjunction with a proper light, is the easiest way to determine correct speed.

Because of the varying load conditions and other factors, a compromise in uniform speed is commercially acceptable. How much of a deviation can be tolerated will depend on the customer's musical ear. The listening test is the one that really counts. The cost of rubber drives is comparatively nil. It doesn't pay to clean them unless the

parts are not available, or are fairly new and only dirty. Carbon tet may be used.

### The Cycle

This is where most of us seem to have trouble. Let me reassure you it is easier to trace mechanical action than it is to chase electrons. All that is needed is the will to fix and lots of patience. Experience will come with practice and in an amazingly short time. There are adjusting screws and or levers which can be turned or bent to control the weight and positioning of the tone arm, Fig. 3 and 4. It must raise high enough to clear all the records on the turntable and yet not high enough to hit the records sitting on the top of the spindle awaiting their turn to spin. The arm must sit down on the record before the first playing groove.

The problem is sometimes complicated by different size records. Levers, stops and other sensing devices tell the arm what size record is about to be played. Unfortunately not all 10" records measure 10". The same holds true for the other size records. Not all records have their grooves start and stop in the same place. Therefore, after having made adjustments, different records should be used to check out the machine's operation. In extreme situations some odd sized records and older types will have to be avoided for automatic operation. Some records

do not have the proper grooves for a velocity trip and still others have enlarged or worn out center holes. Use records known to be good when checking for correct operating conditions.

Once the arm has set down properly, the next problem to come to our attention is tracking. The arm should follow the grooves without any tendency to skip or hold back. Difficulties may be due to a defective or improper needle, improper tone arm balance or binding. The remedy is the same as before. Clean, check, oil and replace worn out parts.

After the arm has passed this test, it is now ready to approach the end of the record and cause a new cycle to start. To do this a trip mechanism is triggered either by the inward speed, position or oscillating motion of the arm. In the case of the speed sensitive trip, the action depends upon the relative slippage of a clutch or friction element. This part must be absolutely clean and dry. Under no circumstances is the velocity trip mechanism treated with oil.

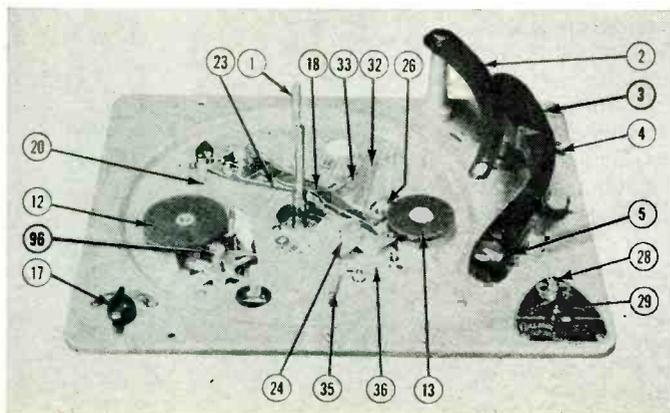
The trip may actuate a micro switch which in turn will cause a relay armature to engage a gear assembly and then cycle the machine. A more popular arrangement has a pawl lever mounted on a "mutilated" gear assembly adjacent to another gear mounted on the turntable hub as in Fig. 5. The pawl

(Continued on page 53)

Fig. 9—Top (left) and bottom (right) view of the Collaro record changer. The cycle drive wheel No. 13 is driven by the turntable and is normally disengaged while a record is playing. This feature is a departure from the mutilated gear arrangement. There are four different sizes of speed change pulleys available for different line voltages, frequencies and operating conditions.

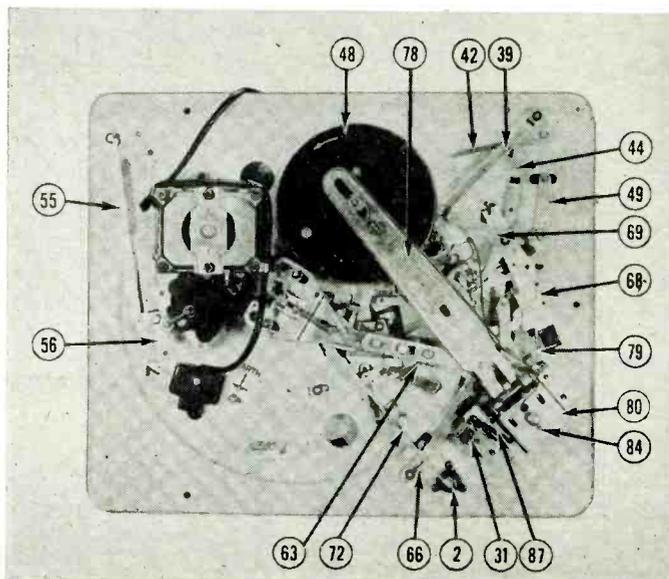
- 1—Spindle assembly
- 2—Record balancing arm
- 3—Pickup Arm
- 4—Weight compensating control
- 5—Plug-in pickup head
- 12—Idler wheel
- 13—Cycle drive wheel
- 17—Speed change knob
- 18—Motor actuating lever
- 20—Idler wheel positioning link
- 23—Shut-off link
- 24—Trip cam

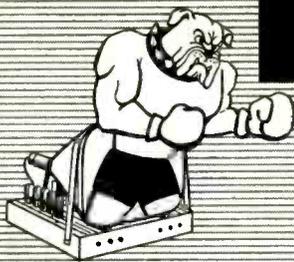
- 26—Swing bracket locking lever
- 28—Position control knob
- 29—Start-reject-stop control knob
- 31—12" record selector (used on Model 3RC-532 only)
- 32—Slide bar
- 33—Automatic stop trip lever
- 35—Slide bar return spring
- 36—Slide bar pivot link
- 39—Manual reject lever
- 42—Control return spring
- 44—Stop link



- 48—Bakelite cam
- 49—Step-down position lever
- 55—Speed change link
- 56—Speed change pivot lever
- 63—Pickup arm positioning plate tension spring (used on model 3RC-532 only)
- 66—Manual stop lever
- 68—Positioning plate indexing assy.
- 69—Pickup arm positioning plate reset lever (used on model 3RC-532 only)

- 72—Shut-off lever
- 78—Main slide
- 79—12" selector wire lever (used on model 3RC-532 only)
- 80—Mounting bracket for pick-up arm actuating assembly
- 84—Height adjustment screw
- 87—12" selector wire lever tension spring (used on model 3RC-532 only)
- 96—Motor & speed change assembly





# "Tough Dog"

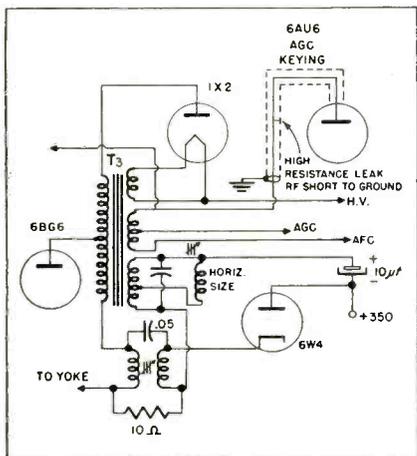
# Corner



## Difficult Service Jobs Described by Readers

### No Raster

As I was returning from lunch one day, I had just said to myself, "Well, it's about time for a tough one to come along," because everything had been going too smoothly for the past two weeks. I didn't have to wait very long, in came a Truetone Model 2D-1095. I hooked it up and tried it out. There was a distorted raster just for an instant and then disappeared. The set would have to be turned off and on again before it would do it again.



Leaky AGC lead caused loss of high voltage.

First I changed the 6SN7 horizontal oscillator, without any luck, then I checked the other tubes and still no high voltage. So I pulled the set out of the cabinet to go underneath.

Relying on past experience, I checked the 0.05μf damper filter capacitor, then I checked the 10 μf decoupling capacitor and still nothing. The boost voltage was 410 volts. (Normally should be 450 to 460 volts.) The horizontal-output tube was not drawing excessive current and there was a trace of rf on the plate of the 1X2. There was just enough voltage induced into the filament winding for the tube to rectify the little

voltage there was, but no sign of a raster of any shape or form. I did notice a slight odor similar to the smell of a broken tube. But it was too vague to pin down. After checking all the afc and agc components, I changed the flyback transformer; same old thing. I even changed the yoke. By this time I was willing to try anything. Consultation with some of the other boys brought no help. I was getting pretty sore on the subject. After drinking a cup of coffee and thinking over the situation, I still hadn't come up with anything. I returned and started probing around again with a screw driver. I was getting desperate. Then all at once, up came a puff of smoke. The minute I pin-pointed where the smoke was coming from I realized what it was.

The shielded coaxial cable from the agc winding on the transformer to the plate of the 6AU6, agc keyer, finally broke down to a dead short; which originally started out with a high-resistance rf leak to the grounded shield in the cable. The rf leak through the rotted insulation

must have caused the odor that I had been smelling. I replaced the shielded cable and regained the high voltage and that's all there was to it. The moral of the story is, it's always the simple little things that will stump you.—Bill Everhart, Chillicothe, Mo.

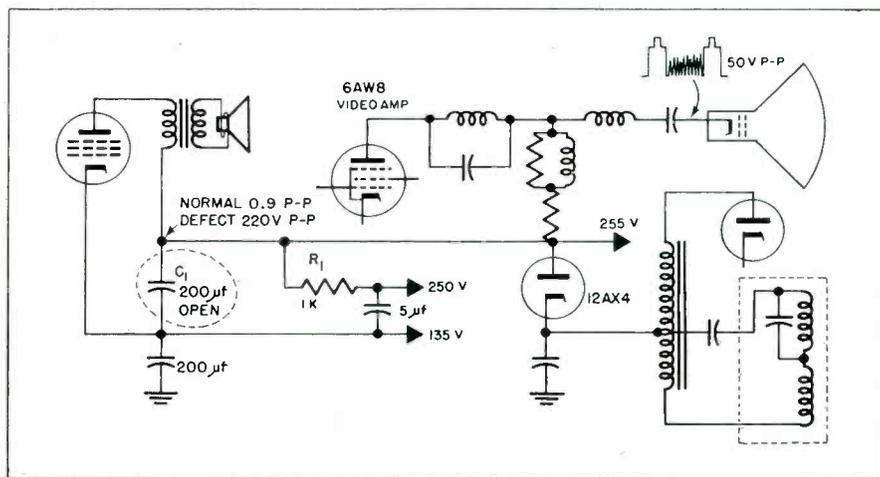
• When troubleshooting this type of difficulty, I have found it helpful to free the flyback of all accessory circuits and components not essential to the production of high voltage. (agc, afc, width coil, capacitors, etc.) —Ed.

### Narrow Raster

A Crosley Model H-17TO was brought to the bench. It had an extremely narrow raster, about 2" wide and located on the extreme left side of the screen. Naturally all tubes in the horizontal section were changed in the field and once again on the bench. The trouble was definitely in the set. High voltage measured 13 kv, boost voltage was about 600 volts and all horizontal circuit

(Continued on page 52)

Crosley Model H 17TO. Most of raster blanked out by unfiltered B+.



# A New Slant On Impedance

## High Fidelity Audio and Video Made Possible By Impedance Matching

MONROE CORN  
DAVID GNESSIN

• When the technician finds a bad output transformer in a radio set, he always makes sure to use the correct replacement so that the impedances will match. He knows from experience that using any transformer, or the wrong tap on a universal type, will result in weaker sound and distortion.

The same principle holds true for antenna lead-in to a TV receiver. Mixing 300-ohm sets with 72-ohm lead-in, or vice-versa, can lead to grief, especially in weak signal areas. The mismatch may cause signal attenuation and ghosts.

Now just what is impedance matching? Is it really as mysterious as some people have been led to believe? Not at all. Any technician knows that impedance matching and maximum power transfer go hand-

in-hand. The generator or signal source has a definite impedance in the circuit, shown in Fig. 1A. It develops a voltage  $E_g$  which is applied to both the load resistor  $R$  and to itself. To obtain maximum power in the load resistor, you may vary its resistance (impedance) until both the generator and load impedances are equal. Since the impedance of the generating source is generally fixed, you can vary the impedance of the load to match it.

Where the load impedance as well as the generator impedance is fixed, matching is just a little more complex. Impedances can be matched by using a transformer with the correct turns ratio. For universal or broader application the transformer may have separate taps, each giving a different turns ratio. A match occurs when the ratio of primary to secondary turns is the same as the square root of the ratio of primary to secondary resistance. Why all this concern about power? Suppose all you

want is lots of voltage, at the input to a TV set, or at the grid of an r-f amplifier in a low-power transmitter or receiver. Why not just wind transformers with nice fat step-up turns ratios and get more voltage? Well it just doesn't work quite that way. In order to get more voltage across a given resistor, you've got to develop more power. This can be easily seen by the power equals  $E^2/R$  formula. To develop maximum power you must match the impedance.

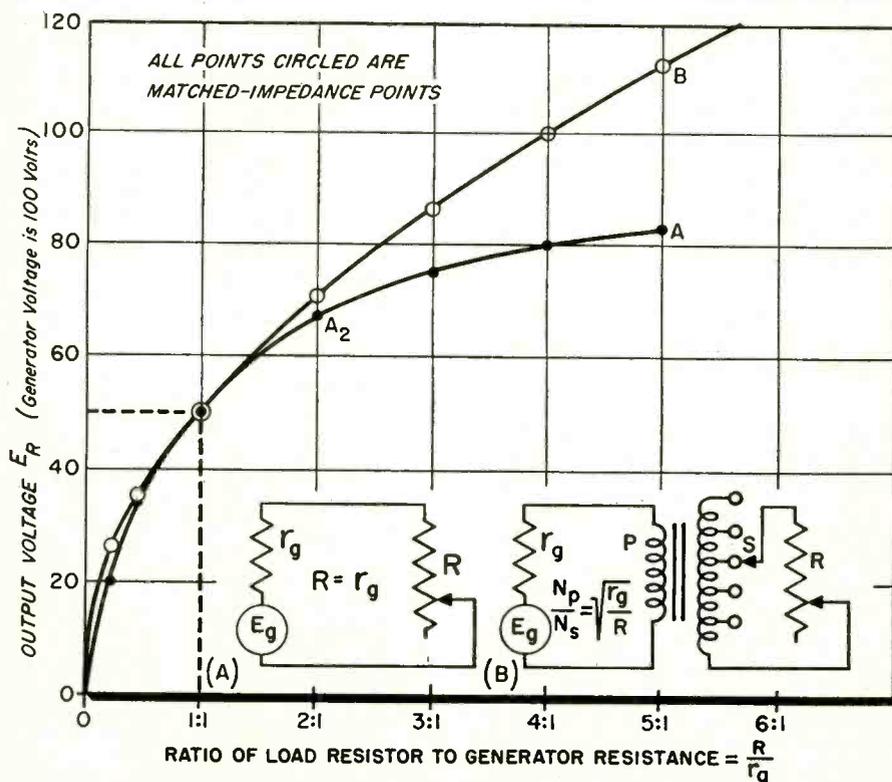
### Effects of Mismatching

Another way to increase the voltage across the load is to increase the load impedance. This results in a loss of power due to the resulting mismatch. However, there are instances when deliberate mismatching is used to reduce the harmonic distortion of a signal to improve the fidelity. However there are limitations and undesirable effects.

A comparison of two basic methods to obtain increased voltage across the load is shown in Fig. 1. Curve A, depicts the conditions encountered in the diagram of circuit A, and curve B shows the advantages to be gained by maintaining impedance match while varying the size of the load impedance. The 100-volt generator is directly coupled to a variable load. The generator resistance is fixed, and is assumed to be in the circuit at all times. When the impedance of the load matches the impedance of the generator, maximum power is delivered to the load. This point is the double circle where the two curves meet. This is the only matched-impedance point for curve A. The dotted lines indicate that the ratio of the load to the generator resistance is 1 to 1 and that 50-volts appears across the load. The other 50-volts is across the generator resistance. Thus you can see that at the impedance-match point only half of the generator voltage is available.

It is possible to get more voltage by increasing the load resistance. Let us double it and see what happens. Now the ratio of the load resistance to the generator resistance is 2 to 1 and the voltage has risen to 67-volts,

Fig. 1—Maintaining impedance match, increases load voltage and transfers maximum power.



# Matching Devices & Circuits

## Techniques. Bass & Treble Boost Improve Frequency Response

point  $A_2$  on curve A. In trying to get more voltage the mismatch has resulted in a loss of power. (It may be of interest at this time to pause a moment and use the  $E^2$  over  $R$  formula to prove this point;  $r_g$  can be any assumed value.) The load resistance can be further increased; but with diminishing returns. Increasing the ratio to 4 to 1 gives 80-volts; only 13-volts, more than the 2 to 1 point. The effects of additional increase in the size of the load is depicted by the flattened curve. It can never quite reach 100-volts. In addition, the power lost becomes greater and greater.

### Matching Transformer

The circuit in Fig. 1B is similar to Fig. 1A, except that a transformer with an adjustable tap has been inserted between the generator and the resistive load. Even for values of  $R$  up to the generator resistance that is for ratios between 0 and 1 to 1, the improvement is noticeable. For example, when the load resistance is only one-fourth the size of the generator resistance, the output voltage for the matched condition is 25-volts. If the circuit in A had been used, only 20-volts would have been available. The voltage obtained with circuit B is 25% higher. This is one of the advantages of using a matching transformer between the plate of the output tube and the low impedance of the speaker. At the 50-volt point, the curves meet, but just for an instant. Beyond this point, the curves separate again, and now the transformer really pays off.

When the load is increased to twice the impedance of the generator and if the transformer tap is moved to the proper point so that the impedance match is maintained, 71-volts will appear across the load instead of 67 as before. If the load resistance is doubled once again, to the 4 to 1 point and the impedance match is maintained by adjusting the transformer tap, 100-volts appears across the load. This voltage was impossible to obtain with circuit A. Even higher voltages can be obtained by increasing the load impedance while main-

taining impedance match. There are limitations of course but within normal limits, unless frequency response is a consideration, the curve may be continued.

Not so simple is the problem of feeding a reactive load or a load comprising the input circuit of a vacuum tube. So called impedance matching from a microphone, for example, to an amplifier grid circuit isn't impedance matching at all. Usually the matching transformer has to work into a grid resistor so high in value that if impedance match were maintained, there would be an intolerable loss of high frequencies. Power is not the criterion here and therefore impedance matching is hardly an applicable term. One reason why transformers can't be built enormously large to give fantastically high voltages is that the turns ratio to match impedance (which varies directly with the square of the impedance ratio) must be preserved rather than turns ratio for voltage step-up alone. Another equally important reason why the transformer cannot produce a virtually unlimited useful voltage is as follows: The microphone, in Fig. 2A, a low-voltage, low-impedance type, feeds the amplifier grid which requires higher voltage at higher impedance. Impedance matching in this case is simply a matter of using the highest step-up ratio consistent with the frequency response required.

The capacity  $C$  shown dotted in represents tube input capacity, plus transformer, wiring and other stray capacity from grid to ground. For each  $\mu\text{f}$  of stray capacitance in the transformer secondary, there are  $n^2$  times  $\mu\text{f}$  reflected back into the primary (where  $n$  is equal to the turns ratio). As the turns ratio is increased, the capacity in the secondary is increased, and the capacity reflected back into the primary is increased many more times, compounding the trouble. The high capacity in the primary now by-passes the signal, losing much of the gain, especially at the higher frequencies. Fig. 2B, is the equivalent circuit of Fig. 2A. The mike is shown as the

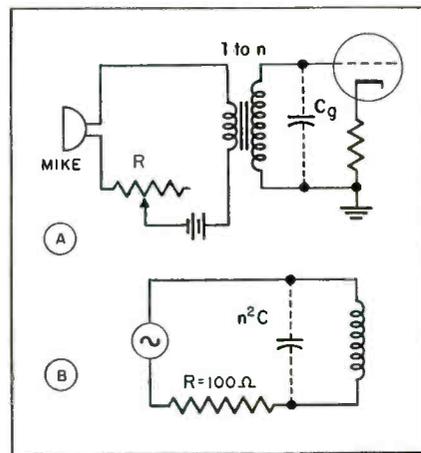


Fig. 2—Mike hookup and equivalent circuit.

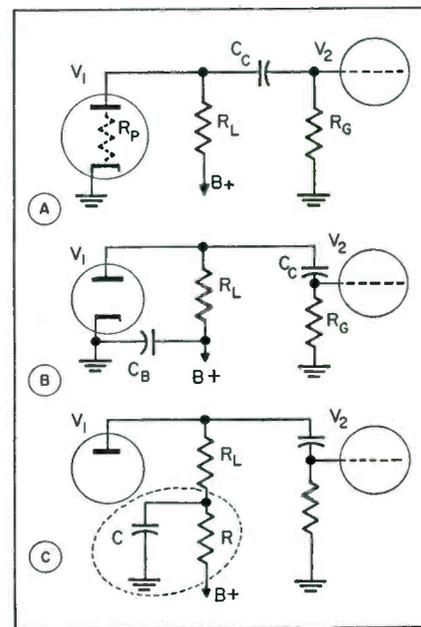
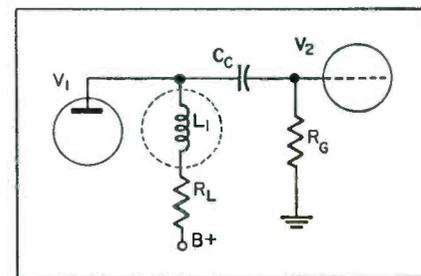


Fig. 3—Low-frequency compensating circuit.

Fig. 4—Shunt peaking boosts high frequencies.



voltage generator, while the mike resistance, wiring and mike control is lumped as  $R$ . For maximum step-up let us consider a turns ratio of 1

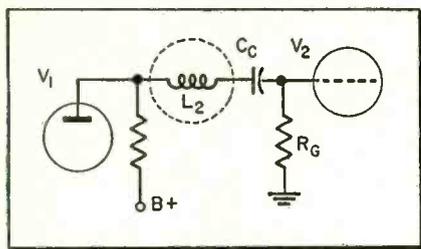


Fig. 5—Series-peaking coil raises highs.

to 100. Under these conditions, a value for  $C$  might be  $50 \mu\text{f}$ . The capacity reflected back into the primary  $n^2C$  would be  $100 \times 100 \times 50 = 500,000 \mu\text{f}$  or  $0.5 \mu\text{f}$ . With this large capacitance across the primary there would be a great loss of the high frequencies. This can be com-

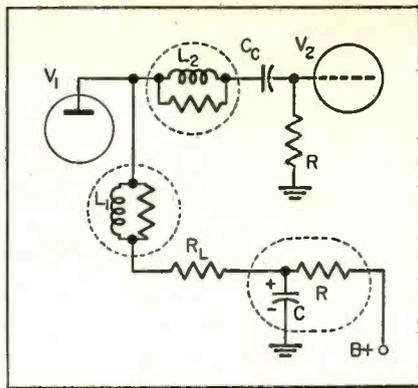


Fig. 6—High & low-frequency compensation.

puted, with a 100-ohm primary circuit, to show that the output would drop to the half-power point, 3-db down, at the relatively low frequency of 3,200 cycles; virtually losing the better part of any musical program.

Giving up some of the desire for

voltage, let us instead use a step-up ratio of 40. Fewer turns in the secondary also means less capacity. The value of  $C$  now may be only  $30 \mu\text{f}$ . The capacity reflected back into the primary is  $40 \times 40 \times 30$ , or  $0.05 \mu\text{f}$ . This shunts the output to the extent that the half-power point is now at 32,000 cycles; virtually the extreme top of any possible audio signal possible to be heard. Properly speaking, then, the correct choice of turns ratio in cases such as shown in Fig. 2, is a compromise between high gain and high-frequency response.

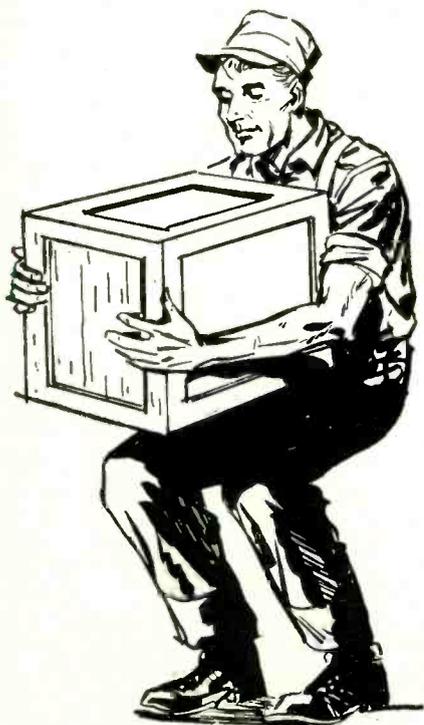
### Power Amplifier

In a power amplifier where it would seem that the primary requirement would be the maximum transfer of power, the apparent solution is to accomplish impedance match. However, such is not the case.

(Continued on page 46)

## How to Lift Without Straining

• The most common source of muscular aches and pains are poor lifting methods. In fact, one work injury out of four results from poor handling of materials. Just consider: When you straighten up from a bent over position, the strain on the muscles, vertebrae, ligaments and discs in your back can amount to more than a quarter of a ton. If you lift with your back at the same time,



the weight of the object is multiplied by 15 times or more.

Follow these four simple rules, and you'll find yourself working and playing without strain. Use your strong leg and arm muscles when you lift—not your back. It has enough to do just supporting you and allowing you to bend. Gear your activity to your age and physical condition. Physical effort, in moderation, is an excellent body builder, but don't carry it to excess. Stop and rest when you feel the danger signals of fatigue. Build up your muscles—but in easy stages. And don't just concentrate on your biceps; get as many of your muscles as you can into the act. Change your working position as often as you can. If your job is a sedentary and stationary one, watch your posture. Periodically rest the set of muscles in constant use; don't let yourself tense.

### SAFE LIFTING METHODS

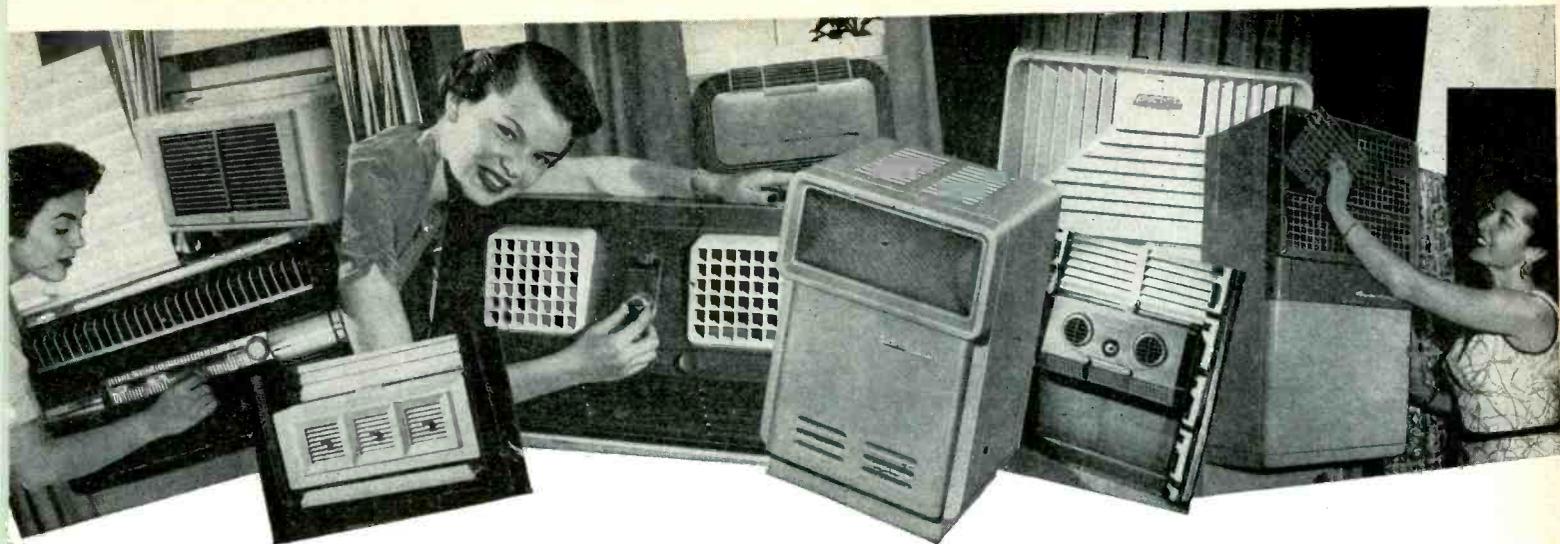
#### DO

1. Inspect load to make sure you can handle it yourself and decide the best way to grasp it.
2. Get a firm footing close to the object to be lifted; spread the feet, the length of a shoe for balance.
3. Bend knees and crouch down to the object.
4. Keep the back almost vertical and feet apart.
5. Get a good grip.

6. Straighten knees slowly, rise, keeping load close to the body and directly over feet.
7. Lower load just like you lifted it.
8. Lift the load waist high and rest it on a support to get a better grip before raising it shoulder height. Bend the knees to give added power for the final lift.
9. Rest frequently when carrying load for a long time. A tired person is more subject to strain, sprain, tripping and loss of balance.
10. Stop, reduce the load by making more trips or get help when you feel strain or pull.

#### DON'T

1. Be a show-off. Do get help when you need it, or use a dolly, lift truck or conveyor.
2. Use quick, jerking movements. They may cause injury by putting sudden strain on the muscles.
3. Carry a load for long periods of time without frequent stops for rest.
4. Carry load balanced on the hips. The body must be bent to one side, thrown off balance. One arm gets all the strain.
5. Lift with your legs straight, back bent.
6. Move object directly from floor to shoulder height without intermediate rest stop.
7. Twist around. Do get the load up and shift your feet to turn your body. •



# Short Cycling Air Conditioners

JOSEPH DERMAN

*Author's second article on  
Air Conditioning.*

• The compressor starts and stops repeatedly at short intervals. This complaint reflects a condition of overload of one kind or another and is interesting and important not so much because of the frequency of occurrence, but rather because of the many factors that may contribute to its cause. Let us consider a typical type of air conditioner circuit as shown in Fig. 1.

The fan motor operates as long as the main switch is on. When the thermostat calls for cooling, the compressor-motor also functions. The overload is a thermally actuated protective switch that prevents excessive current from reaching the compressor-motor.

The relay closes the normally open contacts during the first rush of current through it and the run winding. The start capacitor and start winding are thus energized and assist in starting the motor. As the motor approaches full speed, the current through the relay coil decreases enough to allow the contacts to open. The run winding alone now drives the motor.

## Air Stream

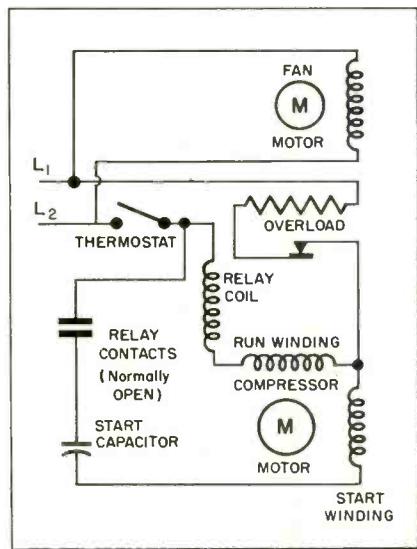
If the fan slips and rotates slowly, or not at all, not enough outside air

contacts the condenser. The gas is not cooled sufficiently to condense and help reduce the gas pressure in this portion of the system. The thermal overload may trip because the compressor is now working harder against this higher gas pressure and drawing excessive current. After a while, the heating element in the thermal overload will cool sufficiently to close the overload contacts and cause the compressor to start again. This short cycling repeats itself until the thermostat is satisfied, somebody shuts the machine off, or

the fuse blows out. Both the inside and outside air stream must be unobstructed. The fan motor must run freely. It should be cleaned, checked and oiled.

Unusually high outdoor temperature or direct sunlight beating down on the air conditioner may also cause short cycling. It can readily be appreciated that the thermal overload may be actuated by high enough outside ambient temperature just as it can be actuated by excessive current through it. This possibility exists and though not general, should be considered. An awning or other suitable shade may have to be installed to minimize the direct and intense heat.

Fig. 1—Initial surge current through the relay coil momentarily closes the normally open contacts and activates the start circuit.



## Line Voltage

One of the characteristics of the induction motor is that it draws more current at low-line voltage than it does at the normal rated voltage. The thermal overload will trip when the voltage drops excessively. The line voltage should be checked with the air conditioner turned on. No more than 10% decrease from rated voltage should be considered acceptable. Higher than rated voltage can also cause trouble and should be avoided. In some cases, line voltage regulating equipment would be desirable.

Some of the causes of low line voltage are: heavy community demand for electricity at a particular time of day; heavy electrical load on

*(Continued on page 52)*

# How To Use A

## An NTSC Color-Bar Signal Speeds Adjustment and Servicing

WALTER J. CERVENY  
THE HICKOK ELECTRICAL INSTRUMENT CO.

• Color-TV servicing is greatly facilitated by use of a standard 100% saturated NTSC color-bar signal. Much of the better receiver service data is written around this standard color signal. To obtain the maximum utility from your color-bar generator, it is helpful to keep the following basic principles in mind:

### Color-Signal Components

When the video-output signal from the color-bar generator in Fig. 1, is applied to the vertical-input terminals of a wide-band scope, the chrominance and luminance components of the complete color signal can be observed separately on the

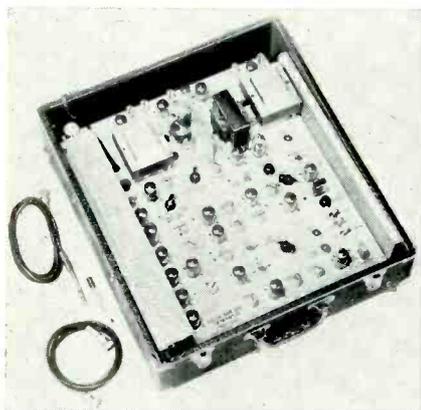
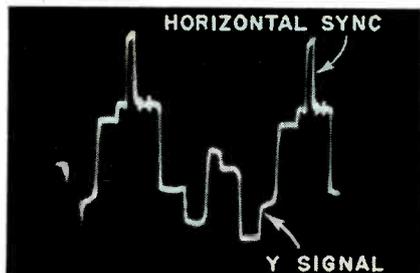


Fig. 1—Signal generator capable of reproducing a 100% saturated NTSC color-bar signal or components thereof. Also sets up horizontal or vertical bars, cross-hatch or dots.

Fig. 2—Luminance part of color-bar signal.



scope screen, as illustrated in Figs. 2 and 3. This is a useful test to make from time-to-time, to determine whether or not the color-bar signal is correct. Service adjustments may need a slight touch-up, due to slow changes in tube characteristics. Fig. 2, illustrates the luminance or Y signal output from the generator. This signal produces only gray bars on the screen of the picture tube in a color or black-and-white receiver.

Fig. 3, illustrates the chrominance component of the color-bar signal, which is obtained when the generator switches are set to suitable positions. It is this chrominance signal which adds color to the Y signal. A black-and-white receiver is unresponsive to the chrominance signal, and will merely display a blank raster when such a chrominance signal is applied. A color-TV set will respond by displaying color bars. However, the chrominance signal alone produces dim and bluish color bars. The chrominance signal does not contain all the color information.

The complete color signal as shown in Fig. 4, has both chrominance and luminance signals. A color-TV receiver, when energized by the complete color signal, will display bars of fully saturated colors. The black-and-white receiver rejects the chrominance signal, and accepts only the Y component from the complete color signal.

### Delay Line

The delay line in the Y amplifier of the color-TV receiver delays the Y signal by approximately 1 micro-

second. This enables the Y signal to arrive at the CRT at the same time as the chrominance signal. Unless the delay line operates correctly, the luminance and chrominance signals do not "register" with each other. To the experienced eye, a shorted delay line causes a very apparent shift of the luminance bars to the left of the chrominance bars as illustrated in Fig. 5. A normal color-bar pattern with the delay line functioning is shown in Fig. 6. The horizontal scanning time is 63 microseconds. A shorted delay line causes a shift of 1 microsecond in the Y signal, which produces a Y-bar displacement of  $\frac{3}{10}$  of an inch on a 19-inch scan. This is a very sizable mis-registration, which cannot be tolerated in color reception.

### Hues

The hues displayed in the color-bar pattern in Fig. 6 are: Green, yellow, red, magenta, white, cyan, and blue. This is the sequence of colors which is obtained when the receiver color-phasing control is properly adjusted. When incorrectly adjusted, the color bars are displayed but the sequence of colors is altered.

When the quadrature transformer in the receiver is misadjusted, some of the color bars will have correct hues, but others will not. In such case, the color-phasing control can usually be adjusted to make any one or two bars display correct hues, but the remainder of the bars will display incorrect colors. After the tuning slugs in the quadrature trans-

Fig. 3—Chrominance information in signal.

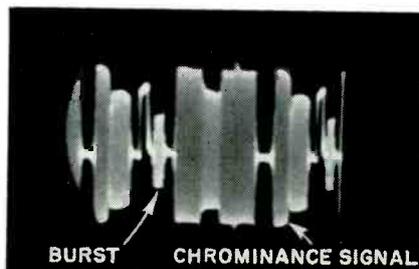
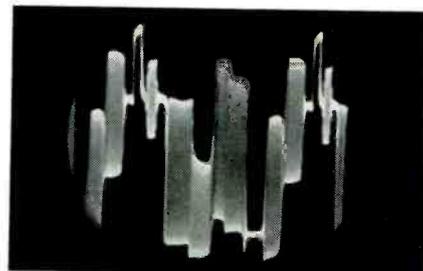


Fig. 4—Luminance, chrominance signal comb.



# Color-Bar Generator

*Procedure. Signal Tracing and Waveform Analysis is Simplified.*

former have been properly set, all the color bars will then display correct hues. Accurate adjustment of the quadrature transformer can be made by using R-Y and B-Y test signals from the color-bar generator, and a scope connected at the output of the color detectors. The B-Y detector nulls on an R-Y signal when the quadrature transformer is in proper adjustment. The R-Y detector nulls on a B-Y signal when the adjustment is correct, as shown in Fig. 7.

## Signal Tracing

When the Y signal, shown in Fig. 2, is applied to a color-TV receiver, this waveform will be found at the output of the Y amplifier, but will not be observed at the output of the bandpass amplifier in normal operation. In case appreciable Y signal is observed when a scope is applied at the output of the bandpass amplifier, it is an indication of a defect in the operation of this circuit.

When the chrominance signal shown in Fig. 3 is applied to the color-TV receiver, this waveform (except for the horizontal sync pulse) will normally be found at the output of the bandpass amplifier, but will not be observed at the output of the Y amplifier. Only the sync pulse will pass through the Y amplifier in normal operation. If appreciable chrominance signal is observed at the output of the Y amplifier, the color-subcarrier trap needs adjustment. This trap is tuned to minimize the amount of chrominance

signal at the output of the Y amplifier.

The color detectors are phase detectors, which normally null on respective quadrature signals. I and Q are in quadrature with each other, and so is R-Y and B-Y. Hence, color detectors null as follows in normal operation: An I detector nulls on a Q signal, A Q detector nulls on an I signal, An R-Y detector nulls on a B-Y signal, A B-Y detector nulls on an R-Y signal

Most present-day color-TV receivers matrix the luminance and chrominance signals in the picture tube, which facilitates such tests: the output from the R-Y detector can be checked by applying the scope at the red grid lead to the picture-tube socket; the output from the B-Y detector can be checked by applying the scope at the blue grid lead to the picture-tube socket. The Y signal can be checked by applying the scope to the CRT's cathode lead.

An IQ type of receiver necessarily employs a matrix for luminance and chrominance signals which is external to the color picture tube, and in such case the scope must be applied at the I and Q amplifier outputs to make null checks. However, very few IQ receivers will be encountered in practical work; nearly all present-day color receivers are arranged to apply the luminance signal to the three cathodes of the picture tube, the R-Y signal to the red grid, the B-Y signal to the blue grid, and the G-Y signal to the green grid.

In conclusion, it is helpful to observe the phase relations of the various chrominance and color signals,

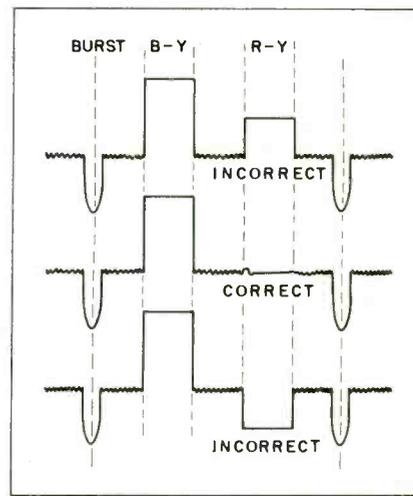


Fig. 7—Scope at B-Y detector shows correct alignment of quadrature transformer when receiver is energized by R-Y/B-Y signal.

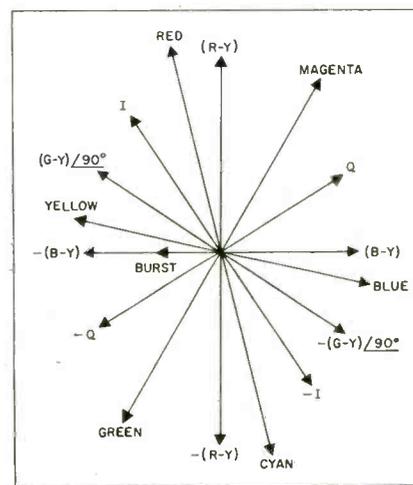


Fig. 8—Relative voltages and phases of the 3.58-mc signal provided by the color-bar generator having an NTSC output the same as a TV station and 100% saturated color bars.

Fig. 5—Shorted delay line causes bar shift.

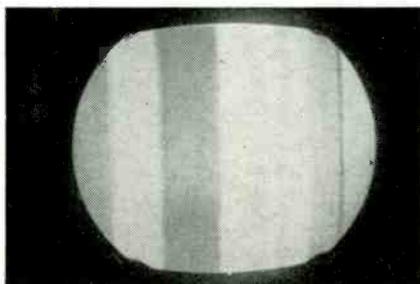
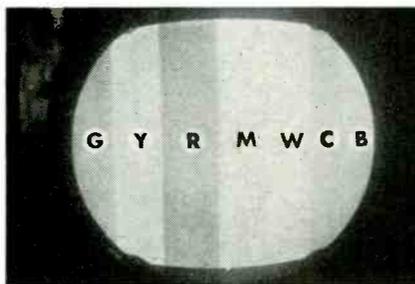


Fig. 6—Color-bar pattern, normal delay line.



illustrated in Fig. 8. Note that the R-Y phase differs from the B-Y phase by  $90^\circ$ ; that the I phase differs from the Q phase by  $90^\circ$ , and that the burst phase is the same as the  $-(B-Y)$  phase.

Test equipment instruction manuals and set manufacturers literature are important tools of the trade. That coupled with basic know-how will result in a job well done. •

# Meet The Servo, Synchro

## Understanding the Intricacies of Servos, Those Special Motors

LAWRENCE X. SHAW

• You have met the servo many times. These controlling devices are not confined to aircraft and telemetering applications. You have already had a handshake with avc, agc and afc circuits in radio and TV receivers. Industry uses are widespread and growing. The second industrial revolution is a term used by many when they describe the impact of this mechanism in our modern society.

A servo is a system (it may be electrical, mechanical, optical, thermal, etc.) which compares actual operation of a device, with desired operation; it produces a signal of the difference, if any, and permits compensating adjustments to make this difference as little as possible. While adjustments are generally performed automatically, manual operation is not ruled out in the definition. For

Fig. 1—Regulator controls output voltage.

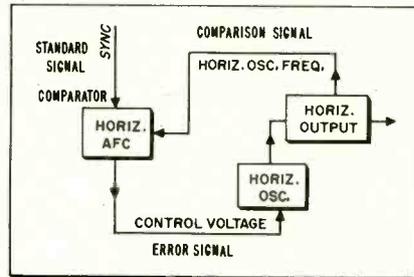
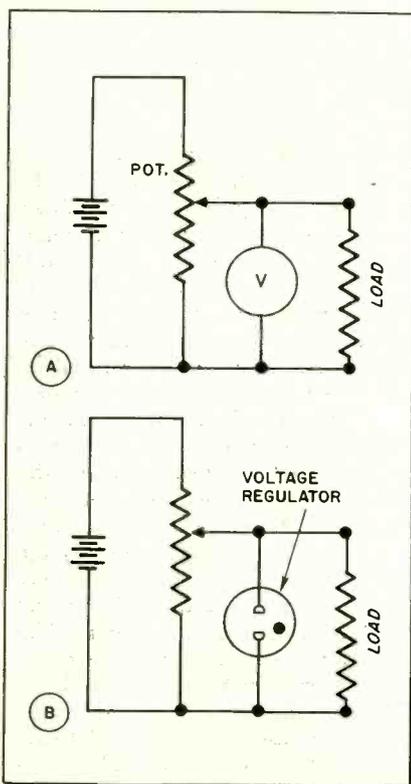


Fig. 2—Comparison of terms used in horizontal AFC system, with those used in servos.

example: a voltmeter indicates the amount of voltage delivered to the load in Fig. 1A. The technician sees that the voltage is incorrect. He senses the difference between a desired voltage and the actual voltage. His hand adjusts the potentiometer to obtain the correct voltage or, in effect, zero difference between the desired and actual quantity.

In Fig. 1B, a glow-tube voltage regulator has replaced the technician. It senses a voltage difference and makes the necessary corrections automatically. The manual system is also known as an open sequence system. The other is automatic and is called a closed sequence system because it works all the time.

### Basic Components

Fig. 2. shows another common example in block form of a horizontal afc system. In it we can see the basic components of a servo found in most systems. The reference quantity or standard in this case is the sync pulse. They occur at the desired frequency. The locally generated waveform frequency must be correct, but is likely to vary. Therefore, a portion of this signal is fed back for comparison with the standard. The comparator, or afc circuit, receives both the standard and comparison signal, compares the two and in the event of a difference, produces a control voltage or error signal. The error signal may indicate not only the magnitude of the deviation but also its sense. That is, over or under standard. Deviation of 200 cycles might produce 2-volts positive if over 15,750 or 2-volts

negative if under.

There may or may not be some means of modifying the error signal. It may be amplified, decreased, integrated, differentiated or delayed. Finally some method for controlling or making corrections is employed. In the afc example the error signal voltage may be applied directly to the horizontal oscillator or through a reactance tube.

### Mechanical Servos

The intent here is to lump all feedback or loop systems that are not purely electronic. Some text books rightfully differentiate between servos, servomechanism and synchros. Other books use a broad approach completely disregarding the differences, concerning themselves not so much with the theoretical aspects as with the actual problems. The inclination here is to adhere to this latter broad approach. The common use of trade names such as selsyns, further detract from the strict definition approach. The selsyn motor and selsyn generator are the same as the synchro motor and synchro generator respectively.

The synchro and servomechanism in many instances can perform the same type of work. However most applications dictate the use of one, or both, or combination thereof. Fig. 3 shows a basic synchro system which consists of a motor and generator. Rotation of the generator armature will cause the armature in the motor to move in exactly the same manner. Hence the name slave unit for the motor. Essentially each unit is the same in this case and either one may act as a master or slave, depending upon the circumstances. It consists of a stator having a three phase winding and a rotor with a single winding. By modifying the connections in the motor, rotation can be made to operate in reverse, or 180° out of phase, or both in relation to the rotation of the generator. Reversing the leads of the armature will cause a 180° shift without changing direction. Reversing the wires going to any pair of adjacent windings will cause the

# and Servomechanism

## and Controls Which Are Revolutionizing Our Industrial Economy.

armature to rotate in reverse. Connections to L2 are usually left intact, and L1 and L3 are used when the reversal is desired.

The excitation voltage (could be any ac source, usually 400 cycles) present in the armature windings induces voltages and currents in the three stator windings because of transformer action. The voltage and current phase angle in these windings depends upon the relative position of the armature. The armatures in both units will have a tendency to assume the same relative position in order to maintain a minimum phase difference between the corresponding windings.

More complex systems may employ, coarse, fine and differential servos or combinations thereof. One corrects for coarse errors while the other does the finishing job. The differential-servo motor or generator has provisions for further modifying the signal by incorporating information received from additional sources. Sometimes many different pieces of information are fed into the system and the servo automatically and almost instantly comes up with the correct answer or motion.

### Control Transformer

A slight departure from the conventional servo motor or generator is the control transformer (CT). The CT also consists of a rotor and stator arrangement and in many ways resembles the servo units. In the servo motor the output is a mechanical motion, in the CT the output is a voltage. This voltage is then used to control the action of another circuit. The armature in the CT is designed not to rotate as a result of the shifting magnetic field in the stator. When the rotor in the synchro generator was turned, the shifting magnetic field caused the rotor in the synchro motor to turn accordingly. In the CT the shifting magnetic field causes a varying amount of transformer action to take place which ranges from maximum in one direction through zero to maximum in the opposite direction. Any transformer action will manifest

itself as an output voltage which becomes the error signal. By rotating the rotor of the CT to its proper relative position, the output will drop to zero. The beauty part of this arrangement lies in the ability of the error signal to control large power devices which can take corrective action. The rotor of the CT is directly connected to the device being controlled and rotates until the correct position is attained and no error signal appears.

### Servomechanism

Fig. 4 illustrates a different type of servo. This system approaches our strict definition of a servomechanism, which simply stated is a mechanical movement controlled by a servo. In the new system we cannot interchange generator and motor units as in Fig. 3. The generator in fact is no longer a rotor and stator motor-like unit. The potentiometer on the left is the generator or master. The one on the right is the slave. The object is to make the slave shaft indicate the same position as the master.

Voltage from the master is compared in the comparator with that from the slave. Voltage, frequency, or phase may be the quantity used for comparison purposes in other systems. The error signal from the comparator is fed to the servo amplifier which controls the motor. The servo motor rotates the shaft of the slave potentiometer until the voltage agrees with the master. Power output requirements for servo mechanism are sometimes relatively heavy. Transmitting type tubes, thyratrons and ignitrons are often used.

Servos exhibit lag. They do not necessarily respond immediately to the error signal. Friction, inertia and other factors contribute to this condition. The lag may be small as in age circuits or long as in some thermally actuated devices. Servos may overshoot or undershoot the desired condition. Sometimes called overthrow and underthrow or overcontrol and undercontrol. Or the slave may hunt or oscillate about the desired state.

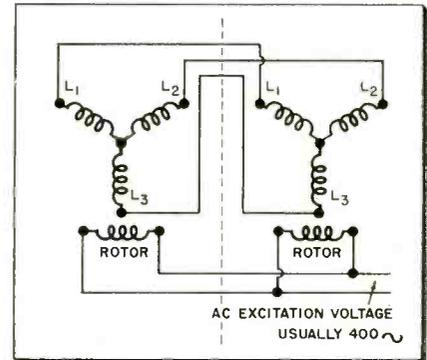


Fig. 3—Basic master-slave synchro system.

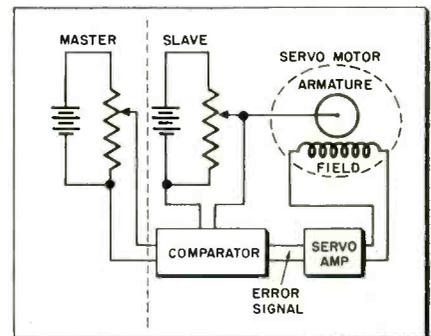
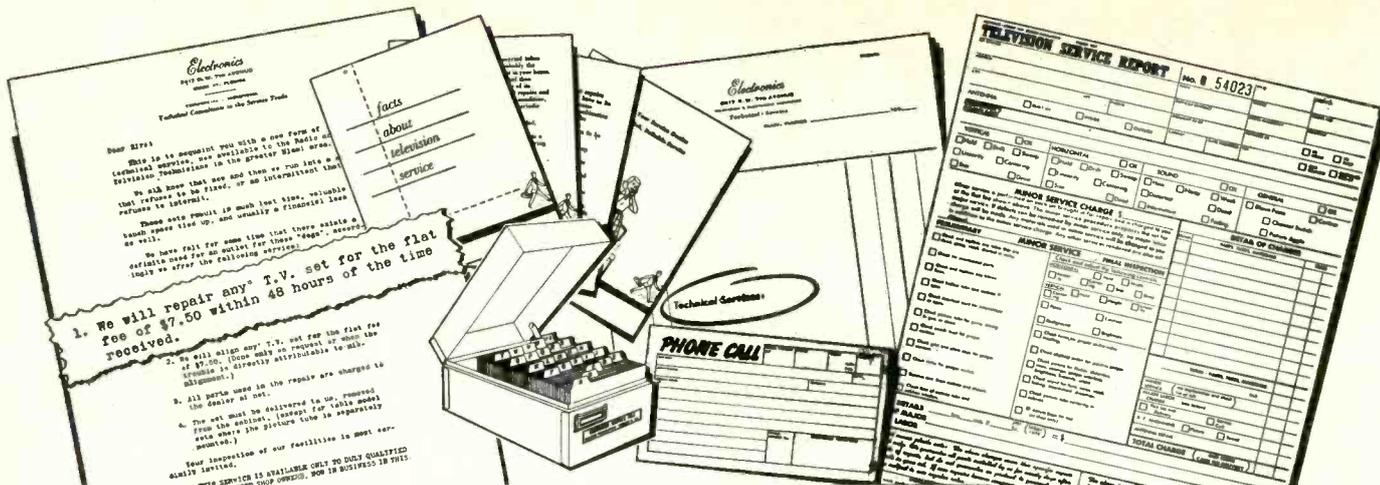


Fig. 4—Error signal causes motor to rotate.

Servos may oscillate at some frequency. Hence they require stabilization as in any loop or feedback circuit. The feedback which is negative for one frequency may so shift in phase as to become positive at another frequency. Regeneration or oscillation is the result. Mechanical systems are even more critical in this respect than are electronic systems. Difficulty often arises from inability to predict performance. As a matter of fact in design work, the mechanical quantities are often converted into their electronic equivalents and the circuit is analyzed. Inductance is substituted for mass, resistance for friction, and capacitance for momentum or inertia. The field of servos is vast. Only the major features common to most have been defined here and illustrated in terms common to the radio and TV technician, so that he may understand them when encountered. •



# A Professional Approach to Service Business

Promotional Activity & Efficient Operation Encourage Profits

EDWARD G. DICKSON

• Even the drop-in customer who makes a simple purchase like a radio tube from Roy Phillips' service shop in Miami won't get a bill made out to "cash." His receipted bill will list his name, address and even his telephone number if the shop can get that information, because Mr. Phillips wants the data for his highly-valued customer file. The customer may not realize it at the time, but he's almost certain to hear again from this shop.

Any customer who comes in or calls in for service once can be jogged into doing so again if he is satisfied with the work done for him. To that

end, the shop has kept a record of each customer and all the work done for him almost since the firm's beginning in 1949.

The firm, operated under the name of Electronics "because we feel that shows we are more than just a fix-it shop," uses a number of methods of capitalizing on this prized-customer list. It mails out booklets, sends postcards announcing some special service offer and makes telephone follow-up calls to check on how a repaired set is working. All methods remind the customer of the firm and its facilities.

The burden of this promotional work is happily assumed by Helen Phillips, the owner's wife. A former bookkeeper, she handles most of the business details of the firm; she also



Well equipped shop facilitates repair work.

has a flair for tucking away in her memory the names and faces of their customers; an ability which helps the firm in its effort to personalize its services. "Roy remembers jobs by the kind of TV set he worked on, while I remember jobs by the name or face of the customer," she explained.

A recent follow-up effort by the Phillipses was to distribute a postcard to about 600 active TV and radio customers announcing a "special offer." "We will pick up, completely repair, clean, polish and deliver back to you any small AC/DC radio, with a three-month warranty on the complete set . . . Our price . . . just \$5.00," the card said in part. "This was planned chiefly to stimulate the radio repair portion of our business," Mr. Phillips explained. "But it brought in other types of business, too, such as a number of

(Continued on page 47)

Telephone contact creates new customers.



Customer file indicates kind of follow-up.



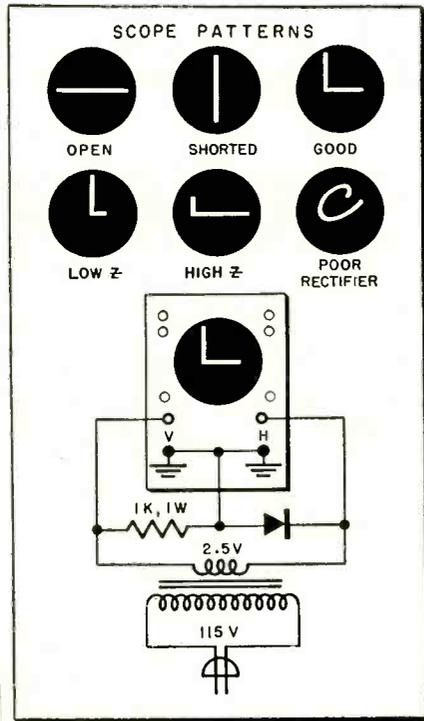
# SHOP HINTS



## Tips for Home and Bench Service by Readers

### Diode Checker

This simple diode checker may be used with any oscilloscope. The technique is interesting and accurate. The input signal is not critical. About 2.5-volts ac is all that is required. Any low-voltage transformer may be used. The plate side of an audio output transformer may be connected to the a-c line. The secondary winding usually develops about 2.3



Simple diode checker and typical waveforms.

volts. Because there is practically no load, the size of the transformer is not a factor. The only other parts needed are a 1,000-ohm, 1-watt resistor and some terminals. The entire unit could be built into the scope. Calibration consists of comparison with a unit known to be good. Crystal diodes may be checked for match, open, shorts, high or low impedance, and ability to rectify. Diagram shows typical waveforms and schematic.—Ed. M. Chenoweth, Osceola, Wisconsin.

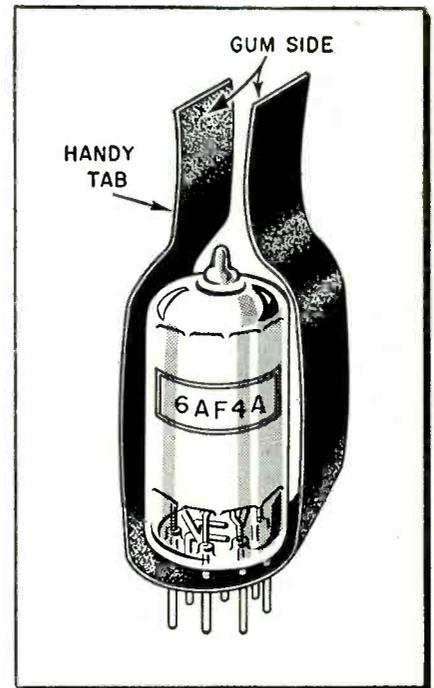
### Tube Saver

The heat developed in and around the horizontal output tube in the TV receiver, often causes the top cap to become loose and unsoldered. Sometimes the cap remains firmly cemented to the glass and the actual electrical connection becomes intermittent and bad. Between the corroded wire and low-temperature solder used for servicing, it is difficult to establish a good connection just by applying the soldering iron to the top of the tube. If the tube is good, except for this condition, I change the connector, on the lead from the flyback, to the spring type if it already doesn't have one. I then spread the spring coils over the wire projecting from the top of the tube. To assure a good connection the wire should be cleaned. This can be accomplished by carefully scraping with a knife blade or emery cloth. When price is a factor, this idea should help improve customer relations. The spring-type connectors can often be salvaged from defective flyback transformers.—Obert Thomley, Chippewa Falls, Wisconsin.

• To avoid damage to the horizontal-output tube especially when it has been in service for some time, it pays to inspect the condition of the cap before attempting to disconnect the lead. Often the lead connection is stronger than the old bond between the glass and cap. A small screwdriver can be used as a lever to gently lift the connection without applying decapitating pressures.—Ed.

### Inaccessible Tubes

When it becomes necessary to replace the larger 6AF4 tube type, and only the smaller 6AF4A is available, the technician may find that the tube fits into a deep recess such as in the UT-21 and UT-22 Philco Converter. If the smaller 6AF4A tube is used, he will find much to his sorrow that he will be unable to remove it for future replacement. I recommend



Heat and shield conditions permitting, plastic tape forms handle for miniature tubes.

the use of a 3-inch length of 3/4-inch wide plastic high-dielectric tape. The smaller 6AF4A is pushed through the tape, gum side up, so that the pins make their own holes. The tape is then folded up along the sides of the tube and squeezed together so as to form a tab. This hint may be used in other inaccessible places provided the tube is not operating at a high temperature.—Harold J. Cohen, Miami, Fla.

• Read "Do-It-Yourself," in the Tuning In The Picture section.—Ed.

### Win \$5.00!

ELECTRONIC TECHNICIAN will pay \$5 for acceptable shop hints. Unacceptable items will be returned. Use drawings to illustrate whenever necessary. A rough sketch will do as long as it can be followed. Send your hints to "Shop Hints" Editor, ELECTRONIC TECHNICIAN, 480 Lexington Ave., N. Y. 17, N. Y.

# Spot Wobble Eliminates CRT Lines

• The dark horizontal lines clearly visible in any close-up look at a TV picture may someday be a thing of the past.

Scientists at the Westinghouse Research Laboratories have developed an experimental method for eliminating these scanning lines—now considered a natural limitation on the size of the picture people enjoy watching.

Elimination of the scanning lines is made possible by a simple but basic change in the construction of the CRT.

This change consists of splitting in half the focussing grid.

## Standard TV Picture Appears as Black and White Lines

Previous research, which has been verified by our experiments, shows that the viewer moves back from a TV picture until he just fails to clearly distinguish these individual lines. For a 24-inch picture, this "normal" viewing distance turns out to be about 10½ feet. Placed closer than this, the viewer begins to distinguish the horizontal line structure which he finds distracting.

If this line structure is reduced or

eliminated, pictures larger than those furnished by the usual 17- or 21-inch receiver can be viewed with comfort at short distances. With line structure reduction we find that the average viewer tends to select a viewing distance of about six feet from a 24-inch picture rather than a distance of almost 11 feet without it.

The new Westinghouse technique employs a method of wobbling the electron beam vertically as it makes its repeated traces across the tube. The slight up-and-down motion of the beam broadens the white lines which carry the picture information and narrows the distracting black lines which lie between them.

This so-called "spot wobble" actually dates back several years, but heretofore the methods for accomplishing it have involved considerable equipment and have not been entirely satisfactory. The system devised eliminates these problems by taking advantage of the "split-grid" structure inside the CRT itself.

The split focusing grid still serves its regular function of sharply concentrating the electron beam on the screen, but at the same time allows the application of a fluctuating volt-

age which wobbles the beam up and down about 15 million times per second. The wobbling voltage is supplied by a single tube fitted to a socket into which the television picture tube is plugged.

## Experimental Stages

The spot wobble is still in its experimental stages and has not as yet been adopted on a commercial scale. Such adoption would likely require some change in the habits of viewers.

Present receivers are in sharpest focus and give maximum picture detail when the horizontal scanning lines are most distinct. The average viewer has come to associate the presence of these lines with a sharp, clear picture. Lack of the lines he associates with poor focus of the tube.

With spot wobble, the viewer would have to become accustomed to a picture which gets rid of these lines without any loss of detail or resolution in the picture. Once accustomed to it, however, we think the average viewer would prefer larger TV pictures which offer both low line structure and higher picture detail. •

## Right Or Wrong In Labor Relations

*A roundup of day-to-day employee problems and how they were handled. Each incident is taken from a true-life grievance which went to arbitration. Names of some principals involved have been changed. Readers who want the source of any of these case histories may write to ELECTRONIC TECHNICIAN.*

### WHEN IS A CRACKDOWN ON LATENESS UNREASONABLE?

#### What Happened:

The service company had had a problem with lateness from way back when. It had tried warnings, pay deductions, various kinds of penalties—with no effect. So out came a new rule: Any employee who was late more than 11 times in a year got fired. "Late" meant arriving after the official starting time of 8: A.M. No exceptions! When Anna Gedman turned up tardy for

the twelfth time in seven months, she was discharged. Anna hollered "Unfair!" She complained:



1. Nobody has ever before been fired for as few as 12 latenesses a year. In the past people had been allowed 24 latenesses a year, and sometimes even 36—without any penalty at all.
2. It wasn't reasonable not to give an employee a talking-to or warning. Just 12 latenesses and out you go!
3. Two of those 12 times I was only one minute late, and another time only two minutes late.

To which the company replied:

1. Maybe 36 latenesses a year were allowed without penalty in the past, but that doesn't mean we have to keep on allowing it.
2. A number of workers keep their tardiness down to no more than four times a year. We think twelve is ample.

(Continued on page 54)

# Latest Test Instruments & Aids

## Hickok GENERATOR →

This new single unit VHF-UHF sweep-marker-alignment generator is specifically engineered to provide all the necessary features required for alignment of TV receivers. The Model 615 features an all-electronic sweep, retrace blanking, internal marker mixing, variable sweep width, and a built-in 4.5-mc crystal. Both marker and crystal oscillators may be amplitude modulated by a self-contained 900-cycle modulator. The Hickok Electrical Instrument Co., 10523 Dupont Ave., Cleveland 8, Ohio. (ELECTRONIC TECHNICIAN 6-2)



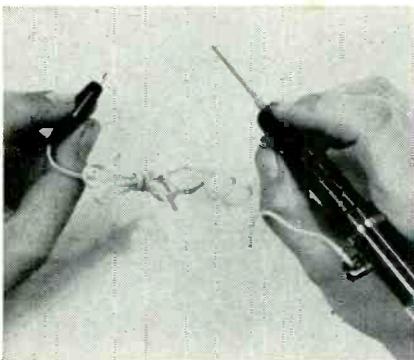
## Sprague TRANSIMULATOR →

New instrument eliminates bread-board layout by simulating complete transistorized amplifier stages. Any a-c or direct-coupled amplifier stage can be simulated, as can multivibrator, switching, phasing, push-pull, and others. Everything required for r-c amplifier circuits is built right into the instrument. Also has an internal battery voltage supply. Almost any external connection can easily be made. Model LF-1 is priced at \$79.50. Sprague Products Co., 65 Marshall St., North Adams, Mass. (ELECTRONIC TECHNICIAN 6-1)



## Walco MINI-METER →

A new pencil-type volt-ohmmeter is offered only as a free premium with Walco's new "Tote-Pak" needle selection, a low-cost assortment of the 12 most popular replacement needle types. The Mini-Meter has been designed to aid the serviceman make accurate ac-dc voltage and resistance checks. A direct-reading, magnified dial located in the head provides clear, accurate readings from any angle. It is completely self-contained. The unit weighs only 2 oz. Electrovox Co. Inc., 60 Franklin St., East Orange, N.J. (ELECTRONIC TECHNICIAN 6-3)



## ASD TUBE TESTER →

The Model A-1000 "Rapid-Check" tube tester, tests all octal, loktal, 7 and 9-pin miniature tubes for gas, leakage, grid emission, shorts and tube worth. Gas and leakage reads on the meter. No set-up whatever is needed to make any of the measurements listed above, making this an extremely fast tester. Tubes are simply plugged in and a button is pressed. The set-ups are automatic. All sections of multi-purpose tubes are fully tested. American Scientific Development Co., 334-336 South Main, Ft. Atkinson, Wis. (ELECTRONIC TECHNICIAN 6-4)



## G-C TOOL KIT

"Top Twelve" alignment tool kit contains both long and short-reach aligners, K-Tran and soldering aids and special tools for RCA and Zenith sets. Each tool is also available separately. Catalog No. 5040. L.P. \$10.95, complete with a durable plastic roll-up case. General Cement Mfg. Co., 400 South Wyman St., Rockford, Ill. (ELECTRONIC TECHNICIAN 6-5)

## Lite SOLDERING IRON

For precision work on miniature electronic components or for intricate or hard-to-get-at connections this midget 10-watt soldering iron weighs ½ oz. and is 6" long. It can be handled and used like a pencil. Operates on 110/120 volts ac or dc without transformers or special attachments. The fully insulated element heats in less than one minute. A heatproof cover allows instant return of the soldering iron to the tool box or pocket. Meadow Sales Corp., 2714 W. Montrose Ave., Chicago, Ill. (ELECTRONIC TECHNICIAN 6-6)

## Minico TUBE TESTER

The Minico "400" is a precision tube tester employing a special electron-ray indicator tube to measure both cathode conductance as well as gas and high resistance shorts. It tests 98% of all types of TV tubes and gives separate tests of both sections of double purpose tubes. The tester has a minimum of adjustments and only 3 tube sockets which help make this a high speed test instrument. Minnesota Instrument Co., 137 W. Seventh St., Saint Paul 2, Minn. (ELECTRONIC TECHNICIAN 6-53)

## Transvision VTVM-VOM

Complete VTVM and VOM instruments combined into one transistorized unit is available in kit form. The transistorized circuit makes it completely portable with no need for a-c power. Covered precision components are specially made to guarantee long wear with accurate performance unaffected by humidity or dust. The meter is a ruggedized 50- $\mu$ a movement. The specially molded plastic components case has individual pockets for each resistor, shunt and battery. The kit is divided into 3 packages which may be purchased separately on the pay-as-you-wire plan. The first stage costs \$10.00; the complete kit is \$36.95; assembled and wired it sells for \$69.00. Transvision Inc., New Rochelle, N.Y. (ELECTRONIC TECHNICIAN 6-54)

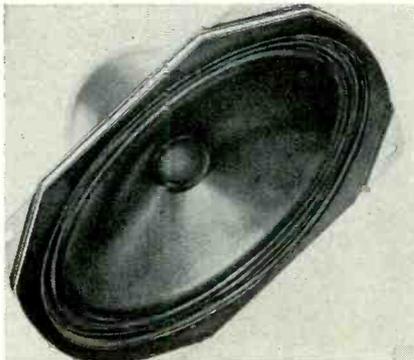
# New Audio Products

## Sonotone TWEETER



The T-64 Linear Standard Elliptical Cone Tweeter is suitable for single or multiple use. The unique elliptical shape gives broad spatial coverage at high frequencies without displeasing effects. The use of a special paper cone speaker for the tweeter results in an unusually high, smooth clean response.

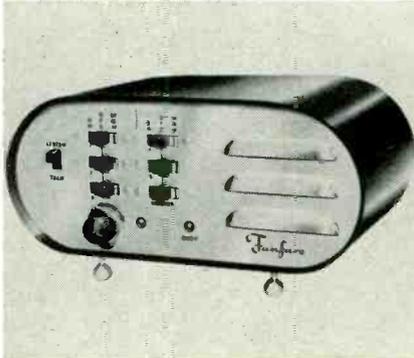
The low price makes the T-64 ideal for multiple speaker installations using several tweeters. Net price in the East is \$7.50 and \$8.50 in the Far West. Sonotone Corp., Elmsford, N.Y. (ELECTRONIC TECHNICIAN 6-48)



## Fanon INTERCOM



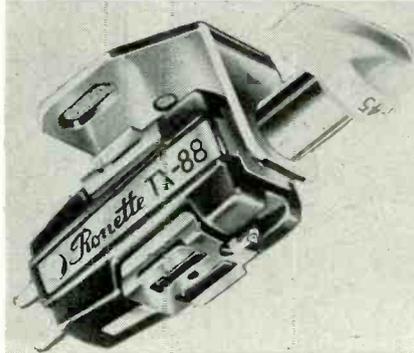
The Monitor may accommodate up to 5 remote stations and permit conversation between the master and any one or all of the remotes, as well as a new feature which allows direct remote-to-remote communication. Thus it acts as a telephone switchboard. It also features 2 pilot lights, one an on-off indicator, the other a busy signal which is only on when conversations are taking place. The FM-6, master is \$37.50 and each remote is \$13.25. Fanon Electric Co., 98 Berriman St., Brooklyn, N.Y. (ELECTRONIC TECHNICIAN 6-49)



## Ronette CARTRIDGE



A new wide range hi-fi cartridge requires no preamp. The design permits quick styli replacement without the use of tools. Frequency response is flat from 30 cps to 24 kc. IM distortion is negligible. The output is 0.4 volts as measured on a Columbia test record RD103. When used in conjunction with a preamp, performance exceeds magnetic pickups. Model TX-88 Superfluid, has no hum problems. Ronette Acoustical Corp., 190 Earle Ave., Lynbrook, N.Y. (ELECTRONIC TECHNICIAN 647)



## Pilot TUNER

The new Model HF-30 is an all-in-one unit which combines an FM-AM tuner, preamplifier-equalizer, and a Williamson-type 12-watt amplifier on a single chassis. It features a beacon-tuning indicator, speaker-selector switch, loudness-contour switch, tuned r-f stage, output jack for tape recording, variable phono-load control, built-in RIAA equalization with calibrated points on the tone controls for other recording curves, separate bass and treble tone controls, 8 and 16 ohms output impedance, built-in FM-AM antennas and a 10 kc AM whistle filter. Retail price is \$169.50. Pilot Radio Corp., 37-06 36th St., Long Island City, N.Y. (ELECTRONIC TECHNICIAN 6-46)

## MusiCall RADIO & INTER-COM

A new AM-FM combination music system and inter-com for home or office is composed of a master station and separate control box for remote stations, three 5" interior speakers and one 4" front door speaker-mike. It can easily be converted to a 7 or 13 station system. Low or normal tones can be heard without blurring or distortion above the music. MusiCall Corp., Los Angeles, Calif. (ELECTRONIC TECHNICIAN 6-44)

## GE WOOFER

The new A1-403 speaker provides excellent undistorted low-frequency power output, up to several times that of single-cone wide-range speakers, in the 40 to 1500-cycle range. The high power output feature results from a specially-treated, deep-convolution cone edge and a linearized air gap and suspension system. Also includes a built-in electro-mechanical crossover system, with an unusual double curve in the cone, to help provide a smooth positive roll-off at the 1500-cycle crossover point. Suggested retail is \$29.95. General Electric Co., Specialty Electronic Components Dept., Auburn, N.Y. (ELECTRONIC TECHNICIAN 6-45)

## Robins INSULATION

The material is a grade of fiberglass especially suited for acoustic insulation. It can be cut to size with scissors and easily tacked, stapled or glued in place. Fiberglass does not burn, rot, or decay and does not attract or provide food for insects. A package contains 6 feet x 18 inch x 1 inch of material. Robins Industries Corp., Bayside 61, N.Y. (ELECTRONIC TECHNICIAN 6-55)

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Watch for an increasing number of audio manufacturers to offer transistorized amplifiers and tuners. In some cases the new equipment will be significantly new in concept; in other cases it will simply be a transistorized version of a regular tube design.

For example, the high-powered intercom systems using transistors and printed circuits, which have just been announced by Webster Electric, are intended for integration with the company's regular line. A 50% saving in wiring cost realized by printed circuits will allow a price similar to the tube versions.

Hoffman Electronics has added a line of hi-fi components. HFA-5 25-watt amplifier at \$69.50; HFG-4 record changer made by Garrard at \$52.75; HFT-8 AM/FM tuner at \$99.50; HSC-3 sound chamber with 3 Jensen speakers at \$49.50. They will be offered through firm's regular distributors.

General Electric has transferred hi-fi product operations to its Specialty Electronic Components Dept., Auburn, N.Y. Ed Hulse is general manager.

University Loudspeakers' advertising will be tripled this year over last.

Oxford Electric elevates Hugo Sundberg to president.

Electrovox drops price of Walco diamond needles to \$14.95, \$15.95 and \$16.95, effective May 15.

Jensen Industries is offering a diamond needle kit merchandiser called the Hi-Fi-Er. It includes microscope, cloth, tools, etc.

Permo appoints Hiram Prince sales manager and Charles Weigand chief engineer for Fidelitone needles.

Recoton has made available a replacement needle cross-reference.

# NEW

## at Ward...

### REAR FIN ANTENNA



Newest, smartest, pace-setting rear fin on the market. Heavy chrome plated—3 sections extend to 27". 15-ft. lead with built-in signal booster.

**MODEL NO. TFL-1**

Also available as dummy mount.—Model TFD-1

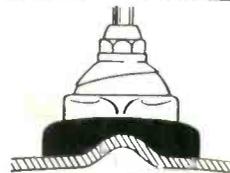
#### ... AND HERE'S MORE!

#### NEW FENDER PADS ... for 1957 cars

**Fender Pads—**  
For mounting 8-Ball mount antennas on front fenders of 1957 cars. C-61



**Fender Pads—**  
For mounting Tear Drop mounts on front fenders of 1957 cars. C-62



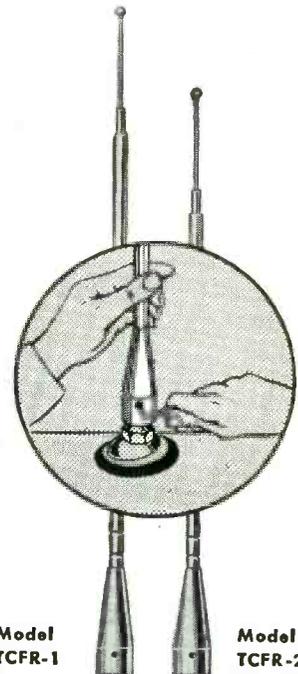
**Fast-Selling Ward**



#### TEAR DROP MOUNT

The fastest selling style leader of them all ... the replacement antenna with original equipment styling. Mounts completely outside the car ... easily ... quickly. Heavy chrome plate ... 3 sections extend from 22" to 56".

Just a few of Ward's new quality leaders that have joined the famous Ward family—8-Ball, Majorette, and Silveramic®. Order *TODAY*. For complete information, write: Dept. ETC-6



#### Smart NEW Replacement Masts

No need to disturb the mast. Just slip on and tighten. Easiest, quickest replacement ever developed. Bell-shaped collar on mast fastens to stub of original antenna mast with set screws.

# Ward PRODUCTS CORPORATION

DIVISION OF THE GABRIEL COMPANY

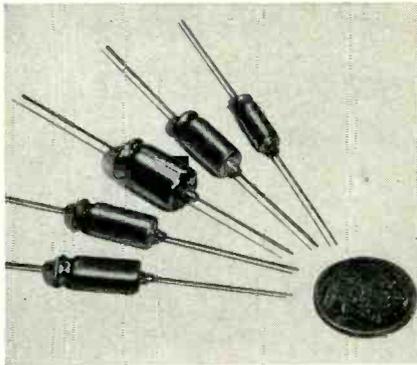
1148 EUCLID AVE. • CLEVELAND 15, OHIO

IN CANADA, ATLAS RADIO CORPORATION • 50 WINGOLD AVE. • TORONTO, ONTARIO

# New Products for Technicians

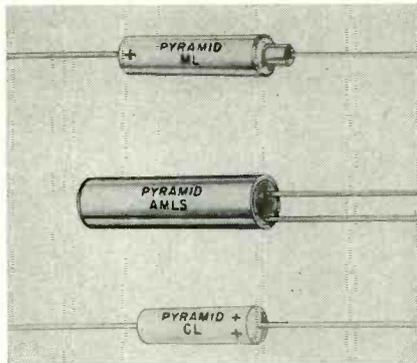
## Mallory CAPACITOR →

The TT series is a brand new line of low-cost subminiature aluminum-cased electrolytic capacitors. These tiny capacitors are ideal for replacement service in all miniature electronic equipment and are especially suited for transistor and battery-powered units. They are available in more than 30 capacity and voltage ratings. The smallest of the line measures only 3/16" x 1/2". They are designed to withstand temperatures from -20°C to 65°C. P. R. Mallory & Co. Inc., 3029 E. Washington St., Indianapolis 6, Ind. (ELECTRONIC TECHNICIAN 6-10)



## Pyramid CAPACITOR →

The new miniature capacitor, type ML is ideally suited for transistor radios, hearing aids, portable TV receivers and other applications where size requirements are an important factor. It is hermetically sealed in aluminum cans and is also available in a ceramic case. Its size depending upon capacity and voltage rating is 3/16" x 1/2" to 7/16" x 1 3/8". Working voltage ranges from 3 to 100 volts. Temperature range is from -20°C to 65°C. Pyramid Electric Co., 1445 Hudson Blvd., North Bergen, N.J. (ELECTRONIC TECHNICIAN 6-7)



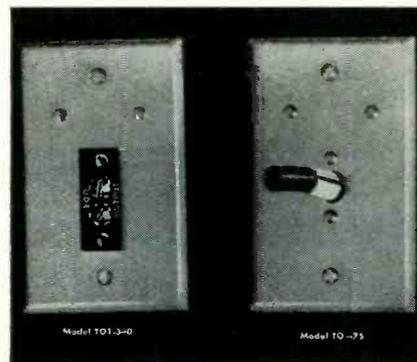
## Raypar VOLTAGE ADJUSTER →

A versatile, though economical, line voltage adjuster has been announced. The Model VR-10, compact autoformer unit has a four-step switch to provide 10% boost, 10% decrease, line straight through, and an off position. Designed for line regulation up to 300 watts. It connects up quickly by inserting it between the outlet and appliance to be operated. Operating the set at its rated voltage assures maximum efficiency and longer tube life. List price is \$6.75. Raypar Inc., 7800 W. Addison St., Chicago Ill. (ELECTRONIC TECHNICIAN 6-8)



## B-T TAP-OFFS →

A completely new series of single and double TV outlet boxes feature 17-db isolation plus effective strain relief for RG 11/U or RG 59/U "through cable". The 300-ohm outlet boxes, Models T01-300 and T02-300, are matched internally to the distribution cables. The T01 series is designed for recessed mounting. The T02 series (not shown) mounts externally. For color, b&w and FM reception. Net for the T01 is \$2.50, and for the T02 is \$5.00. Blonder-Tongue Labs, Inc. 9-25 Alling St., Newark 2, N.J. (ELECTRONIC TECHNICIAN 6-9)



## Microtran VOLTAGE ADJUSTER

The Model LVB-10 is an up-down line voltage adjuster with a rating of 250 watts, 100 to 130 volts at 50/60 cycles ac. A 4-position switch provides a 10-volt boost; 10-volt drop; straight through; and off position. It has an oven baked finish. This miniaturized unit has a size of 3" x 3" x 3" and weighs 2 lbs. List price is \$7.50. Microtran Co. Inc., Mineola Ave., Valley Stream, N.Y. (ELECTRONIC TECHNICIAN 6-13)

## Terado MOBILE CONVERTERS

The "Supreme" and "TV Special Chief" Models of Trav-Electric convert 12-volt storage battery power in car, truck or boat to 110-volt, 60-cycle ac at 175 to 200 watts, and 100 to 125 watts respectively. In addition to portable TV sets, the converters operate a great variety of do-it-yourself tools, dictating machines, tape recorders, public address systems, electric shavers, paint sprayers, car polish buffers, soldering irons, drills, etc., Terado Co., 1068 Raymond Ave., St. Paul 14, Minn. (ELECTRONIC TECHNICIAN 6-12)

## Brach ANTENNA

The new Model No. 5609 TV Compact is an indoor-hidaway antenna and features two 38-inch collapsible five-section elements, which pivot a full 360°. The case is made of hi-impact polystyrene plastic. Friction in each rod section is such that a 2 oz. force will not telescope or pivot the element. List price is \$9.95. Brach Mfg. Corp., 200 Central Ave., Newark 3, N.J. (ELECTRONIC TECHNICIAN 6-51)

## GE SILICON RECTIFIERS

Four new rectifiers, RETMA designated 1N115, 1N116, 1N117, and 1N118, are now in mass production. The rectifiers have peak inverse voltage ratings of 100, 200, 300 and 400 volts with maximum RMS voltage ratings of 70, 140, 210 and 280 volts respectively. They are designed for a maximum output of 600 ma at a case temperature of 150°C. At 85°C, the devices have a maximum allowable DC output current rating of 1.5 amperes. The maximum full cycle average full load voltage drop at 150°C is 0.65 volts while the maximum average leakage current at that temperature is 0.4 ma for the 1N115 and 0.3 ma for the other three rectifiers. They have a 10-32 stud for direct chassis mounting, are small enough to fit into a thimble, and are housed in a welded, all-metal case for maximum reliability. GE Semiconductor Products, Syracuse, N.Y. (ELECTRONIC TECHNICIAN 6-40)

**Electro**

ADVANCED DESIGN  
DC POWER SUPPLIES



Specially designed . . . not a conversion  
**IMPROVED D-612T**  
now better than ever . . .  
at same low cost!

\$44.95 net

LESS THAN **1/2%** RIPPLE  
(up to 5 Amperes)

DC POWER FOR . . .

- TRANSISTOR Portables
- TRANSISTOR Auto Radios
- TUBE Auto Sets

- Dual Range—0-8 and 0-16 V., continuously variable.
- 10 Amperes continuous duty up to 12 V.
- 20 Amperes intermittent service.

**NEW DUAL RANGE EFB . . .**

. . . for laboratory and design work on transistor circuits and electronic equipment.

1/10% ripple                      0-16 or 0-32 V.  
Carbon brush-type variable transformer for smooth voltage control.

**SEND TODAY FOR NEW BULLETINS**



CANADA: Atlas Radio Ltd., Toronto

**ELECTRO PRODUCTS LABORATORIES**

4501-T North Ravenswood Ave.  
Chicago 40, Illinois

7436

# the **BURGESS** 1957 Portable Radio

**BATTERY PROGRAM**

*STAY FRESH... LONGER!*



**WILL INCREASE YOUR SALES!**

Here's a four-barrelled portable battery promotion that's bound to boost your battery profits in 1957. Built around proved sales-getters, the Burgess program has everything . . . Be sure to see your Burgess distributor soon for complete details about this big new 1957 promotion.

**BURGESS BATTERIES FOR QUICK SALES—EXTRA PROFITS**



**NEW SALES STIMULATING PROMOTION IDEAS!**



A new dual-purpose wall chart or counter easel contains Portable Radio Picture Chart, Replacement Guide Index and Cross Reference Chart. Ask your jobber. It is **FREE!**

**POINT OF SALE MERCHANDISING AIDS THAT SELL BATTERIES**



Window card in full color at right is just like the one described above except it is not animated.

**IT'S ANIMATED!**  
New action display merchandiser at left has colorful animated action. Use in window or on counter. Will display assortment of most popular Burgess portable types or both batteries and a radio.



Full line wire rack at left accommodates complete inventory of radio batteries. Durable full-time salesman. Best merchandiser of all!

- BATTERY TESTERS
- OTHER MOTION DISPLAYS

**CONTACT YOUR BURGESS DISTRIBUTOR FOR DETAILS TODAY!**

**BURGESS Portable Radio BATTERIES**



**WINDOW STREAMER**

A big, bright full-color window banner that's double-designed to stop the customer and tie in with the other Burgess sales aids for maximum impact in the store. **FREE!**

**RETAIL PRICE CARD**  
Furnishes Burgess Portable battery numbers, voltages and up-to-date retail prices in "easy to select" form. **FREE!**



**REPLACEMENT BATTERY STICKER**

Provides ample space for replacement battery number and dealer imprint—a sure repeat business getter! **FREE!**



**BURGESS BATTERIES**  
BURGESS BATTERY COMPANY    FREEPORT, ILLINOIS

## Impedance Matching

(Continued from page 32)

In order to accomplish maximum undistorted power, it has been found that the load resistance for a triode should be twice the plate resistance and 1/10th the plate resistance of a pentode. If the dynamic transfer curves of an amplifier, having the plate and load resistance equal, were examined, it would be found to have excessive curvature resulting in

objectionable nonlinear distortion. Nonlinear distortion results in high harmonic distortion and unequal amplification.

At the expense of some loss in power, it is possible to compensate for the loss of both high and low frequency response. Let us consider a resistance-coupled network as shown in Fig. 3A. In Fig. 3B, the circuit is redrawn slightly.  $R_L$  is by-passed to ground through  $C_B$ , thus the entire a-c output across  $R_L$  is applied across  $C_c$  and  $R_g$ . No matter how small a reactance  $C_c$  has, it contributes to the overall load impedance. The useful output of  $V_1$  is delivered to the

grid of  $V_2$  from a point on the voltage-divider composed of  $C_c$  and  $R_g$ . This loss through  $C_c$  occurs at low frequencies.

In Fig. 3C, a bass-boosting circuit consisting of  $R$  and  $C$  helps compensate for low-frequency loss as follows: Capacitor  $C$  is quite large, so at frequencies above 100 cycles its reactance is low compared to  $R$ , virtually short-circuiting  $R$  above 100 cycles, leaving the load resistor  $R_L$  in the circuit which is effective for the middle and high frequencies. As the frequency decreases, the reactance of  $C$  increases, causing the total plate load impedance to increase, which in turn increases the gain at low frequencies.

There are basically two methods in common use to compensate for the loss of high-frequency response, namely shunt and series peaking. In Fig. 5,  $L_1$  is in series with the load resistor put parallel with the plate resistance. Since inductive reactance varies directly with frequency, the impedance of the load will be increased at higher frequencies thereby raising the gain as the frequency goes up. Fig. 5, shows a series peaking arrangement which also raises the gain of the higher frequencies.

As a matter of fact any circuit that tends to counteract the shunting effect on high frequencies by the stray capacitance of the tube and its associated wiring will improve the high-frequency response. In actual practice, it is not unusual to find both shunt and series compensating networks incorporated in a single stage.

Fig. 6 shows a combination of shunt peaking, series peaking and low-frequency boost, all combined as is often found in the TV video amplifier. Another interesting consideration is the natural resonant frequency of the peaking coil. If this resonant point falls within the range of frequencies handled, then the response curve will, instead of being as near flat as possible, show an excessive rise at one point. To overcome this reaction and to flatten out the curve, the  $Q$  of the circuit is purposely kept low by adding resistance to the circuit. A resonant hump in the curve may be detected on the TV screen as ringing.

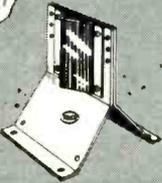
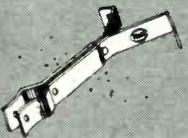
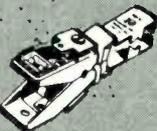
It is only fair to mention that this article has just about scratched the surface of impedance matching. Reactive loads, and at varying frequencies, set up all sorts of complex situations which not only affect the gain of the amplifier, but all sorts of phase shift and linearity situations present themselves. So if maximum power is obtained, it is indeed a very happy coincidence. •



# TELCO TV HARDWARE

with Di-Chromate Finish

**EVERYTHING YOU NEED... QUALITY MADE FOR PROFITABLE INSTALLATIONS!**

 <b>ROOF MOUNTS</b>	 <b>STANDOFFS</b>	 <b>ARRESTORS</b>	
 <b>TOWERS</b>	 <b>CHIMNEY MOUNTS</b>	 <b>LINE CLIPS</b>	 <b>WALL MOUNTS</b>
 <b>ALL ACCESSORIES</b>		<p><b>Di-Chromate Finish Prevents Roof Streaks</b></p> <p>All Telco TV Hardware is built and finished to last regardless of the rigors of weather, climate or usage. Quality features at a price that makes your TV installations profitable. Insist on TELCO for all your hardware needs.</p>	

**YOUR JOBBER HAS COMPLETE TELCO HARDWARE STOCKS... SEE HIM AND SAVE!**

## TELEVISION HARDWARE MFG. CO.

Division of G-C • Textron Inc.  
 400 South Wyman Street • Rockford, Illinois

## Service Business

(Continued from page 38)

good-sized TV jobs." Among the results of this mailing was the acquisition of a number of new customers. Some of the old customers had moved and the cards went to their old addresses, with the result that new occupants read the cards and service calls came in from brand-new customers. When she gets out a mailing like that one, Mrs. Phillips checks all the addresses with the city directory and the telephone directory, making any changes that are indicated and eliminating names of customers who apparently have moved away. Not all changes can be caught, however, and some cards obviously go to the wrong address.

The Phillipses feel some form of follow-up promotion is far more important than advertising for new customers. "I'm interested in getting quality customers rather than quantity," Mr. Phillips said. "If we keep the customers we have satisfied coming back to us, they are about all we can handle for the present. Most of our new customers come to us through recommendations from old customers, and that's the kind of customer we want to add." Even the records which comprise the customer list show which of the customers the company feels are "quality" customers. In mailings and follow-up phone calls, those customers the company does not want to encourage to return are not covered. "It's easy to tell which ones you want to keep," Mrs. Phillips said, "listing persons who shop for cheap prices and those who are never satisfied with any job as among the types which fail to get the quality classification."

For cash sales or small radio repairs, a company bill-head is used. In each case, the Phillipses make every effort to obtain correct names and addresses and telephone numbers. The file copy, which is a full record of the work done, is kept alphabetically by customer name. Mrs. Phillips determines whether or not there should be a telephone follow-up, and if so, she makes a notation on the filed copy of the service report form. Another form used lists all requests for outside service, giving details to the serviceman. A copy of each completed form is kept in an index file for quick reference in the advent of a callback.

One of the useful follow-up reminders used was a booklet, "Facts

About Television Service" prepared by General Electric, which tells in simple form some of the basic problems in television servicing. Copies of this booklet were mailed to television customers, with the shop's card tucked inside. For preparing postcard mailings or small handbills, a small mimeograph machine is used. Mrs. Phillips addresses postcards in longhand because she believes they are more personal and receive more attention than if typed.

The Phillipses operate the shop with the assistance of a part-time apprentice serviceman. About 60 per

cent of the work is TV and radio servicing and of that, three-fourths is TV. The other 40 per cent consists of servicing electronic equipment such as diathermy machines, tape recorders, water leak detectors, X-ray machines, electro-cardiograph machines, sterilizers, autoclaves, relays in power machinery controls, electronic counters and audiometers.

Shop equipment cost about \$2,500. Mr. Phillips also offers technical service to TV dealers and to other TV service organizations which may not be able to handle jobs which come in to them. •

# ADDS INCOME 2 WAYS

1. Tests and Repairs Picture Tubes
2. Makes New Tube Sales Easier



**CATHODE REJUVENATOR TESTER**

**CRT 400 PROVES REAL MONEY-MAKER**

*Here's what Joe Driscoll of TV Trouble Shooters, St. Paul, Minnesota says: "It has made more money for us than any other instruments, with the possible exception of tube checkers. We make an additional charge each time we use the instrument in the home to check or correct picture tube conditions. We have been able to convince customers much easier that their old tubes need replacing and have enjoyed a nice profitable business from the sale of new picture tubes without leaving any doubt whatever in the customer's mind that he needed a new tube."*

This is typical of the experience of thousands of servicemen using the CRT 400. It cuts service-operating costs... brings new profits... builds customer good-will... quickly pays for itself. Also saves money on TV set trade-in reconditioning. Has 4½-inch plastic meter. Easily portable. **NET \$54.95**

See Your Distributor today or Write for Bulletin No. 400-T

Makers of CRT, DYNA-QUIK, DYNA-SCAN and CALIBRATOR

**B & K MANUFACTURING CO.**  
3726 N. Southport Ave. • Chicago 13, Illinois



## News of the Industry

**MERIT COIL & TRANSFORMER CORP.** names FRED HOLLAND as its Sales Engineer.

**GENERAL CEMENT MFG. CO.** has appointed ARCHE T. HOYNE as Eastern Sales Manager and WILLIAM H. DEAN as West Coast Sales Manager.

**GENERAL TRANSISTOR DISTRIBUTING CORP.** announces the appointment of HARRY A. FRIEDMAN as Assistant Sales Manager.

**ALLEN B. DUMONT LABS.** launches a marketing program for TV line. The new industrial television systems will be sold nationally by independent local distributors in marketing areas from coast-to-coast.

**HEATH CO.** has started construction of its new 142,000 square foot plant located on a 16 acre tract in St. Joseph Michigan.

**P. R. MALLORY & CO.** has a new package design. The end tabs of the cartons will be printed in a different color value for each of the component lines in order to speed up stock picking and inventory checking.

**THORDARSON-MEISSNER** announces the appointment of HENRY H. TEPLITZ ADVTG. AGENCY, Chicago.

**WINEGARD COMPANY** will soon put on the market a new type outside TV antenna called the "Twilight."

**CHANNEL MASTER CORP.,** in association with the U. S. Air Force, has instituted a program to award recognition plaques for "outstanding service" to Ground Observer Corps posts.

**RADIO ELECTRONIC TV SCHOOLS** has appointed ROBERT G. MIDDLETON to the post of International Director of Technical Information.

**RAYTHEON MFG. CO.** has assigned the post of Retail Field Merchandiser for the Operations' Distributor Sales Department to ANTHONY P. RICCO, and ROBERT G. CALOGGERO has been appointed Staff Assistant in the Distributor Sales Department.

**INSULINE CORP. OF AMERICA** announces the appointment of JACK NIESE to Vice President in charge of product sales.

**PAUL JACKSON,** President of JACKSON ELECTRICAL INSTRUMENT CO. of Dayton died in that City on April 27th after an extended illness.

**GENERAL TRANSISTOR CORP.** announces that it will launch its new distributor sales program at the Electronic Parts Distributors exhibit in Chicago.

**JOHN F. RIDER** reports that text books published by his company, which formerly were used in vocational schools, technical institutes and adult divisions of colleges, are now making their entry into the field of academic school texts relating to the physical sciences.

## Representatives

**RYE SOUND CORP.** has appointed the following new reps: JACK FIELDS SALES CO. of Verona, N. J.; GEORGE A. ROSE, Brooklyn, N. Y.; ELECTRO-REP SALES, Rochester, CARMINE-PADEN ASSOC. of Mo. and FRED HAIGHT of Seattle.

**ALLEN B. DUMONT LABS.** has appointed DANIEL ECHO to the new post of assistant manager of Industrial Tube Sales.

**ART CERF & CO.,** mfrs. reps., have just installed a Pension and Insurance Plan for both office staff and outside fieldmen. . . . ART CERF has been appointed rep in Va., Md., Dela. and District of Columbia for MERIT COIL & TRANSFORMER CORP.

**A** *lways dependable...*

**B** *etter quality and design...*

**C-D**

**VIBRATORS**

*the complete line...*

*There is a CORRECT replacement C-D vibrator for every original installation...no guessing...no problems! And every C-D vibrator delivers longer service that is dependable...and quieter in operation! AND...the complete line of COMMUNICATION VIBRATORS answers every replacement problem in this important field!*

It's as basic as knowing your A B C D's... that C-D vibrators are your best buys year 'round... day in and day out! Look for the famous C-D seal... it is your guarantee of quality combined with skilled engineering and controlled manufacture!



**CORNELL-DUBILIER**

Plants in South Plainfield, N. J.; New Bedford, Worcester and Cambridge, Mass.; Providence and Hope Valley, R. I.; Indianapolis, Ind.; Sanford, Varina and Fuquay Springs, N. C.; and Venice, California. Subsidiary: The Radiart Corporation, Cleveland, Ohio.



**J. Y. SCHOONMAKER CO.** of Dallas has been appointed sales reps in Texas, Ark., La. and Okla. for **CLEVITE TRANSISTOR PRODS.**

**SAM KARNS CO.** has changed its name to **LINCOLN SALES CO.** with offices at one Fisher Dr., Mt. Vernon, N. Y.

## Catalog & Bulletins

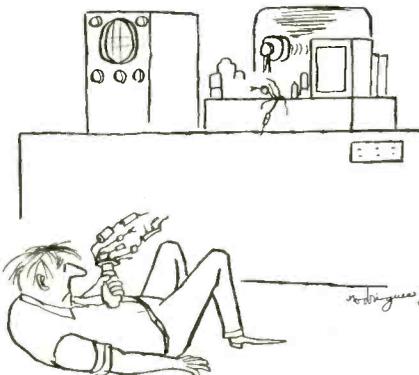
**ELECTRONIC PARTS:** Catalog containing 224 pages listing components, equipment and other electronic products for industrial and service use. Available from branch offices and Warren Radio Co., 1002 Adams, Toledo, Ohio. (ELECTRONIC TECHNICIAN No. B6-1)

**RESISTORS:** Comprehensive data on construction, types, winding technique, characteristics, etc. of precision wire wound resistors. Detailed charts and graphs—4 pages. Bulletin D-1b available from International Resistance Co., 401 N. Broad St., Philadelphia 8, Penna. (ELECTRONIC TECHNICIAN No. B6-2)

**TWO-WAY RADIO:** Bulletin ECR-458 describes "building block" design of two-way radio, explaining how components may be interchanged between station and mobile combinations to assure flexibility. 80 pages. Available by writing to General Electric, Communication Products Dept., Syracuse, N. Y. (ELECTRONIC TECHNICIAN No. B6-3)

**ENVELOPE STUFFER:** An envelope stuffer measuring 3¼" x 5¾" in the shape of Model 8100K soldering kit and listing the manufacturers full line of professional model soldering guns plus prices available from Joseph F. Whitaker, Weller Electric Corp., Easton, Penna. (ELECTRONIC TECHNICIAN No. B6-4)

**CERAMIC CAPACITORS:** Six-page catalog describing complete line of ceramic capacitors. Disk, tubular and plate types are illustrated with charts and diagrams. Skottie Electronics, Inc., Peckville, Penna. (ELECTRONIC TECHNICIAN No. B6-5)



**MICROPHONES:** "The ABC's of Microphones" is a 22-page well illustrated catalog describing the basic types of microphones and tells how to select the right microphone for specific applications. Electro-Voice, Inc., Buchanan, Michigan. (ELECTRONIC TECHNICIAN No. B6-6)

**KITS:** 1957 Spring Flyer illustrates and describes latest line of kits, covering Hi-Fi speaker system kits, etched-circuit VTVM kits, signal generator kits, etc. Prices and order blanks enclosed. Heath Co., 305 Territorial Rd., Benton Harbor, Mich. (ELECTRONIC TECHNICIAN No. B6-7)

**PHONO NEEDLES:** Large, colorful "Needle Wall Chart for 1957" is a guide to Hi-Fi needles. Also a 17-page catalog with needles well illustrated and information easy to find. Forms J 100 and J 92 respectively. Jensen Industries Inc., 7333 W. Harrison St., Forest Park, Ill. (ELECTRONIC TECHNICIAN No. B6-9)

**PHONO NEEDLE:** Simplified cross reference folder. Contains illustrations, prices and different manufacturer's numbers to facilitate needle selection. Recoton Corp., 52-35 Barnett Ave., Long Island City, N. Y. (ELECTRONIC TECHNICIAN No. B6-10)



## Sell More Antenna Replacements with the new **CHANNEL MASTER®** **TV Antenna Check-Up Kit**

Who says antenna sales must slow down during the Spring and Summer months? Channel Master offers you a **brand new concept in antenna merchandising** that's sure to perk up your antenna business. It's the nationally advertised "TV Antenna Check-Up Kit" — designed to **build store traffic** for you by making present TV owners aware of their faulty antenna installations.

**CALL YOUR CHANNEL MASTER DISTRIBUTOR NOW! He also has Posters, Streamers, and Newspaper Mats to help you merchandise the "TV Antenna Check-Up Kit."**

**This 3-piece consumer literature kit includes:**

- 16-page illustrated booklet "Better Pictures On Your TV Set"
  - 10-point check-up folder "Spotting Antenna Trouble"
  - Literature about the TW Antenna
- Use these kits as free giveaways or mailing pieces to build store traffic.

**Tie-In with Channel Master's High-Powered National Advertising in America's Leading Magazines**



**CHANNEL MASTER CORP.** ELLENVILLE, NEW YORK

Copyright 1957 Channel Master Corp. ® Reg. U.S. Pat. Office and Canada

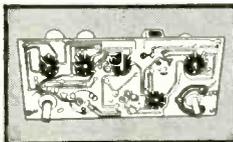
# MORE ACTIVE! EFFECTIVE!



## KESTER "RESIN-FIVE" CORE SOLDER

**THE BEST FOR TV-RADIO WORK . . .  
EVERYTHING ELECTRICAL**—Kester "Resin-Five"  
Core Solder is better and faster than any solder ever  
developed. It has an activated flux-core that does a perfect job on  
all metals including zinc and nickel-plate. The flux residue  
is absolutely non-corrosive and non-conductive.

Available in all practical Tin-Lead  
Alloys; 40/60, 50/50 and 60/40 in  
diameters of  $\frac{3}{32}$ ",  $\frac{1}{16}$ ",  $\frac{3}{64}$ ",  $\frac{1}{32}$ " and  
others.



Printed Circuit Soldering  
On Copper-etched boards  
use 60% Tin-40% Lead  
Alloy . . . for those that  
are Silver-surfaced use  
3% Silver-61½% Tin-  
35½% Lead

## KESTER SOLDER COMPANY

4264 Wrightwood Avenue, Chicago 39, Illinois • Newark 5, New Jersey, Brantford, Canada

## New Books

**TV—IT'S A CINCH.** By E. Aisberg. Pub-  
lished by Gernsback Library Inc., 154  
W. 14th St., New York 11, N.Y. 224  
pages. Paper cover, \$2.90. Hard cover,  
\$4.60.

A unique new book which covers TV  
from the transmitting studio to receiver  
picture tube in breezy dialogue form.  
It is illustrated with hundreds of amus-  
ing but informative sketches.

**DAVE RICE'S PRICING DIGEST.** Prepared  
and published by Electronic Publish-  
ing Co., 180 N. Wacker Drive, Chicago  
6, Ill. 248 pages. Paper cover. \$2.50.

New Spring and Summer 1957 edition  
features a comprehensive guide, con-  
taining suggested list or resale prices  
of over 65,000 items, and a guide to TV-  
radio service charges. Since many  
manufacturers revise their price sched-  
ules in the early months of each new  
year, there have been price changes in  
over one-third of the items listed since  
the last edition. Several thousand new  
items are included.

**OFFICIAL REGISTRY OF RADIO SYSTEMS IN  
THE INDUSTRIAL SERVICES.** Copyright 1957  
by Communication Engineering Book  
Co. Published by Milton B. Sleeper  
Publisher. Radio Hill, Monterey, Mass.  
152 pages. Paper cover. \$5.00.

Revised and brought up-to-date an-  
nually from official license files at  
Washington, D.C. by permission of the  
Federal Communication Commission,  
this edition lists systems in the follow-  
ing services: Low Power Industrial;  
Special Industrial; Forest Products;  
Power Utility; Petroleum and Gas;  
Relay Press; Motion Picture; and VHF  
Maritime. Listings by licensees and by  
frequencies make this book a handy  
quick-reference guide. Listing by  
names of licensees shows: name and  
address of licensee; location of each  
fixed transmitter; number of mobile  
and portable units authorized; operat-  
ing frequencies of fixed, mobile and  
portable transmitters, including relay,  
operational and control transmitters,  
call letters; and make of equipment  
used.

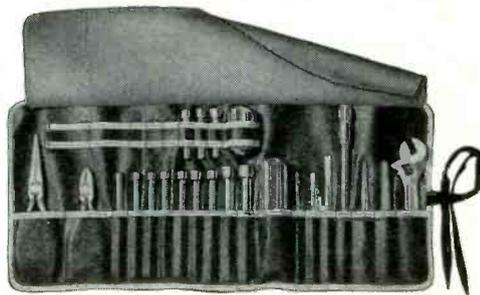
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By B. R. Bettridge. Published by  
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## Association News

### CETA Elects

The N. Y. Regional Chapter of the Certified Electronic Technicians Assoc. an alumni group of the RETMA advanced TV course given at the N. Y. Trade School, has elected the following officers: Pres. Robert Cornell, Technical Editor of *ELECTRONIC TECHNICIAN*; VP Nick Colon; Secy. Al Schabhttl; Treas. Fred Saron; Sgt. at Arms Harry Corsa. The executive board consists of George Clark, Arnold Freedman, Art Gottlieb, John Hendricks and Ed Tilin.

### NATESA Directors Meet

The Board of Directors of the National Alliance of TV & Electronic Service Association declared their April 28 meeting in New Orleans a huge success. Included among the many subjects on the agenda were the formation of a licensing committee to prepare a brochure on the subject, and the introduction of a national promotion plan through magazines, phone directories and other media.

### New ESA Officers

The Electronic Service Assoc. of Detroit, Mich., has elected the following officers: Pres. Joseph Rosson; VP Arthur Shaul; Treas. Edward Kahn; Recording Secy. Dale Broch; Corresponding Secy. Howard Larsen; Sgt. at Arms William Hanson.

### IESA Elects

George Roberts has been elected President of the Indiana Electronic Service Assoc. Other officers are: Vice-Chairman Harold Crume; Secy.-Treas. Edward Carroll.

### MINTSE Annual Meet

The Minnesota TV Service Engineers held their annual meeting at the Univ. of Minn., May 6-8 for service managers, and May 27-28 for clerks and assistants. Tentative program at press time covered cost accounting, labor relations, credit, law, safety and business practices. Also covered were merchandising, office procedures, telephone techniques and customer relations.

### Calif. Prexy Council

The President's Council of the Los Angeles area TV & radio service

technician associations, informally formed four years ago, plans to draw up a formal charter combining all 10 local associations. The 10 member groups would support the area organization, which in turn would support the state CSEA.

### IRTSA Officers

Indianhead Radio-TV Servicemen's Assoc., Wis., now affiliated with NATESA, has elected: Pres. Everett Siemond; V. P. Clyde Struve; Secy. Richard Presnell; Treas. Vernon Meindel.



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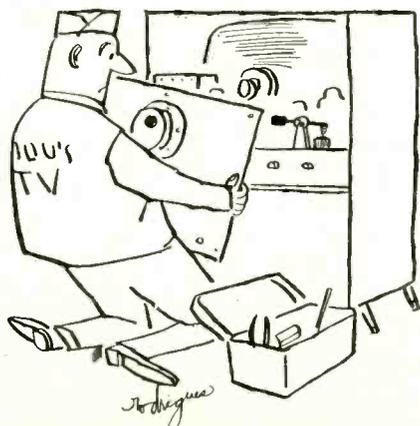
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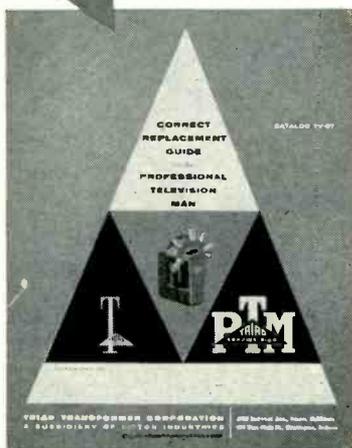
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## Air Conditioners

(Continued from page 33)

the house-branch circuit used for the air conditioner; faulty or inadequate wiring, poor connections or long extension wires, especially of small diameter, may introduce enough resistance to cause a large voltage drop; etc. Use No. 14 or No. 12 gage wire.

### The Compressor

The heart of the air conditioner is the compressor. While we don't have to concern ourselves with hardening of the arteries, except perhaps for the man who has to pull the unit, we are concerned with the pressures that exist within the cooling system. Excessive friction due to worn bearings and unusual loads are mechanical causes of failure. Shorted or open windings and associated electrical components require the need for a suitable ohmmeter. As in many other types of power equipment, neglected faults in one section will cause damage in others. It is wise to perform repairs at the first sign of trouble. Preventative maintenance is still the first line of defense. Excessive heat and friction may cause insulation breakdown and wear necessitating major replacements.

Associated circuitry and components are not to be overlooked, particularly the capacitors. Many a stuck compressor turned out to be nothing more than an open start capacitor. The symptoms are the same. When current is applied, the compressor hums and does not rotate. The motor terminal posts are conveniently marked "C" for common, "R" or "M" for run or main winding and "S" for start winding. The motor windings have low resistances, approximately 7 ohms for the start winding and 2 ohms for the main winding.

The capacitor can likewise be checked with an ohmmeter. A jumper wire can be used to localize some defective components. The thermostat coil, relay coil, their contacts, and start capacitor may be shorted out temporarily. Caution should be exercised; bridge components just long enough to observe the effects of this test on operation.

### Thermostat

The thermostat shuts the compressor off when it is satisfied. This should occur when the air condi-

tioner has caused the room temperature to coincide with the thermostat setting.

If the room is poorly insulated and many heat leaks are present, the room temperature will rise rapidly and cause the unit to go on again in a very short time. An often overlooked thermostat operating characteristic is the range of temperatures required to open and close the contacts. The narrower the range, the shorter will be the cycle. In the absence of a differential, the contacts would open and close the instant temperatures varied only slightly from the desired setting. If a mean heat level of 75° were desired and if the thermostat had a differential of 6°, then the air conditioner would shut off at 72° and remain off until the thermometer climbed to 78°. The differential settings may be checked by holding a thermometer in the inside-air stream and observing the action of the thermostat. Alternately opening and closing doors and windows will speed up test procedure. •

## Tough Dogs

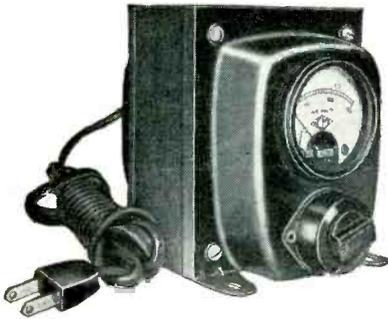
(Continued from page 29)

test points checked out. Thus ending this approach. The scope was next brought into play. Drive to the 12CU6 was adequate and all synchro-guide waveforms were reasonable correct.

Another glance at the diagram prompted the next step. The capacitor in series with the horizontal yoke winding was replaced. The theory behind this was that if it were leaky, dc would flow through the yoke winding and cause the displacement as well as the narrow raster. Still no luck. The job was rapidly developing into a hit or miss yoke or flyback replacement proposition. While in a deep huddle with the diagram, the break finally came. It was noticed earlier that a 1,000 ohm resistor, R<sub>1</sub>, in the proximity of the 12CU6 was somewhat discolored. However, there was only a 5-volt d-c drop across it and since it didn't seem to tie in with the horizontal circuitry, no connection with the difficulty was made, at the time.

The aforementioned huddle indicated a possible connection. The resistor was employed to drop the 255-volt B+ to a 250-volt buss. In so far as both voltages were normal, was it possible that an a-c component was also present? The B+ line is also connected to the plate of the

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damper. Anxiously I placed the scope probe on the plate of the damper tube. There it was, a nice fat 220-volt peak-to-peak pulse. This pulse not only was causing  $R_1$  to overheat, it was being applied to the cathode of the CRT. It didn't take long to find and replace the open 200  $\mu$ f, C<sub>1</sub>, B+ filter capacitor.

What was thought to be a narrow raster was in fact a partially blanked screen. If the pulse were sharpened and applied to the kine grid it would have provided excellent horizontal retrace blanking.—*Alfred Consiglio, The Bronx, N.Y.*

## Record Changer

(Continued from page 28)

is pushed against the hub gear by the trip lever and the power in the turntable drives the gear assembly through the cycle. During the cycle the pawl is reset, and the hub and gear become disengaged when the mutilated or cut away portion is reached. Failure to reset the pawl will result in continuous cycling. Congealed lubricant and dirt will often cause the pawl to bind. Even slight restriction of movement will cause intermittent difficulties including failure to change records.

Most changers have a provision to shut down after the last record has been played. The record support assembly, Fig. 6, on some units actuate a lever when it moves down far enough. If this lever is bent or distorted, shut off may occur prematurely or not at all. The customer should be instructed to lift the lever from the rear rather than from the front part near the spindle and under no circumstances to use force. Another type uses a semaphore arrangement, as in Fig. 7, to signal not only the size of the record to be played, but also the absence of any more records sitting on the spindle. Still another type of signaling device depends on the weight of a record to prevent final shutoff.

Just as there is no hesitation on the part of the experienced TV technician to use schematics, so should the phono repair man avail himself of the manufacturer's literature. Typical faults and their cures are described and in most cases include a complete parts list. •

### ILLUSTRATION CREDITS:

Garrard Figs. 1, 8; Motorola Figs. 2, 5; Philco Figs. 3, 4; V-M Fig. 6; Webster-Chicago Fig. 7; Collaro Fig. 9.

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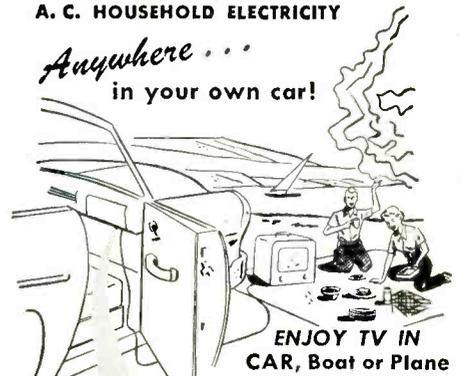
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## Labor Relations

(Continued from page 40)

3. A system of warnings proved fruitless. The employees were told unmistakably and positively that 12 latenesses in a year would be cause for dismissal. They were told to check with their supervisors to find out how their lateness records stood. They were told to keep a record themselves for their own protection. Considering all this, "12 latenesses and out you go!" is reasonable.
4. Workers were told that anyone arriving after 8: A.M. would be given a tardy mark. One minute past eight is as truly late as fifteen minutes past eight.

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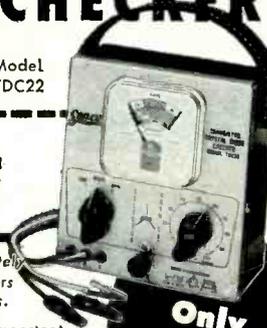
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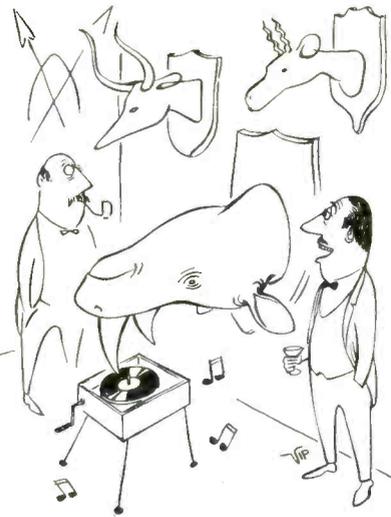
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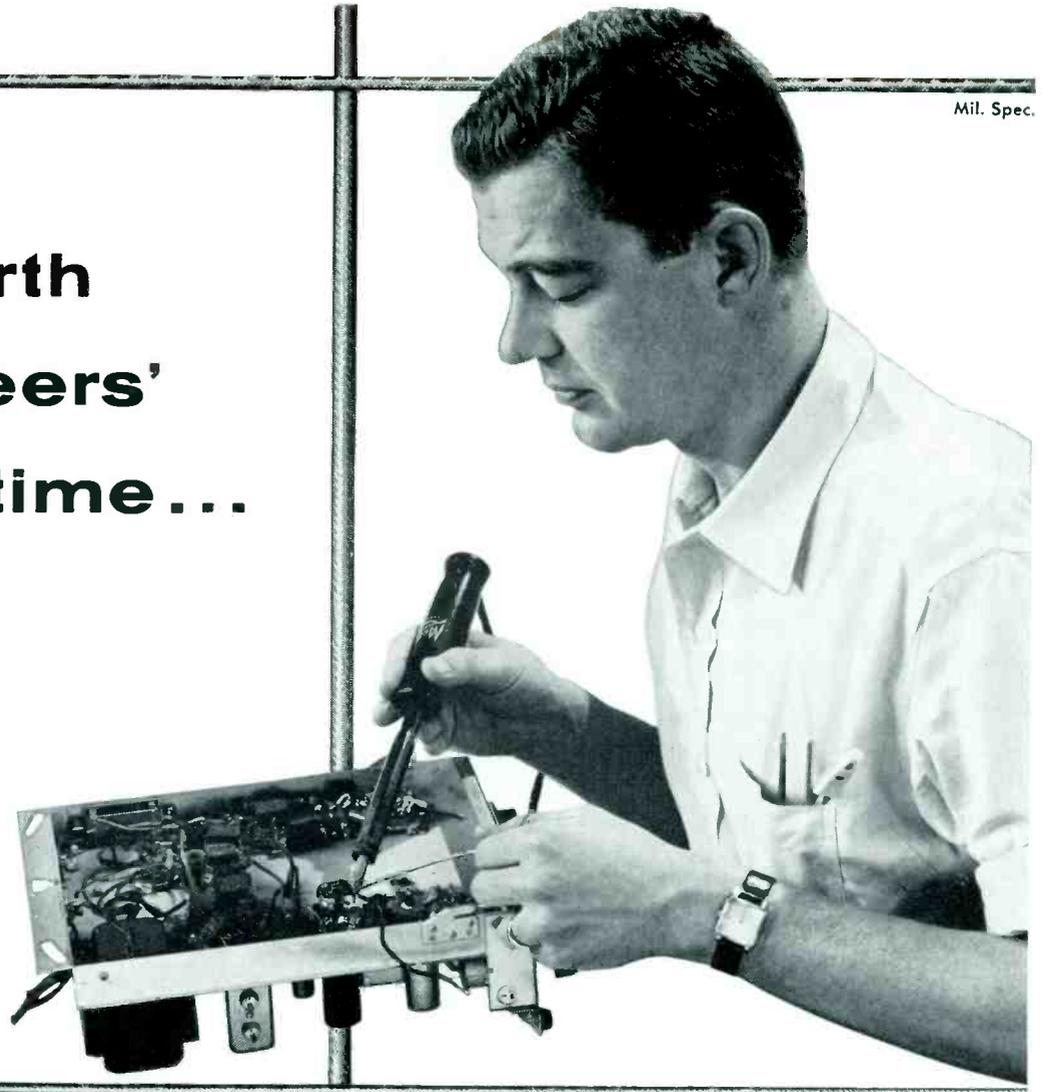
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