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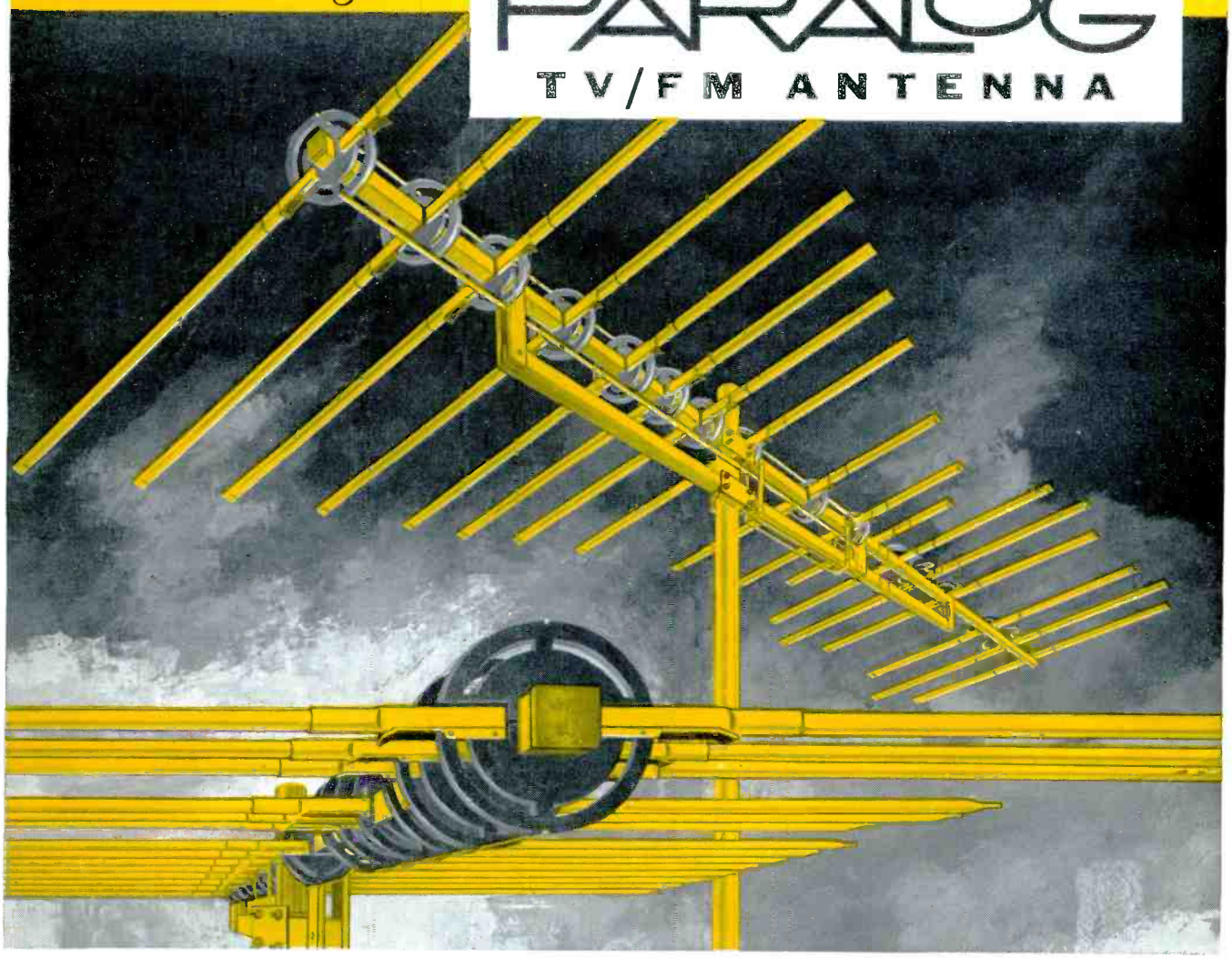

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FLOOR PLANS FOR SERVICE SHOPS

Time and step-saving arrangements for one-man businesses as well as large specialty firms.—by Patrick M. Craney

Radio and television service shops are found in a wide variety of shapes, sizes, and layouts. Many are located in small, crowded rooms while others occupy large, spacious quarters with plenty of working and storage room.

Although available space is inevitably the limiting factor in planning a shop layout, individual taste is important. The serviceman's dream shop often exceeds practicality; after all, what serviceman wouldn't like to have all the space he needs for his benches, test equipment, and parts storage, or a well-planned showroom for maximum sales appeal? Few technicians work best in a dirty shop; and it takes proper storage facilities to help keep the place neat.

When a customer walks in, he very often appraises your work by how your shop looks. If it is crowded, dirty, and dreary looking, chances are he'll make some excuse and walk out.

Occasionally, a customer will frequent a run-down dirty shop expecting the prices to be lower. Lack of pride eventually brings about poor workmanship, loss of business, and then price cutting. This "bargain" will attract only people who can't afford quality, guaranteed work. However, if a technician has any pride in his work, he'll make the best of what he has.

On Cleanliness

This is not to say that all dirty shops are run down or show a lack of quality. Many shops in old buildings with cracking walls develop a reputation for good work and competitive prices. However, if a customer realizes you have a neat shop—even though it is located in an old building—he will then have to pass judgment only on your service.

There is little excuse for a dirty shop; but some are undermanned and the owner will not take time to clean them up. Perhaps they *are* too busy making money, as they often say, but I wonder how much more they might make if facilities were clean and efficient.

Customers who see the shop for the first time are mildly shocked when they enter the premises. There is a film of dust on all the radios and TV's on the showroom floor; the floor and windows are dirty, and cartons and chassis are strewn around the showroom floor. In fact, the whole working area is very messy. The customer then wonders what the inside of his TV set looks like. Naturally, this probably has nothing to do with how the set works, but just try to convince a customer of that!

Shop Requirements

As stated earlier, space is prerequisite to planning your shop. However, what you would like to do with available space, and what you can do, may be two different things. Depending on whether you are alone, or have several technicians, you may have to make the available space suffice.

Perhaps you want drive-in facilities, but find you can't have them and still have all the bench space you need. Or perhaps you desire a special room for demonstrating color TV or stereo equipment; this undoubtedly would aid sales, but is sometimes impractical. You will have to decide how your space can best be used.

Benches

First of all, you're a serviceman; you need a workbench. You can do without fancy showrooms if need be, but you do need a working space. Your bench is primarily a table with extra facilities—like drawers or shelves to provide storage for parts and test equipment. You could work on a flat table, but it would prove ineffective. Since this is where you will be spending a lot of your time, it should be made as comfortable and convenient as possible. In a busy shop, time wasted walking around hunting test equipment and parts is money lost.

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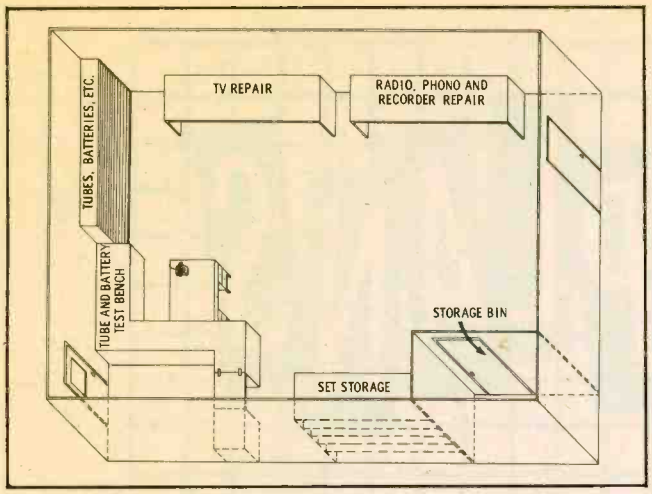


Fig. 1. A home-operated workshop can be converted from almost any spare room into a very attractive and efficient service center.

Consider benches like those shown in Fig. 1, for instance—just tables for conveniently working on sets. Nothing fancy at all. Consider, though, what it will be like to have several pieces of test equipment on that table. Assume you have a VTVM, scope, and signal generator on the bench, plus the usual number of small tools. What happens when you want to put a 23″ table model TV set on the bench? "Just move a couple of things around," you say? Fine! But what if you want to put another set on the bench too? You either stack the test equipment or build a bigger bench. And again there is the problem of available space.

Space need be no problem if you lay out your bench wisely. Fig. 2 illustrates what can be done to arrange test equipment and parts for time-saving convenience. Notice that this bench has shelves for signal, sweep, and color generators, VTVM, scope, and a reference book or two. All this equipment is up off the bench, but within easy reach.

Notice also that the bench has a stool, a telephone, and small parts drawers. The fact that the serviceman can sit down to work can increase his output considerably. This makes money and helps keep employees—and customers. Also, there is no need to keep jumping up and down to reach parts and tools. Everything is handy to service the run-of-the-mill set: test equipment, test CRT's, substitute speaker board (behind phone); and resistor, capacitor, and coil drawers. Replacement tubes are within arm's reach; tools and other parts are kept in the drawers at each side of the bench.

Fig. 2. A well-planned workbench will increase overall efficiency.

Thus, a serviceman must have his workbench, even if he has little else. His hours spent there should be money-making hours. Make this portion of your shop convenient and comfortable.

Storage

Perhaps the second most important requirement of a service shop is storage space. It is very confusing if finished sets are mixed in with those waiting to be fixed. It is also very time-wasting to have parts in boxes strewn all over the shop. Where do you look if you want to find something?

There should be at least two places to store radios and television sets—one for those to be repaired, and one for those already completed. It is best to locate the "completed" rack close to the counter so there is little delay in finding the customer's set when he comes for it. TV sets that are to be picked up are usually located near the door where they can be loaded easily.

Looking back at the floor plan in Fig. 1, notice that storage space is provided for small parts (tubes, batteries, etc.), large parts (storage room), and sets. Since tubes and batteries are sold over the counter and through service, they are located between the counter and the service bench. Likewise, storage shelves should be convenient to the counter, back door, and bench.

Another storage need is for replacement picture tubes, speakers, transformers, and other large units that have to be kept on hand, but not necessarily in the immediate bench area. Therefore, this area is usually located at the rear of the shop—sometimes even in the basement, if there is one.

Sales Area

For the shop seriously interested in sales, it is an unwritten rule to provide a showfloor through which the customer must pass to get to the business area—generally the service counter. This sales area should be arranged with an attractive variety of TV sets, radios, and similar equipment.

Cramming too many sets into a given space detracts from the overall appearance, and actually discourages some sales. Of course, getting a lot of sets on the floor does give the customer a wider choice, but most customers like to look at the sides and back too; and this can't be done on a crowded showroom floor.

Thus, it is wise to plan your showroom floor layout carefully. Set sales can be an important factor in retaining business in certain localities. If your shop has a lot of walk-in business, a well kept showroom with an eye-appealing layout will naturally invite inspection by your customers. Try keeping one or two sets playing so the customer can witness the quality of picture and sound. It is often wise to provide space for radios on one section of the floor, TV sets in another location, and phonographs and recorders in still another.

The floor plan in Fig. 3 includes a salesroom area. Notice the entrance is situated on the side of the showroom farthest from the desk and TV bench where a technician will most likely be working. A customer entering the shop will have to walk across the salesroom, and past the sets on display, to reach the technician. The radio display has been located along the wall nearest the desk where business is transacted.

With a pleasant showroom to browse in, many customers actually welcome the opportunity to wait a

few minutes for service. They will check your display, pick up some literature, watch the TV pictures, and listen to the sound quality from one of your better radios. When the customer decides to purchase a new set, you stand an excellent chance of getting his business —and without need for pressure tactics, either!

The effect of the "long" showroom is enhanced if someone starts toward the door to meet customers as they enter. However, if the customer indicates by word or action that he just wants to look, leave him alone. Utilize the advantage of having a showroom by using it properly.

Office Facilities

Even the smallest shop will need a telephone and must keep some sort of records. This business area can be the corner of your workbench, or a separate room complete with secretary and detailed filing system. Although office space is not so important a consideration as working and storage area, without at least a desk and filing cabinet you will find yourself steeped in a confusing pile of papers, call reports, job tickets, sales literature, and warranty cards. Once this pile gets started, it is a monumental task to straighten out.

With an office area visible, customers will automatically walk to it upon entering the shop, for it is a kind of common denominator between customer and technician. If the technician can't come to the counter or desk at that moment, the customer will generally wait.

Miscellaneous Considerations

There are perhaps two other facilities that can be included in shop layouts; restroom and drive-in space.

Restroom facilities depend on the number of employees. The restroom is usually located at the rear of the shop, out of sight. It should be neat, clean, well ventilated, and comfortably heated.

As far as drive-in facilities go, many shops don't feel any need for them. However, almost every car on the road now has a radio, which must be serviced periodically. Also, there is the ever growing number of Citizens band and commercial two-way radios in cars. These radios eventually will end up for service in the hands of the competent electronics technician.

Plan ahead for mobile radios—and even the coming trend towards rear-seat TV sets. The wise technician will provide facilities for drive-in business. In the summer months, this work can be done easily outdoors unless it's raining. But, in winter, outdoor weather makes for uncomfortable work.

The ideal solution is an attached, heated garage, something like that in Fig. 4. This one is designed as a drive-through, which enables a production-line movement through the garage to facilitate handling more cars in a given period. This design also helps prevent problems caused by autos backing out of the garage into a street, alley, or parking area. Such a garage can be equipped with automatic door lifts and heater blowers. Thus, when a car pulls in or out, the doors can be lowered quickly and the blowers will prevent a widely fluctuating temperature.

You might not need a garage on the basis of your present business alone, but consider what business you could develop. A few years from now, there will be more and more personal two-way sets and rear-set TV's. The sophisticated customer will select a shop to handle not only his TV work, but his auto radio and two-way work as well.

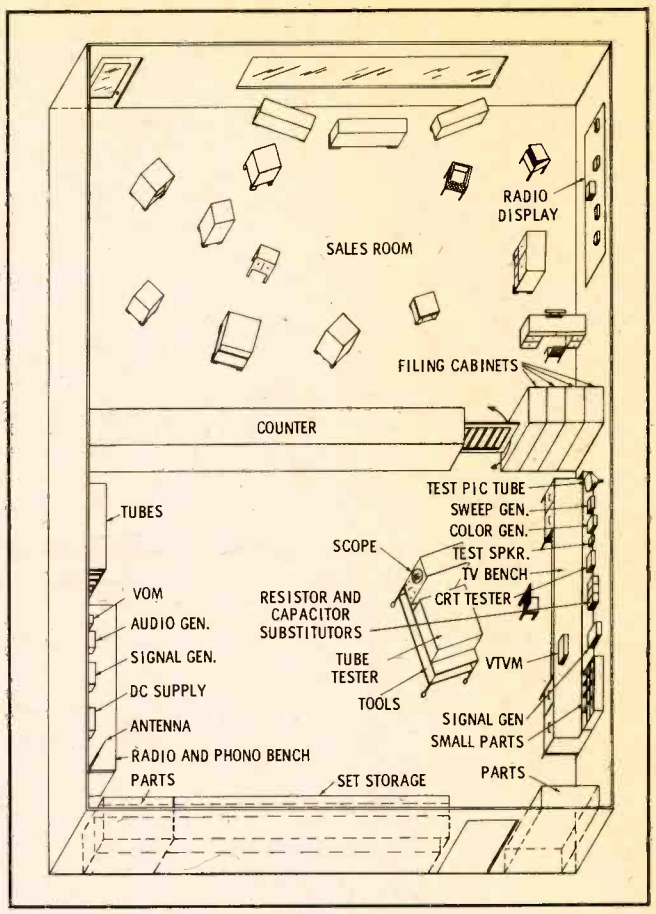


Fig. 3. A well-planned shop with separate sales and service areas.

A well-planned garage doesn't *have* to offer drive-through facilities; one door will suffice. However, your garage must be big enough to accommodate a car, the customer, yourself, and a few tools and test instruments. There should also be an easy access to the service area, and a window or two. You will find the garage retains heat better if you use a low ceiling and door—unless you handle trucks.

Floor Plans

Actual floor plans depend upon the whims and desires of the technician, and the space available. Some shops are quite elaborate and show much attention to detail, while others are thrown together in a haphazard manner. Small shops are usually laid out more neatly than large ones, because space must be conserved.

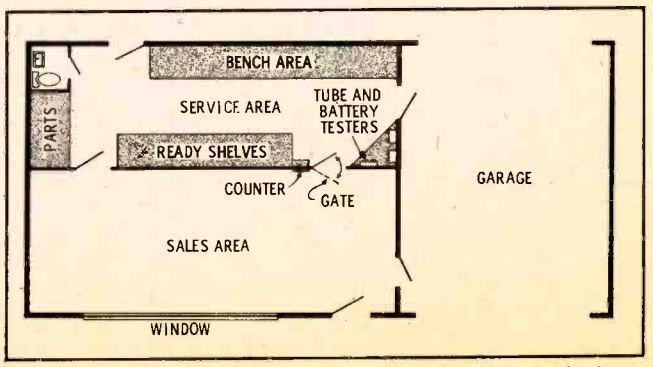


Fig. 4. A one or two man shop complete with drive-in facilities.

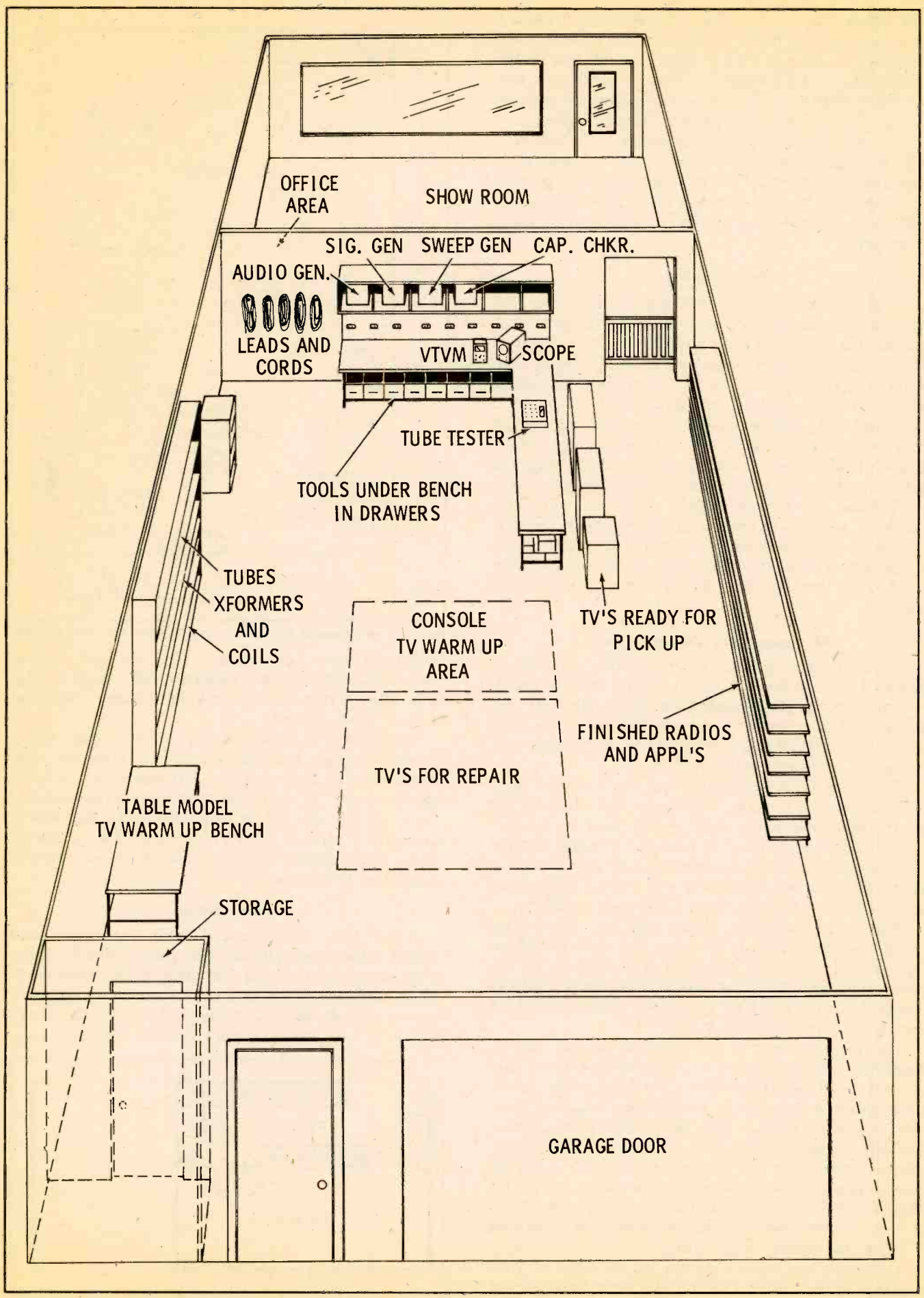


Fig. 5. A compact two-man shop featuring a large, efficient main work bench, an auxiliary bench, and plenty of storage.

A Home Workshop

Fig. 1 indicates that, if very little space is wasted, you can put a shop in a room only 12′ by 16′. This layout could fit into a single room in the technician's home.

The facilities are convenient and proportioned to fit the needs of a one-man shop. There is an air of business about the place, and not the fly-by-night atmosphere that is found to exist in some home-operated shops. The storage space and shelves are just deep enough for one TV, or maybe two table-model radios. The counter is only 18″ wide, and the benches are just over 24″ from front to back.

A small shop such as this can easily be kept clean and attractive. Although the tendency is to throw all junk in the storage bin, it soon becomes as full as Fibber McGee's closet. Therefore, there should be a place for everything, and everything should be in its place; "junk" should be eliminated.

Small Drive-In Shop

Fig. 4 shows what can be done with a small building to provide all the features of a sales and service shop, and also take care of drive-in customers. The garage area can be constructed or remodeled to suit your particular needs and desires.

It is well to provide access to the garage from both the service and sales areas. You probably don't want the customer to follow you into the service area and peer over your shoulder while you work. (What if he touches the high-voltage lead of a cooking TV set? If he does, you'd better have insurance.) Hang a sign, or otherwise indicate to the customer that he is to wait in the sales area. Provide chairs or stools so he can see into the area where you are working. This is psychologically necessary, as most customers don't like to be left alone while you disappear into the mysterious interior of your shop to do heaven-knows-what to their set.

Notice that tube and battery testers are located where the customer can readily observe them. He likes to *see* the needle indicate whether he needs a new tube. Some shops have a simple emission checker on the counter so the customer can check tubes himself. Needless to say, this pleases both customer and technician—the customer has no doubts, and the technician is relieved of a time-consuming task.

The parts shelves are on one wall of this shop, away from customers. Sticky-fingered people are few and far between, but it is wise to make your parts as inaccessible as you can, thus removing temptation.

If there is little for the waiting customer to do, provide him with a few magazines or some sales literature. Make his stay as comfortable as possible, and he'll return whenever he has service problems.

The "ready" shelves are convenient to the customer. By placing them in this location, you don't have to make the customer wait while you "go" get his set. He will also have a shorter distance to walk to the front door, since it is directly in front of the counter and gate.

Two-Man Shop

Fig. 5 depicts a shop built to accommodate one bench technician and one outside technician. This layout has a drive-in feature meant primarily for loading and unloading the service truck. You may wonder why the drive-in area is in the center of the workshop itself.

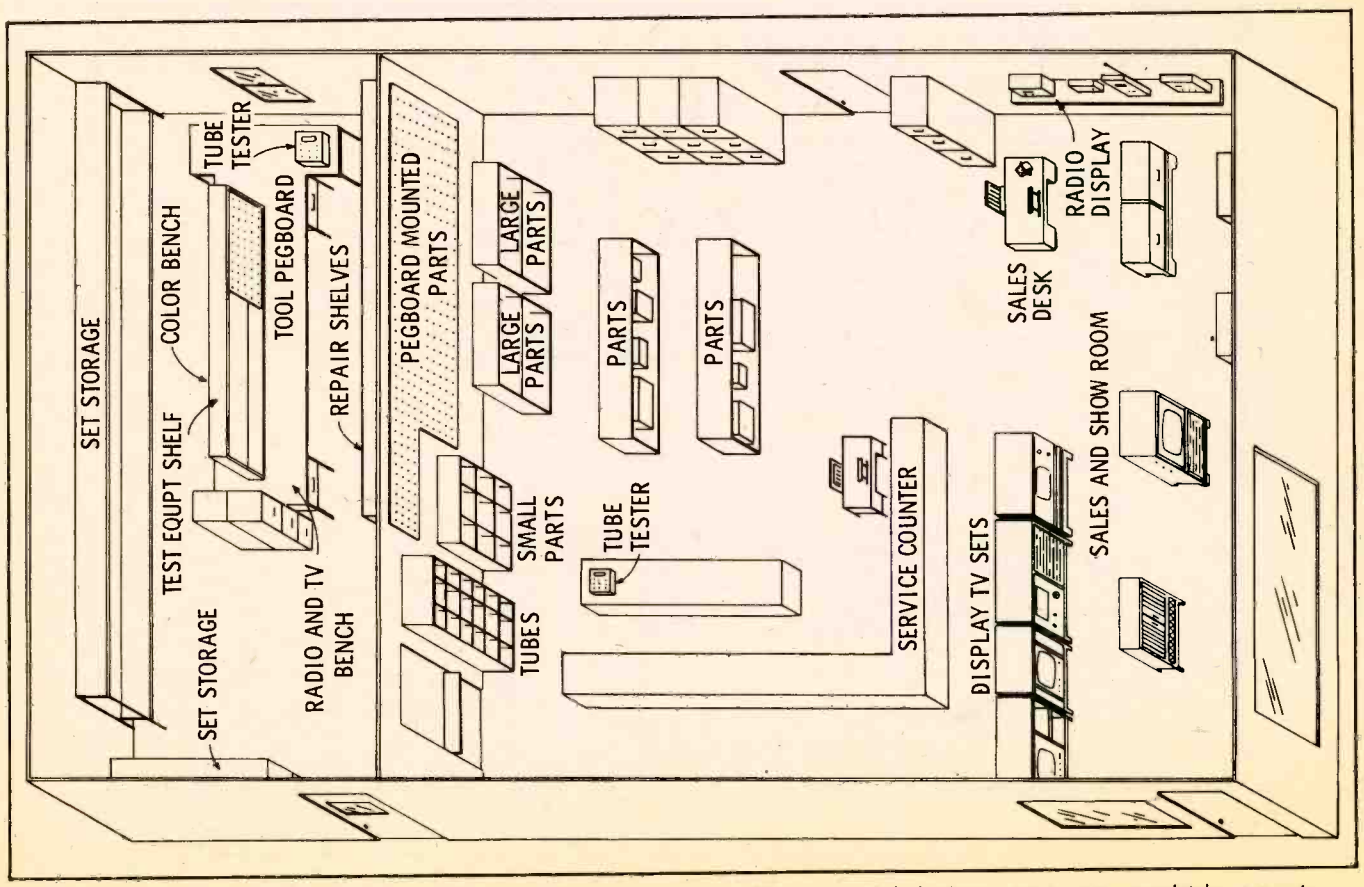


Fig. 6. This floor plan shows a shop with an isolated service area. The sales and business areas are completely separate.

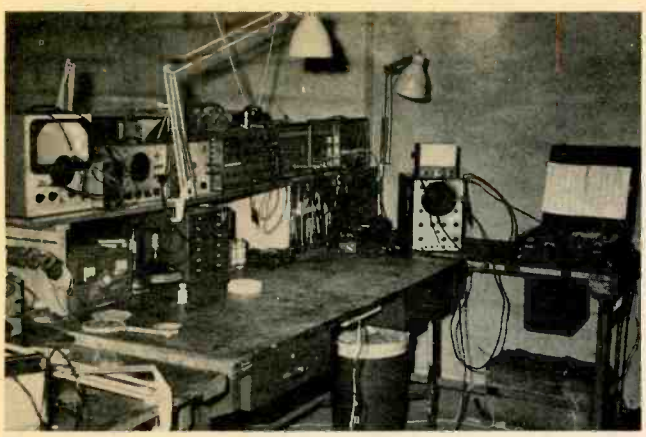


Fig. 7. Compartments keep test equipment up off the bench, thus providing a larger, cleaner working area for the technician.

This layout is used by a shop whose service vehicle is equipped with complete test and service facilities. So, to provide another "workbench," it is necessary only to pull the truck into the shop and connect its bench to AC power.

In a small shop such as this, TV's for repair are often placed on the floor since they will be put on the bench right away. However, not only is there a possibility of running over them with the truck, but someone might stumble over them and crack a shin—or worse, a picture tube. In this particular shop, however, the technicians just didn't have sufficient space for more shelves. It seems all the excess room was always filled up with odds and ends like picture-tube cartons, and TV cabinets. Perhaps if the storage room had been bigger . . . ! But then, we're back to the old problem of available space.

The workbench in this shop shows much careful thought. The test equipment is up off the bench, but within easy reach. There are drawers under the bench for small parts, speakers, and tools. A side extension on the bench leaves space for testing tubes and letting a set or two "cook."

Notice that the parts shelves are placed well back in the shop area. Although this may prove a little inconvenient, it does help keep your inventory level above what might be expected if the stock were within arm's reach of the showroom gate.

Medium-Sized Shop

Although it is arbitrary what can be called a medium-sized shop, four to six employees usually make up a medium-sized service business. In this type of shop, the technicians might handle phone calls and sales activities, as well as service calls and bench work. Perhaps only one employee—the manager or an office girl—will handle sales and calls, and the others will be strictly service personnel. The shop might appear as in Fig. 6, with the service area entirely out of sight behind the showroom and business area.

This shop features an adequate sales room with plenty of room to situate televisions and radios for maximum customer exposure. Notice that the customer has to walk across the showroom to reach the service counter. A tight row of TV sets guides him to the sales desk.

The middle area combines business, service, and parts storage. This is where business between customer and shop is transacted, service and sales records and files are stored, and the main parts inventory is kept—

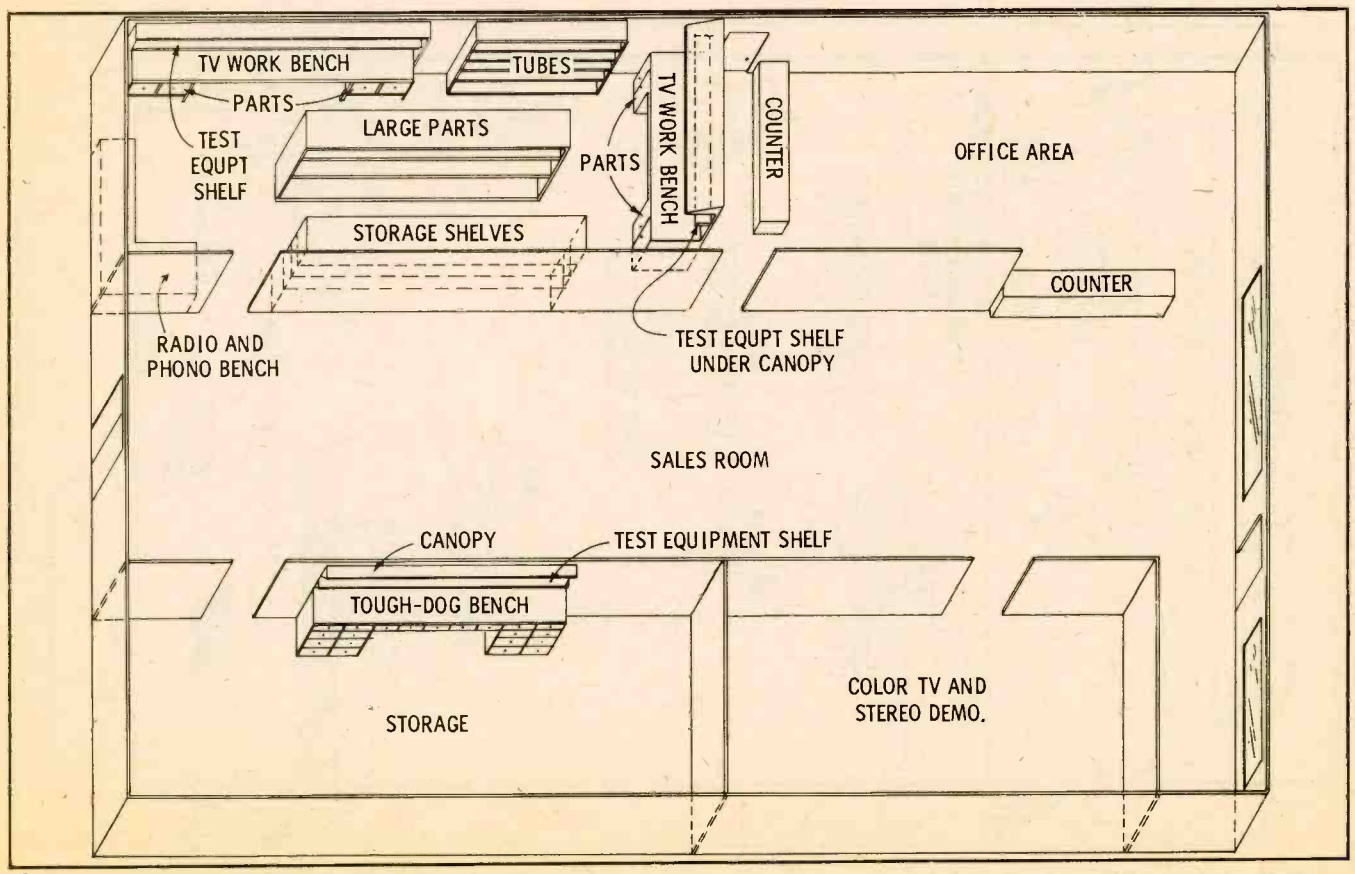


Fig. 8. This shop has two main TV benches, a radio-phono bench, and a separate "tough-dog" bench located in another room.

under lock and key. If a customer wants a tube, it is obtained from a cabinet at the end of the counter; likewise, batteries and other impulse-sale accessories are kept inside glass-enclosed cases. Each technician has his own parts and tube caddys, and stocks them at the end of the day. There is also a large pegboard mounted along the rear wall to provide for speakers, CRT brighteners, and similar items.

The service area features plenty of space for benches and shelves. In this layout, a double bench (Fig. 7) with test equipment racks placed back to back can be located in the center of the room. The bench away from the window is used for all color work and contains the color TV test equipment. There is sufficient space for set storage, and even room for schematic files.

There is an obvious lack of small parts drawers near the benches. As mentioned, each serviceman has his own caddy and refills it daily from the main parts stock. This generally suffices for bench work, too. There is otherwise no need for the servicemen to be in the business area. There is an "employees" door to the shop, and customers are kept in the business area by a Dutch door.

Large Shop

How much floor space should a shop have to qualify as a large shop? How many technicians? For the sake of reference, we'll say a shop should have around 8 or 10 employees. In this arrangement, technicians do nothing but service work; office help takes care of filing, telephone answering, and most sales work.

Most shops this large have five or more technicians, plus office and sales personnel, and the owner-manager. The shop and store space must be adjusted to accommodate the type of trade and the personnel required.

If there is more service business than sales, one man may be able to handle both sales and office work, and the shop doesn't need a big sales room. If most of the technicians spend their entire day making house calls, the bench and shop space needn't be as large as for a shop that has mostly carry-in trade. On the other hand, if sales is a major portion of your business, only a few technicians might suffice, while a sizable staff of salesmen would be employed. In either case, a secretary can almost always handle routine office duties.

Fig. 8 shows a typical "big shop" layout with a large sales room and a special demonstration area for color TV and stereo. The sales, office, and demonstration areas are the only portions of the store the customer sees. All service areas are out of sight to provide the technicians as much privacy as possible. If the shop is well run, and the office staff well informed. customers do not need to see the service technicians.

The service area in this layout is worthy of special mention. Notice the convenience of the parts and storage shelves to the benches. Both TV benches are approximately equidistant from the shelves and are separated from each other. This last helps reduce excess distraction and chatter between technicians. Two long TV benches are used to service sets brought in by the outside men; however, any "dog" is taken to the bench in the storage room for extensive troubleshooting by a seasoned veteran. A shop of this size often has one man specializing in "dogs." This facilitates taking "tough dog" work from smaller shops.

The benches in the service area are laid out for maximum access to test equipment and small parts drawers. This aids the serviceman in completing each job more efficiently. If he has to walk around looking for a piece of test equipment or a part, he will be distracted and lose his train of troubleshooting thought. He may even be tempted to start a conversation with the other technicians, and this adds up to lost time.

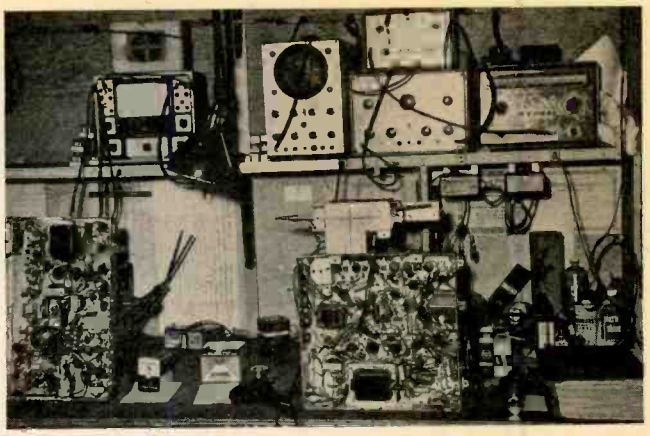


Fig. 9. Test equipment shelves are positioned for ease of equipment operation and the convenience of the TV technician.

Fig. 9 shows the test equipment layout on one of the benches in Fig. 8. The shelf holding the test equipment is high enough that a TV chassis will fit under it. This enables the serviceman to "cook" a chassis or two while he works on another set. The high shelves also allow taping price sheets or tube and transistor charts to the back of the bench where they are easily referred to. Yet the shelves aren't so high the technician must stretch unduly to reach them.

Fig. 10 shows how a bench like this is constructed. The canopy extends over the test equipment shelf, with a drop in the front. Under the canopy is a fluorescent light with reflectors that direct maximum light on the working space, yet minimize reflections on the scope screen and instrument scales.

This type of bench serves two purposes in addition to enhancing the beauty of the shop. It helps maintain privacy from the opposite side of the bench and can be part of a "wall" between service area and customer. It also provides lighting far superior to overhead or suspended lights. Better lighting, of course, helps the

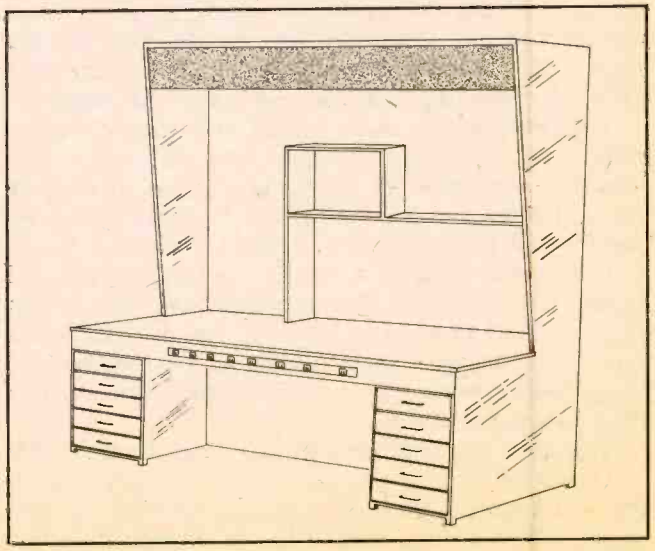


Fig. 10. Construction details of canopy type test bench showing location of test equipment shelves, drawers, and AC outlets.

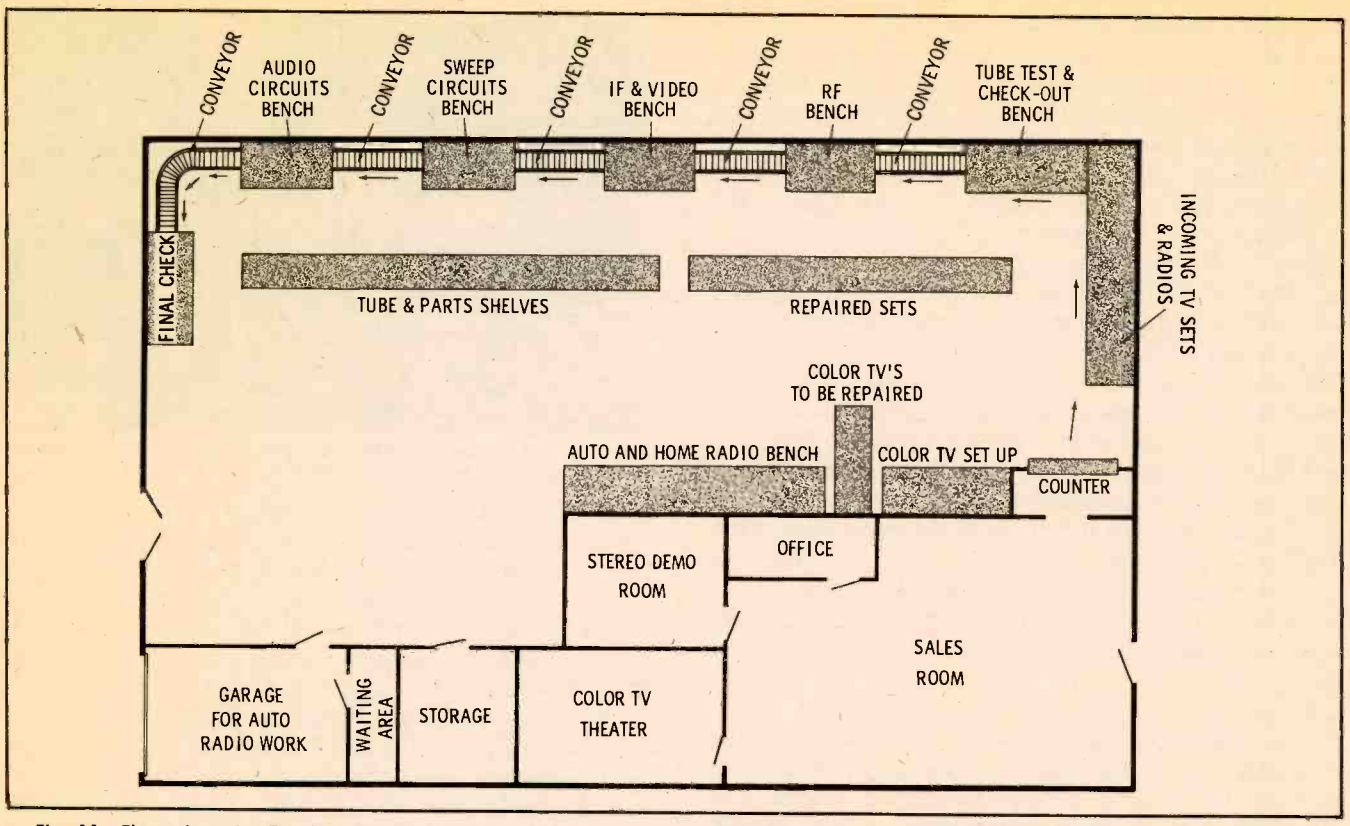


Fig. 11. Floor plan of a TV shop featuring conveyor belts to connect specialist's benches, a separate color TV bench, and a radio bench.

technicians do a better job with less eyestrain. With a bench like this, it is much easier to keep a clean and tidy shop.

The Production-Line Shop

Some larger shops have found it practical to have a series of test benches, with each technician assigned a particular duty. Fig. 11 shows such a shop. Here, incoming black-and-white TV sets are brought to the service counter by either the customer or outside technician. At the check-out bench, sets are disassembled, bad fuses and tubes replaced, and obvious faults corrected. Sets are then tagged with their symptoms and sent to the RF bench.

At the RF bench, each set undergoes a tuner check and a quick RF-IF alignment, if necessary. The set moves on to the video position, where the video stages are checked out. Naturally, any necessary repairs are made. The set proceeds down the line, with every stage of the set receiving attention and repairs as necessary.

This setup has its merit in that each man is responsible for only one type of circuit, and can become very expert in the variations encountered. It is up to each to see that his particular section of every set is working properly. When the set gets to the final checkout bench, it is in good working condition and all circuits are tuned. The customer is thus assured that his set has been checked thoroughly, and the cost is usually less that with a one-man shop. Callbacks are few, because borderline troubles are usually caught and repaired before they can develop.

This shop also features a special bench for color TV work and another for radios, phonographs, and recorders. In addition, there is a garage for drive-in auto work, with a waiting area adjacent. Should the radio have to be taken to the bench, the walk is short and not at all in the way of the TV line. The large open area in the rear of the shop can be used as a loading area and for service truck parking at night, as well as for additional auto-servicing space when the work load is heavy.

The showroom is situated so customers have no access to the service area. The room is divided into the regular sales floor, a color TV "theater," and a stereo-hi-fi demonstration room. Special attention can thus be tended these latter products, to help boost sales.

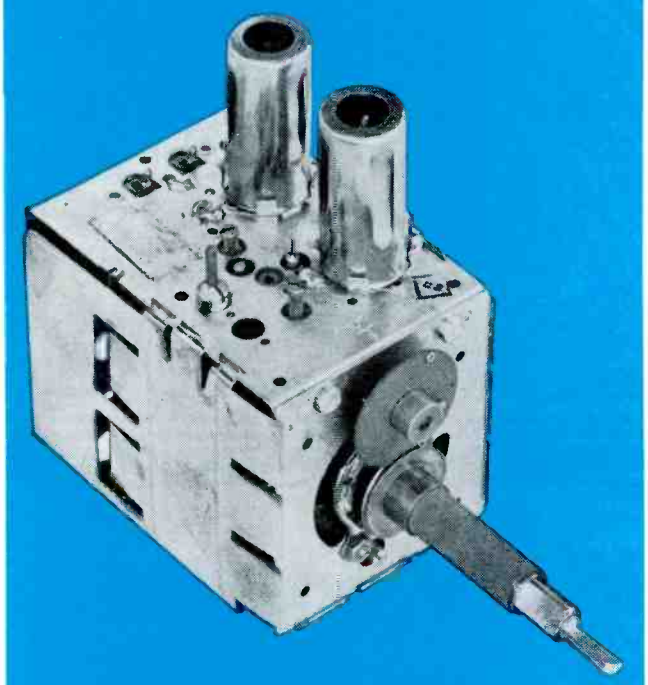
Trends

Who can say for sure what the future holds? In a few years, most household and automotive appliances will fall into the electronics category. Even now, many are moving out of the mechanical and electrical field into the hands of the electronics technician.

What effect will this have on shop layouts? No one can say for sure, but it seems likely that radios, televisions, phonographs, and recorders will all still be around. There may also be such things as short-range portable radar, or personal direction finders for hunting trips. Autos will probably have anti-collision radar and signal-actuated devices to guide them down the highways of the future. Almost every car will contain a transmitter and receiver.

These things, and many more, will affect planning of the service shop of the future. New testing instruments will have to be accommodated, necessitating different shop layouts. It's even possible that robots will take over the service shops! Then you'll really have to watch your parts shelves . . . those electronic men will constantly be taking parts to improve their own circuitry, so they can keep up with the Jones' robot. ▲

TUNER REPAIRS



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TUNER SERVICE DIVISION

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Manufacturers of Tuners . . . Semiconductors . . . Air Trimmers . . . FM Radios . . . AM-FM Radios . . . Audio Tape . . . Broadcast Equipment

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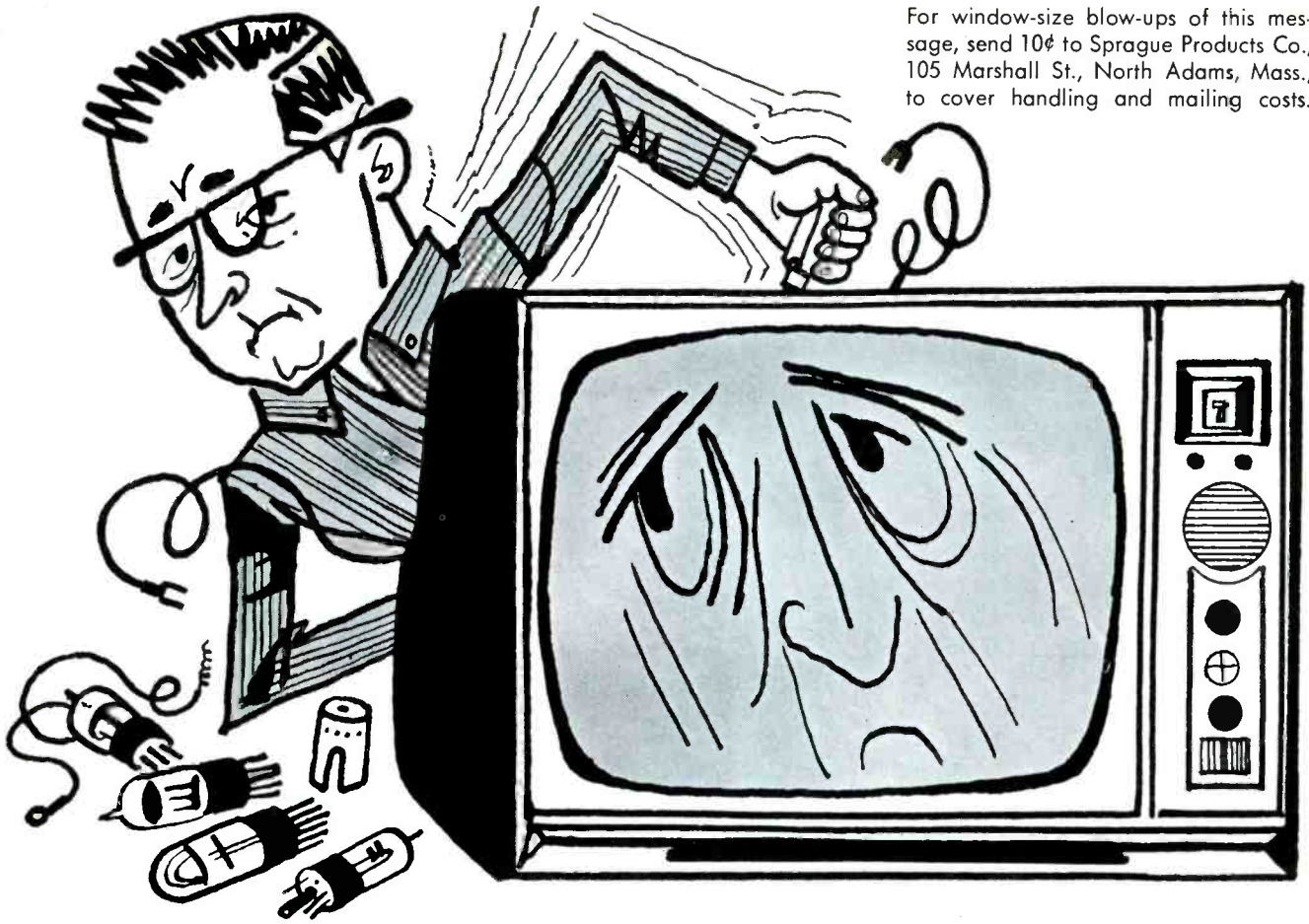
For window-size blow-ups of this message, send 10¢ to Sprague Products Co., 105 Marshall St., North Adams, Mass., to cover handling and mailing costs.



Is "do-it-yourself" TV Service as dangerous as they say?

When a TV set starts "acting up," a tube is often involved. At least, that's where the trouble *appears* to be.

Some people will pull the back off the set, remove the tubes, and take them to the "do-it-yourself" tube tester at the neighborhood store. The test instrument shows which tubes are faulty (but not always—some faults do not show up on these testers). Replacements are purchased, then inserted into the set. Reception improves, and the trouble has been caught and corrected.

BUT HAS IT?

The self-service test instrument checks *tubes.* It can't test the *more than 500 other parts* in your set! It can't show you the *source* of the trouble that probably blew the tube. Neither can it show the damage often suffered by other parts due to the faulty tube.

Mere tube replacements do not always cure these trouble spots. Weak links continue to exist, *setting up chain reactions of damage, trouble, and expense!*

The total failure of many a good TV set can be traced directly to "do-it-yourself" tinkering.

Your TV set is the most complicated device you own—far more complex than even your automobile. When you need TV service, call an expert technician—your fully trained and experienced Independent Service Dealer.

AFTER ALL, YOU WOULDN'T ENTRUST YOUR JOB TO AN AMATEUR, WOULD YOU?

THIS MESSAGE WAS PREPARED BY SPRAGUE PRODUCTS COMPANY,
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YOUR INDEPENDENT TV-RADIO SERVICE DEALER

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PF REPORTER
including Electronic Servicing
VOLUME 14, No. 1 JANUARY, 1964

CONTENTS

ABOUT THE COVER

Have you a crystal ball? If not, don't rush out to your medium and buy one until you've first consulted our special Modernization section. In addition to "timely" servicing articles, you'll find some predictions. . . .

Letters to the Editor

Dear Editor:

This is a letter of thanks and appreciation for Allan Kinckiner's article "Ringing Checks for Sweep Coils" (March, 1963 PF REPORTER. My biggest problem in TV servicing has always been the horizontal circuit, mostly because I was never sure whether the yoke and flyback were good or bad. I have always wasted a lot of time checking and doublechecking the horizontal oscillator control tube and output stage components before finally deciding the trouble might be in the flyback or yoke. As an old timer, who used to short out turns to raise the frequency of a transmitter tank coil, I found it hard to believe a one-turn short would have as much effect as described in the article. So I tried it, and it certainly works. Was I surprised! You see, I'm not one of those technicians who fire up a set, lay the scope probe near it, take one squint at the waveform, and come up with the answer—usually in 10 seconds flat! So this method of testing is a real timesaver for me. Again, many thanks.

V. W. HODGE
Hodge Radio & TV Shop
Claremont, N. H.

Ten seconds flat is a little speedy for us, too, V. W. But the more shortcuts such as these you learn, the faster you will be. Keep reading, and you'll find lots more in issues to come.—Ed.

Dear Editor:

I'd like to agree with Ray Dilbeck (February, 1963 "Letters"). Every issue is clear, understandable, and each article is easy to grasp. I wish my $400 correspondence course had been so interesting to read. You keep writing, and I'll keep buying—and reading.

W. L. HULSEY
Birmingham, Ala.

You've got yourself a deal!—Ed.

Dear Editor:

One of your November *Product Report* items describes a crystal-controlled CB transceiver priced at $29.95. If this price is correct, can you furnish me with the manufacturer's address?

CHARLES M. SHADE
LaGrange, Texas

Dear Editor:

We've drawn an unusually large number of inquiries from the item in your November issue about our "Poly-Comm-Pro," showing the price as $29.95. Unfortunately, that's a little off. The correct price is $269.50.

EARL R. BAILEY
Sales Manager
Polytronics Labs, Inc.
West Caldwell, N.J.

Ouch.—Ed.

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Works quickly, simply . . . gets the job done profitably!
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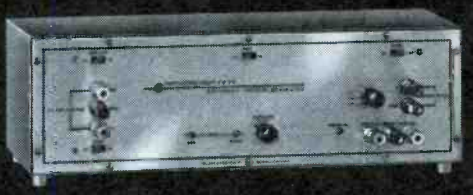

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The perfect combination of superior quality at the very lowest possible price!
A full line designed with one objective: to help you accurately handle all testing jobs faster, easier and *more profitably!* Never was there equipment designed with your real needs so much in mind!
And it's available at your local distributor *now!*

As shown:
Model G-30—Kit: $32.95; Semi-kit: $39.95; Factory Wired: $44.95
Model G-32—Kit: $85.95; Factory Wired: $159.95
Model S-55—Kit: $99.95; Factory Wired: $155.95
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G-30 RF Signal Generator

G-32, Sweep Generator and Marker Adder

S-55 DC to 5MC Oscilloscope

ES-550B Wide Band 5MC Oscilloscope

S-51, General Purpose Oscilloscope

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AT THE MOMENT OF TRUTH -- THE PICTURE IS THE PROOF!

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Model LPV11 (illustrated)

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Performance has made the LPV first in antenna sales—not claims or words. JFD will gladly abide by that moment of truth that proves the true caliber of any antenna's performance- THE PICTURE IS THE PROOF!

THE FIRST TV/FM ANTENNA BASED ON THE GEOMETRICALLY-DERIVED LOGARITHMIC-PERIODIC SCALE DEVELOPED BY THE ANTENNA RESEARCH LABORATORIES OF THE UNIVERSITY OF ILLINOIS FOR SATELLITE TELEMETRY.

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Model LPV17: 18 Active Cells and Director System for areas up to 175 distant. $59.95 list.

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Model LPV11: 11 Active Cells and Director System for areas up to 125 miles distant. $39.95 list.

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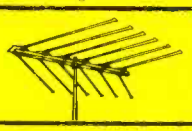

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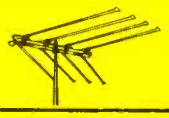

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- **HIGHER FORWARD GAIN** Element for element you get two to three times **more** gain than with similar-priced competitive makes. **Flat** gain across each channel, too, for vivid color rendition. (**More** driven elements do it.)
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Harmonically Resonant V-Elements, Operating on the Patented Log-Periodic Cellular Formula, in the Fundamental and Third Harmonic Modes, Provide Flawless COLOR . . . Black and White TV . . . FM Stereo!

The technical press . . . the news press . . . the consumer press . . . the trade press—never before have so many so acclaimed a new TV antenna!

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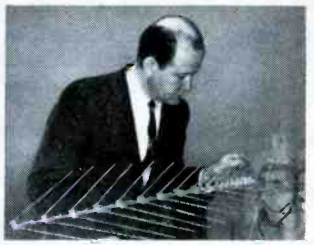

Professor Paul Mayes of the Antenna Research Laboratories of the University of Illinois, originator of the log-periodic V-dipole antenna concept.

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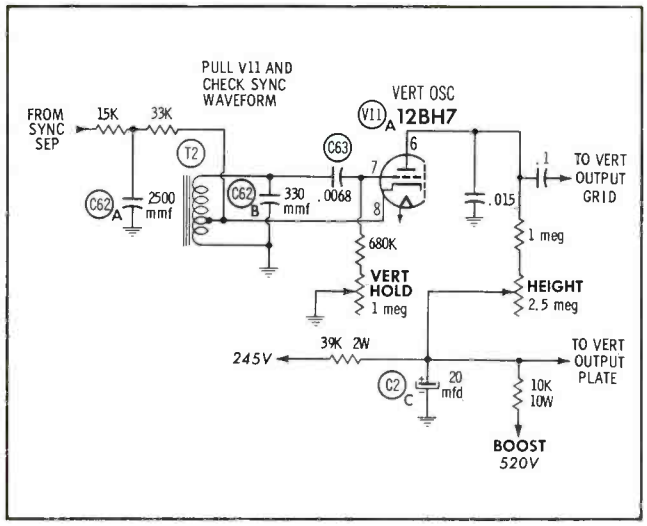


much worse effect on height and linearity than on vertical sweep frequency.

The clues you mentioned in your description of the trouble hint at a sync-pulse distortion problem rather than an oscillator-drift problem, but they don't give conclusive proof either way. To help isolate the fault, first make a rough visual check by observing the action of the vertical hold control when the set is cold, and again after the rolling begins. If sync "grabs" just as solidly on the second try, but the rolling is stopped at a different point in the control's rotation, the oscillator is drifting beyond the normal lock-in range. On the other hand, an increased touchiness in the response of the control means the sync pulses are becoming weaker as the set operates. If the control adjustment always seems somewhat critical, the sync pulses may be marginally

The Troubleshooter

answers your servicing problems

Delayed Rolling

A Philco Chassis TV-330 (PHOTOFACT Folder 425-9) develops vertical roll after it has operated for about an hour. The picture can be stopped with the hold control, but begins rolling again a few minutes later.

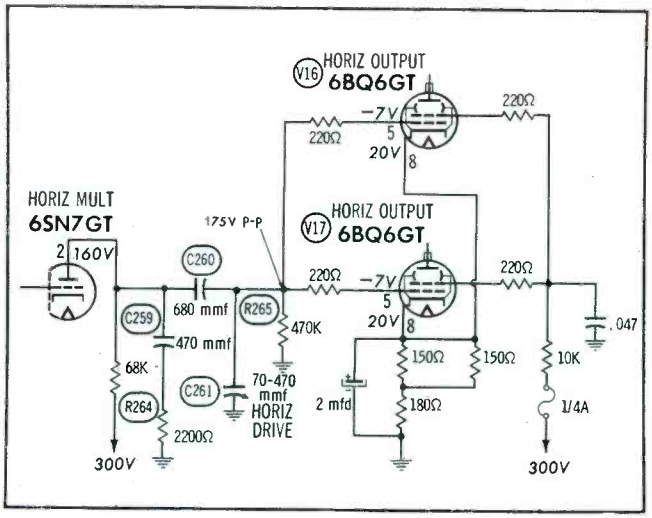
I have scoped the video signal ahead of the sync separator, and have noticed that the slightest electrical interference will trigger the rolling. There also seems to be a bit of vertical sync-pulse compression in this signal. I can find no abnormal voltages or other definite signs of trouble in the picture circuits.

I have tried new vertical sweep and sync separator tubes, have substituted for all capacitors and resistors that have anything to do with the vertical sweep frequency, and have replaced B+ filter capacitor C1. As yet, I haven't changed the vertical output transformer, and I'm wondering if it might have anything to do with this trouble.

STEPHEN H. MILLER

Raymond, Ill.

Since this set uses a blocking oscillator and a separate output stage instead of a combination multivibrator-output circuit, the output transformer is unlikely to cause oscillator-frequency drift. Some interaction between the oscillator and output stages is possible via their common plate-voltage supply; however, troubles in this circuit generally have a



both 6BQ6's at the same time; if this doesn't cure the trouble, your first concern should be the extremely negative grid voltage. An overbiased grid is usually the result of a great increase in the amplitude of the drive signal; therefore, it's important to check this signal with a scope or AC VTVM. If it exceeds 175 volts peak to peak, you will undoubtedly find some trouble in the circuit that connects the multivibrator to the output stage. Specifically, coupling capacitor C260 could have increased considerably in value, trimmer C261 could have lost most of its capacitance, or some fault could have developed in the waveshaping network C259-R264.

Should you find nothing wrong with the grid circuit, check the voltages and currents in the cathode and screen circuits of the output stage. I won't rule out trouble in the flyback, damper, or boost circuits, but I'd say the chances of this are remote.

....New Developments in Electrical Protection

weak, and unable to overcome a normal amount of oscillator drift.

A more accurate isolation test can be made by monitoring the waveform on the lead connecting the integrator to the vertical oscillator. (Pull out the oscillator tube to eliminate its conduction waveform, which would obscure the sync pulse.) If the amplitude of the incoming sync signal stays constant and is close to the normal value of 6.5 volts peak to peak, you can assume your trouble is due to oscillator drift. In this case, I'd suggest rechecking C62B and C63, which have been known to give trouble in this particular chassis. Substituting NPO types for the original capacitors might solve the problem. As a last resort, replace blocking-oscillator transformer T2.

If the sync signal is defective, first try substituting for C62A; then follow through on your idea about vertical sync compression in the video signal. In many other cases where the vertical sync pulses have been low in amplitude with respect to the rest of the signal, the trouble has finally been isolated to the video output stage. However, if the scope shows weak vertical pulses in the input to this circuit, the set probably has some trouble that affects RF-IF alignment.

Running in Overdrive

Please help me with a horizontal sweep problem in a Sylvania Chassis 1-515-1 (PHOTOFACT Servicer, Set 320). The right side of the raster is distorted, and there are three light lines (somewhat like drive lines) in the left half of the raster. These lines can be minimized by tightening the drive trimmer, but the 6BQ6GT output tubes still have too much bias; cathode and grid voltages measure 8 and −45 volts, respectively, instead of the normal 20 and −7 volts. The output section of the horizontal multivibrator has the correct plate voltage.

EMIL O. BRIESE

Cambria Heights, N.Y.

To avoid being misled by a "weak sister" output tube, replace

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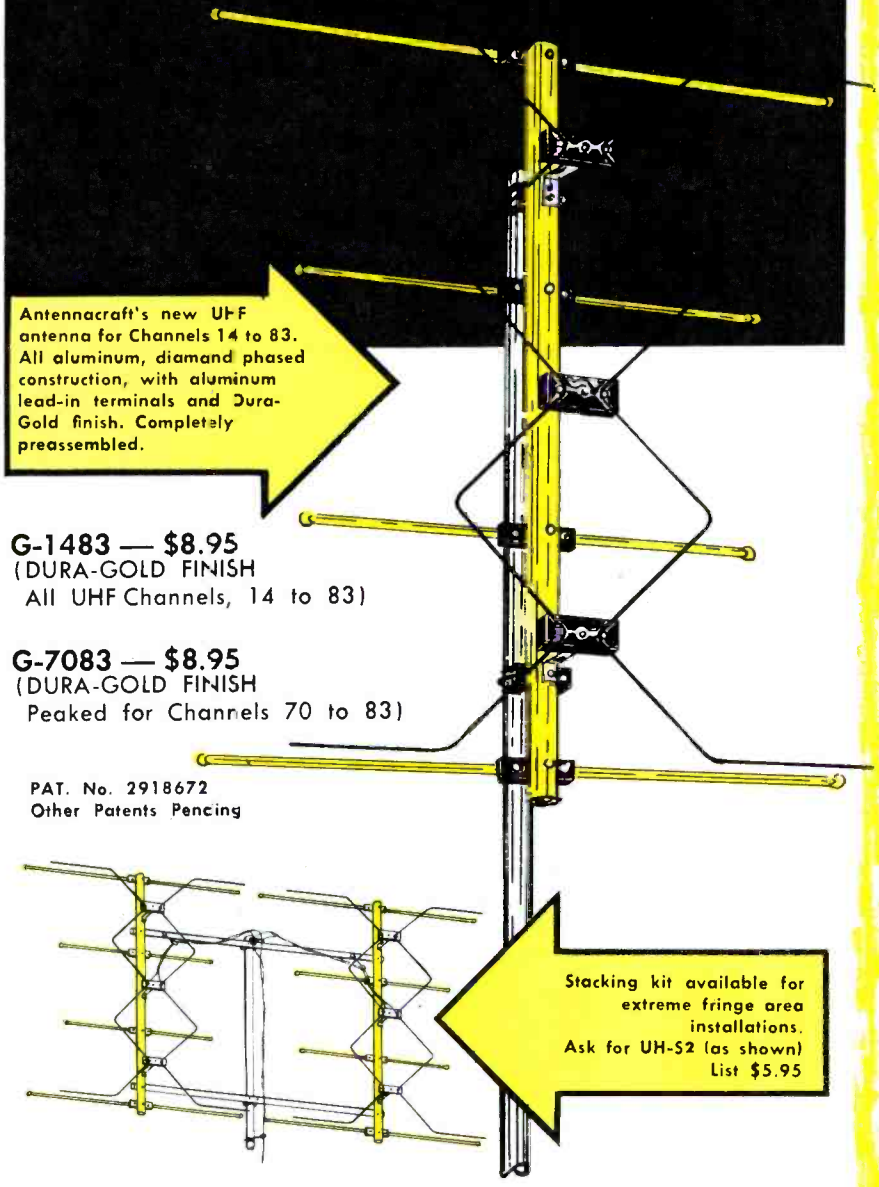

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(DURA-GOLD FINISH
All UHF Channels, 14 to 83)

G-7083 — $8.95
(DURA-GOLD FINISH
Peaked for Channels 70 to 83)

PAT. No. 2918672
Other Patents Pending

Stacking kit available for extreme fringe area installations. Ask for UH-S2 (as shown) List $5.95

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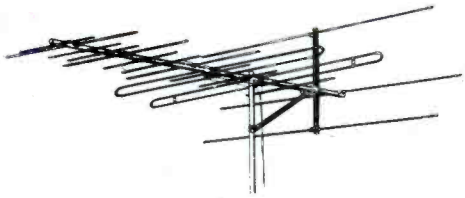

BONANZA SUPER CHIEF

The Bonanza Super Chief is an all channel antenna SUPER POWERED for deep fringe areas. The new Tri-Flector reflector system provides maximum front-to-back ratio. Structural ruggedness is increased with the new boom brace and longer lasting peak performance and beauty is assured with Antennacraft's Dura-Gold finish.

MODEL B59G ONLY $39.95

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All new addition to the value packed Dura-Gold Bonanza line. Extra strong, extra tough, all aluminum construction, with extra high impact insulators. Unexcelled performance and the long lasting beauty of Antennacraft's new Dura-Gold finish insures years of satisfying black and white or color.

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The Bonanza Chief by Antennacraft is tops in performance, quality, and workmanship. Crush-proof mast clamp, extra heavy, extra high impact insulators, all snap-out elements, all aluminum, rust-proof terminals, plugged boom ends, plus new Dura-Gold finish makes the "Chief" the best antenna value available for deep fringe areas.

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A tremendous value!! The Bonanza Raider by Antennacraft has fringe-area power. The Dura-Gold Raider when stacked delivers maximum performance and excellent front-to-back ratio on all channels. With all the quality features of the Bonanza Chief including the new Dura-Gold finish.

MODEL B52G ONLY $17.95

The Electronic Scanner

news of the servicing industry

The Winner!

Carl E. Mosley. President of **Mosley Electronics Co.,** and Olin W. Lippincott, Assistant Sales Manager, look on while G. J. Chiappino, VP in charge of sales, presents Fred Wamble of the Fred Wamble Sales Co. with the first-place award for selling the greatest number of "Scotchmaster" antennas in 6 months. The second-place award winner was Art Sinclair of Sinclair Electronic Associates.

New Veep

James W. Burke has been elected Vice Pesident and General Manager of the Tuner Division at **Standard Kollsman.** Mr. Burke, who joined Standard Kollsman in 1955, has been Assistant to the President since 1962. As such, he had devoted his major attention to Tuner Division activities. Prior to this, he served in a number of management positions, including Assistant Sales Manager, Plant Manager, and Factory Manager.

New Marketing Manager

Robert M. Butler has been apointed new Distributor Marketing Manager for **Cornell-Dubilier.** One of Mr. Butler's principle concerns will be to broaden the C-D Authorized Industrial Distributor (AID) program. His responsibilities will include maintaining close liaison among plants, field sales, and warehousing, and developing policies and procedures relevant to the company's replacement parts merchandising program.

Dealer Premium Program

A two-way premium program, offering a large variety of free gifts to participating TV antenna dealers and installers, is the means by which **Trio** is introducing their new antenna line. A coupon worth a certain point value, depending upon the price of the antenna, is packed with each Trio antenna. The dealer saves these coupons until enough points are accumulated to redeem premiums ranging from wrist watches to VW panel delivery trucks. If the dealer prefers, he may return the coupons to Trio in exchange for S & H Green Stamps of equivalent value.

Managerial Appointment

The appointment of H. Donald Nelson to the newly created post of Distributor Sales Planning Manager for entertainment electronic components has been announced by **General Electric.** Concentrating on distributor market for components used in television, radio, and hi-fi equipment, Mr. Nelson is charged with the responsibility for developing plans and programs that will support the field sales force and aid independent distributors.

TEST EQUIPMENT

Accessory Guide

Another word which might be used to describe an "accessory" is *aid*. Your business is servicing, and aid in any form is always welcome. That's where accessories for your test equipment can play a large part. Although the aid derived from an accessory may be secondary, it invariably lends itself to some primary objective of servicing.

Take your oscilloscope for example. This instrument, without extras (except test leads), is probably one of the most versatile servicing aids you can have. But, equip it with a detector probe and a low-cap probe, and see how much easier signal tracing in a TV receiver can be. This kind of troubleshooting saves you time—and *time is money!*

We've compiled the accompanying guide as an "accessory" to help you expand the usefulness of your test equipment. As you'll notice, we've stipulated the major purpose for each item. The chart should enable you to choose what you need to make *your* test instruments more versatile.

The manufacturers of test equipment usually make accessories such as those we've listed. Usually, they are made especially for their own units; a quick check of their catalog will tell. If a particular accessory isn't available for your instrument, you can generally select a suitable substitute from some other firm. We've included a few tips about this under the "accessory" column. For example, when purchasing a low-capacitance probe, make sure it matches (or can be adjusted to match) the input of your scope.

EQUIPMENT	ACCESSORY	PURPOSE
Oscilloscope	Low-Capacitance Probe (match to scope input impedance)	Reduces loading on circuit being tested. Some have switch that permits user to change instantly from direct probe to low capacitance.
	Demodulator Probe	Permits visual signal tracing in RF-IF circuits of radio and TV sets.
	Voltage Calibrator	Can be used to check scope calibration or to measure unknown voltages.
	Scope Preamp	Amplifies signal voltages to increase sensitivity of scope.
VTVM	High Voltage Probe (order correct multiplier resistor and cable connector to match instrument)	Extends voltage of VOM or VTVM, permitting direct measurement of high voltage, usually to 30 kv or 50 kv.
	RF Probe	Extends frequency at which measurements can be made. Usually reaches to 200 mc. Essentially a demodulator probe.
Sweep and RF Generators	RF Modulator	Permits video sweep modulation of RF signals; used to check RF, IF, and video frequency response of TV receivers.
	Video Multimarker	Provides simultaneous absorption-type markers in video frequency region; used during video response check and/or alignment of color receivers.
	Marker Adder	Permits adding marker to sweep response curve without mixing in the receiver, avoiding overload and curve distortion.
Miscellaneous	Bias Supply	Provides clamping voltages to aid in servicing and/or alignment of electronic circuits.
	Power Line Monitor	Permits constant visual check of power line voltage.
	Isolation Transformer	Isolates equipment from power line, minimizing shock hazard and damage to test equipment or apparatus being serviced.
	Phase Checker	Used to check phase in audio equipment; scope, VOM, or VTVM is used as indicator.
	Tube Tester Adapter	Some modernize tester for new tube types; others adapt tester for CRT's (including color) or special-purpose tubes.

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FEBRUARY						
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APRIL						
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DECEMBER						
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27	28	29	30	31		

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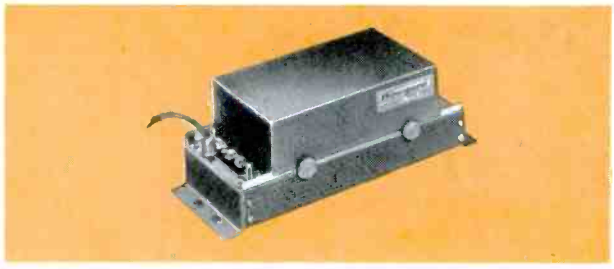

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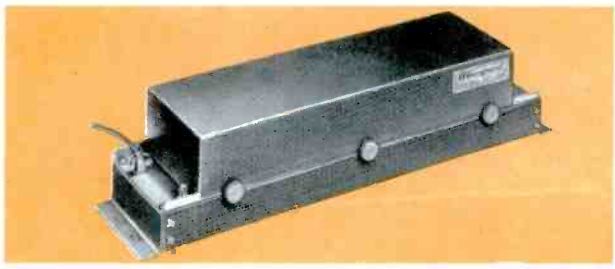
SPECIFICATIONS—Tubes: two 6HA5. **Gain:** +15db. **Bandpass:** 50-110MC, 170-220MC. **Response:** flat, ±.25db per 6 MC channel. **Noise Figure:** 3.7db lo-band, 5db hi-band. **Max. Signal Input:** 350,000 microvolts. **Max. Signal Output:** 2V. **Input Impedance:** 75 or 300 ohm. **Output Impedance:** 75 or 300 ohm. VSWR input and output better than 1.5 to 1. Two C-59 75 ohm connectors supplied. Blue Baked enamel perforated steel cabinet, 2⅞ x 9¼ x 3⅜". AC cord. **Switches: On-Off;** power to pre-amplifier. AC fuse. 117V 60 CPS 14 watts.



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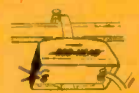

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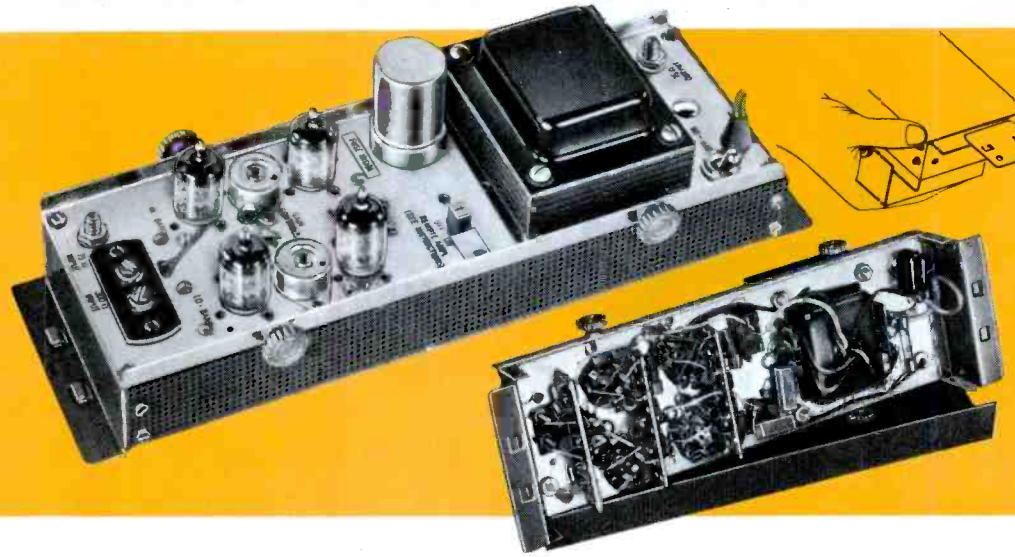

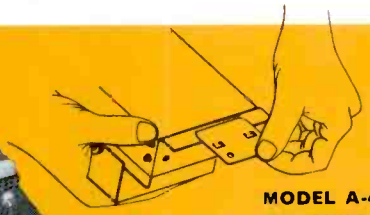

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SPECIFICATIONS—Tubes: four 6HA5. **Gain:** +30db. **Bandpass:** 50-110MC, 170-220MC. **Response:** ±.25db per 6 MC channel. **Noise Figure:** 3.7db lo-band, 5db hi-band. **Max. Signal Input:** gain control at max., .02V. per band; gain control at min., .1V per band. **Max. Signal Output:** 2V. **Separate Hi and Lo Band Gain Controls:** 0-10db. **Input Impedance:** 75 or 300 ohm. **Output Impedance:** 75 ohm. VSWR input and output better than 1.5 to 1. Two C-59 75 ohm connectors supplied. Blue baked enamel fully ventilated perforated steel cabinet, 2⅛" x 11" x 3⅜". AC cord. **Switches:** OFF-ON; power to preamplifier. AC fuse. 117V. 60CPS 25 watts.

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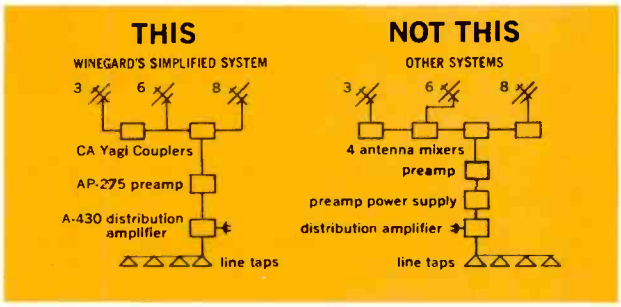

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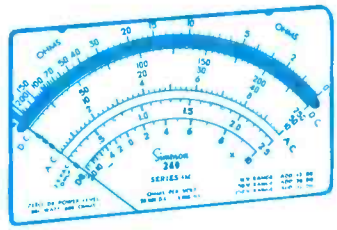

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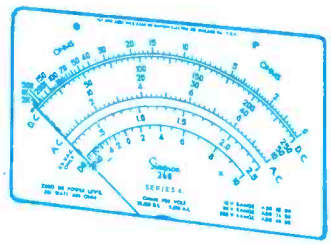

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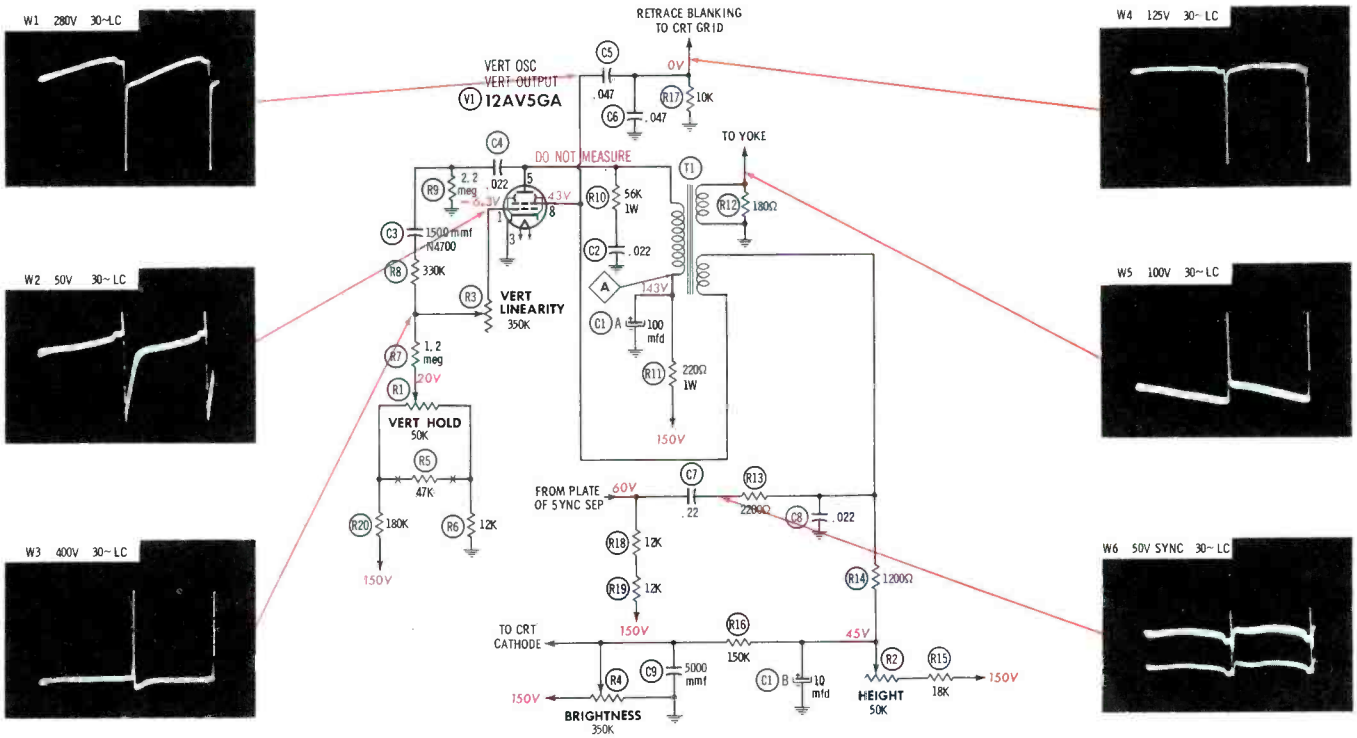


DC VOLTAGES taken with VTVM, on inactive channel; controls set for correctly proportioned raster.

WAVEFORMS taken with wideband scope; low-cap probe (LC) used to obtain all waveforms shown.

Normal Operation

This vertical output stage is capable of self-oscillation, dispensing with need for separate oscillator. V1 plate current is blocked at regular intervals by means of feedback from plate to screen through third winding on special output transformer T1. Blocking action is touched off when plate current drives T1 to saturation, causing decline in feedback voltage. Screen voltage begins to drop, plate current decreases, and negative-going feedback to screen creates snowballing effect that rapidly cuts off plate current. Interruption of current in T1 causes high-voltage ringing pulse (negative spike in W1, and positive spike in W5), which causes retracing of CRT beam. In plate waveform, pulse amplitude is 1200 volts—considerably above maximum rating of input circuit in many scopes. At end of pulse, screen voltage again goes positive, and V1 resumes conduction. Time interval between pulses, as well as waveshape of plate current during this interval, is controlled mostly by grid circuit. Positive retrace pulse is coupled from plate through RC network to grid, causing surge of grid current that charges capacitors in network. When grid current ceases, grid voltage goes highly negative—note sharp dip in W2. Charge leaks off through hold-control circuit, rapidly at first (to bring V1 out of cutoff) and then more slowly (to produce gradual increase in plate current needed to develop proper scanning waveform for yoke). In this circuit, from Muntz Chassis T37, negative sync pulses are applied to screen of V1 for precise triggering.

Operating Variations

PIN 8 Circuit adjustments have only minor effect on W1. Full scan is obtained at minimum setting of R2; advancing this control causes considerable overscan and raises screen voltage (maximum value, 65 volts). Hold and brightness control both vary screen potential by 10 to 15 volts.

PIN 1 R3 limits amount of grid current at retrace time, and varies charge placed on grid capacitors. At minimum-resistance setting, greatest current is drawn; negative pulse in W2 increases to 100 volts peak to peak, and grid bias is −12 volts. V1 then comes out of cutoff more slowly than usual after retrace, and top of raster is compressed. With R3 at maximum resistance, W2 amplitude is only 25 volts, and bias is −4 volts. R1 and R2 also vary DC grid voltage by a few volts.

R1 Discharge rate of grid-bias circuit is controlled by returning it to source of variable positive voltage. Sometimes this stage develops problem of "one-way sync," not due to any component defect. In such cases, one quick remedy is to broaden range of hold control by removing shunt resistor R5. Voltage at arm of R1 can then be varied from approximately 10 to 35 volts.

A Voltage at this point can be subtracted from B+ to determine voltage drop across R11—an item of information useful in computing value of plate current.

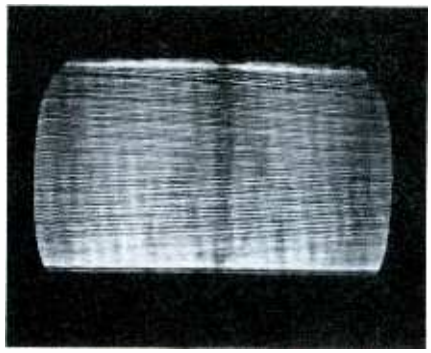
Reduced Height

SYMPTOM 1

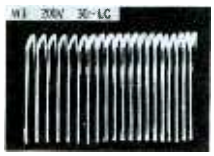
Oscillator
Far Off Frequency

C4 Open

Symptom Analysis



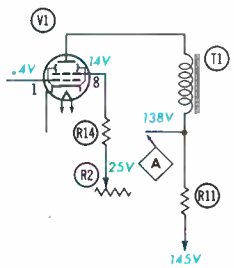
Raster fills one-half to three-fourths of screen, depending on R2 setting. Scanning lines are jittery and few in number. T1 emits faint high-pitched hum (several hundred cps). Hold and linearity controls have small effect. Details of picture are obscured.



Waveform Analysis

Circuit still oscillates, and W1 is fairly strong; but large number of cycles displayed in this waveform prove frequency of oscillation is far above normal. W2 contains pulses coinciding with those at screen; however, it is weak enough to suggest possibility of grid-circuit trouble. High-amplitude pulses, normally seen in W3 except at minimum setting of R3, are missing; logical conclusion is break in pulse-feedback path from plate to grid of V1.

Voltage and Component Analysis



Screen voltage of V1 is extremely low, and arm of R2 measures only 25 volts at minimum-resistance setting. In other words, voltage drops across R14 and R15 are too great, due to excessive screen current. This condition is explained by loss of grid bias, traceable to absence of feedback spikes in W3. Break in feedback path can be found by bridging R8, C3, and C4 with good components. This circuit, unlike multivibrator, suffers little ill effect from shorted or leaky feedback capacitor at plate of output tube.

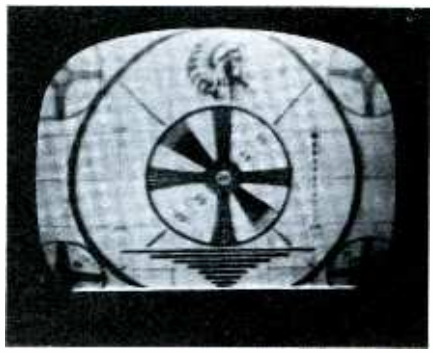
Best Bet: Isolate with scope; check feedback components.

Bottom Foldover

SYMPTOM 2

Linearity
Otherwise Normal

R11 Increased in Value

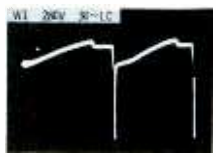


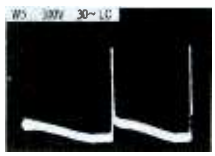
Symptom Analysis

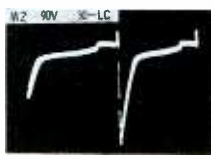
Turning R3 counterclockwise (toward minimum resistance) decreases foldover, but compresses top of raster. Clockwise rotation of control stretches top of picture and makes foldover worse. Picture snaps solidly into sync. Neither R1 nor R2 corrects foldover.

Waveform Analysis

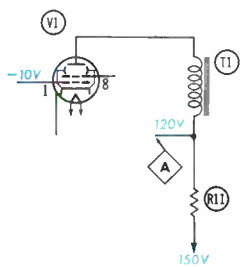
W1 and W5 have nearly normal amplitude, but display unusually wide flat spot just to left of retrace pulse. This symptom indicates V1 is operating at zero bias for longer than usual period, flattening bottom of raster. Smaller flat spot found in normal waveforms does not cause noticeable raster distortion. Relatively strong pulses in W2 are simply a result of setting R3 farther counterclockwise than usual. Reduced bias is suspected.







Voltage and Component Analysis



Voltage drop across R11 is much greater than normal. It is not plausible to suspect great increase in plate current of V1, because tube has ample grid bias (normal for low-resistance setting of R3), and correct screen voltage. However, there are other possibilities—leakage in C1A or T1, or increase in value of R11. Ohmmeter measurement directly across resistor shows rise in value to just over 900 ohms. Further increase in resistance would have seriously decreased height. R11 is one of most critical components in circuit.

Best Bet: Check DC voltages—then components.

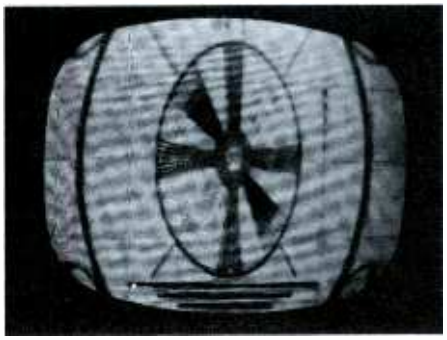
Excessive Height

SYMPTOM 3

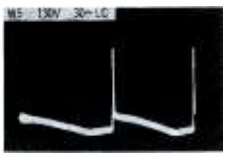
Touchy Hold

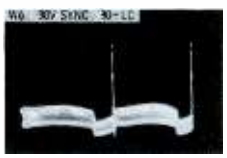
C7 Shorted

Symptom Analysis



Raster greatly overscans screen at both top and bottom, even with R2 fully counterclockwise. Top can be squeezed down by turning R3 to minimum setting. Picture locks into sync, but tends to roll for several frames whenever signal fades or is interrupted.

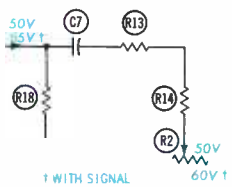




Waveform Analysis

Amplitudes of W5 and W2 are above normal; this confirms that sweep circuit is "working overtime," but doesn't explain why. W6 offers one subtle clue: sync signal (bright band) is less than two-thirds normal height, and dip in this waveform caused by feedback from vertical circuit is unusually severe. At output of integrator (opposite end of R13), vertical sync pulses measure 7 volts, only half of normal. Pulses can be seen by adjusting R1.

Voltage and Component Analysis



All voltages in circuit of V1 are within few volts of correct values, if control settings are taken into account. Distortion in W6 is reminder to check sync separator. Plate voltage of that stage is nearly normal with no signal applied, but increases only slightly when station signal is tuned in. (Separator should develop grid-leak bias in response to signal, raising plate voltage to 120 volts.) Unwanted DC path through shorted C7 makes separator unable to develop normal signal across plate-load resistors R18-R19.

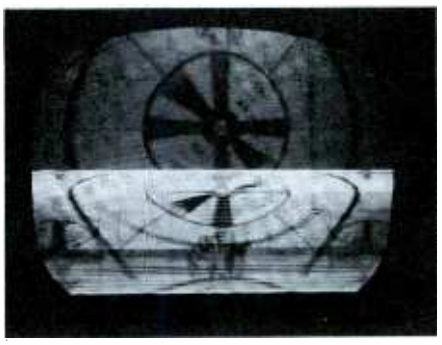
Best Bet: Localize with scope and VTVM.

Intermittent Distortion

SYMPTOM 4

Raster Collapses on Vacant Channels

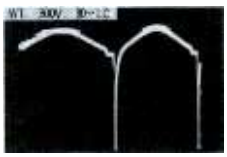
C1B Open

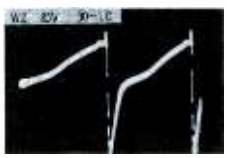


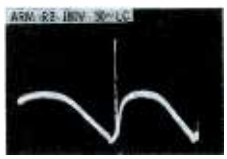
Symptom Analysis

"Reflecting pool" effect, caused by inverted image overlapping bottom half of picture, occurs erratically. When R1 is turned, symptom disappears, but picture tends to stretch at top and fold over at bottom. With no sync signal present, raster is only 2″ high.

Waveform Analysis

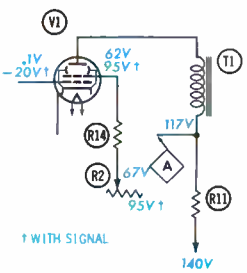






Even when normal sweep is established, W1 has humpbacked shape instead of normal upward slope between pulses. Sag in middle of W2 compensates for hump in W1, and allows reasonably linear rise in plate current. Tracing back through screen circuit localizes origin of distortion in W1—high-amplitude waveform is found at arm of R2, which should be bypassed to ground via C1B. Normal ripple here is parabola-shaped, with amplitude of 1 volt.

Voltage and Component Analysis



Off channel, failure to oscillate causes many discrepancies in DC voltages. Note reduction in B+ source voltage, and large voltage drop across R11; these are results of heavy plate current in V1 due to loss of grid bias. When station is tuned in and controls are adjusted for normal picture, grid of V1 develops unusually great bias, and voltages in screen circuit climb far above highest level ever encountered in normal operation of stage. Screen voltage is best DC clue available, but does not pinpoint fault.

Best Bet: Scope finds exact source of trouble.

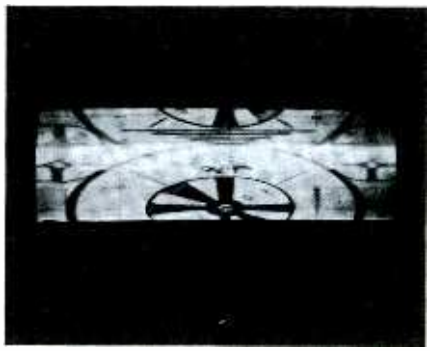
SYMPTOM 5

Reduced Height

Good Linearity

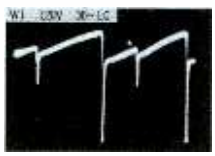
R2 Open

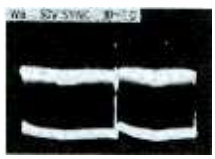
Symptom Analysis



Raster height is one-third of normal, and is unaffected by turning R2. Both R1 and R4 have some effect on height; also, if either R1 or R3 is turned very far from counterclockwise limit, raster breaks into overlapping sections. Picture does not roll.

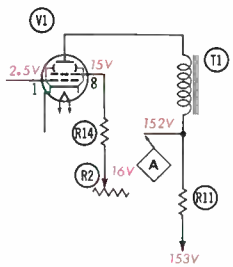
Waveform Analysis





Amplitude of W1 and W5 decreases by amount proportional to loss of height in raster. When R1 is turned to make sync pulses visible in W1, they are seen to have several times normal amplitude; this explains why raster splits in two, and gives hint of trouble in screen circuit. W6 includes full-strength sync signal, but pulses fed back from V1 are much weaker than normal.

Voltage and Component Analysis



Grid bias on V1 has decreased as consequence of weak signal fed back from plate to grid. DC plate and screen currents are considerably below normal—note reduced voltage drops across R11 and R14. Low VTVM readings in screen circuit indicate something wrong with screen-voltage source. Arm of R2 remains at 16 volts when control is turned; this proves control is inoperative. Screen continues to receive small positive DC voltage from brightness-control circuit via R16. (Normal function of this connection is to reduce screen voltage slightly at high brightness settings, thereby reducing interaction between height and brightness.)

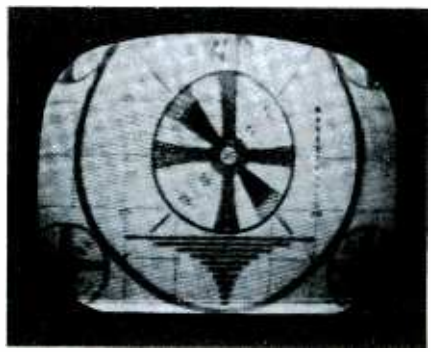
Best Bet: VTVM tracks down this trouble.

SYMPTOM 6

Top Stretched

Intermittent Vertical Jitter

R8 Increased in Value

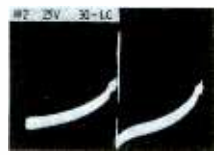


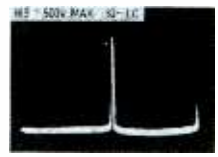
Symptom Analysis

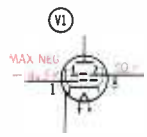
Top of raster is stretched; bottom edge pulls away from border of screen, and may fold over. Least distortion is obtained at minimum-resistance setting of R3. When jitter occurs, R2 as well as R1 must be readjusted to stop it, at some sacrifice of linearity.

Waveform Analysis

Most abnormal waveform is W2; it's very weak and has distorted slope. Just as in Symptom 1, this abnormality points to defect in feedback and waveshaping network between plate and grid. Checking amplitude of pulses in W3 gives more evidence. Maximum value, with both R2 and R3 at clockwise limit of rotation, is 500 volts. Circuit should be capable of developing 800 volts.







Voltage and Component Analysis

Before assuming grid voltage of V1 is "within tolerance," remember that R3 has to be set to minimum resistance for best linearity. At this setting, approximately 12 volts of bias should be developed at grid. Insufficient bias, like weak grid waveform, is often a symptom of faulty feedback from plate of V1. Components in feedback network give relatively little trouble, but may fail occasionally, because they carry high impulse voltages. In this instance, R8 nearly doubles in value. Change in value of C3 would be most likely to cause frequency error. Jitter sometimes develops in normal circuit; can be stopped with controls.

Best Bet: Scope or VTVM; then component tests.

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Circle 14 on literature card

TEST EQUIPMENT for the modern bench

Older instruments are being outmoded by progress . . . by George F. Corne, Jr.

Not so many years ago, you could enter almost any service shop and find only the simplest of test equipment. You'd see at least a VOM or VTVM, some simple type of tube tester, and probably an RF generator. Occasionally, an oscilloscope would meet your eye, and once in a while a sweep generator. These basic instruments were perfectly suitable to service the few types of home entertainment equipment then on the market. Receiver design was confined to ordinary tube-type radios, phonos, TV chassis, and an occasional heavy-weight portable radio.

Contrast that picture with the variety of instruments needed to service modern electronic equipment. Now you have color TV, stereo FM, stereo amplifiers, complicated intercom systems, Citizens Band and two-way radio gear, plus numerous equipment designs utilizing semiconductors. Invariably, this modern equipment demands up-to-date test instruments for servicing. Let's examine some of the test equipment you might need in a modern shop—particularly in the fields of color TV and stereo FM, where the necessity for adequate test gear is most urgently felt at the present time. We'll present some of the latest types and discuss why you might need them.

Color TV

There's no need to dwell on why special test equipment is necessary for servicing color receivers. It's simply a case of "must have" to do the job *properly*. Let's look at some of the features these instruments should have.

Color Bar-Dot Generator

The various patterns available from this type of instrument are used primarily for convergence of the picture tube beams and alignment of the chroma circuits. Some produce an array of different-colored bars covering the complete CRT; others produce only one or two color bars. Often, those that produce one or two bars will also supply one or two *reference* bars of a neutral color. The color-bar pattern(s) can be used for several checks of color receiver operation:

1. to see if the receiver under test

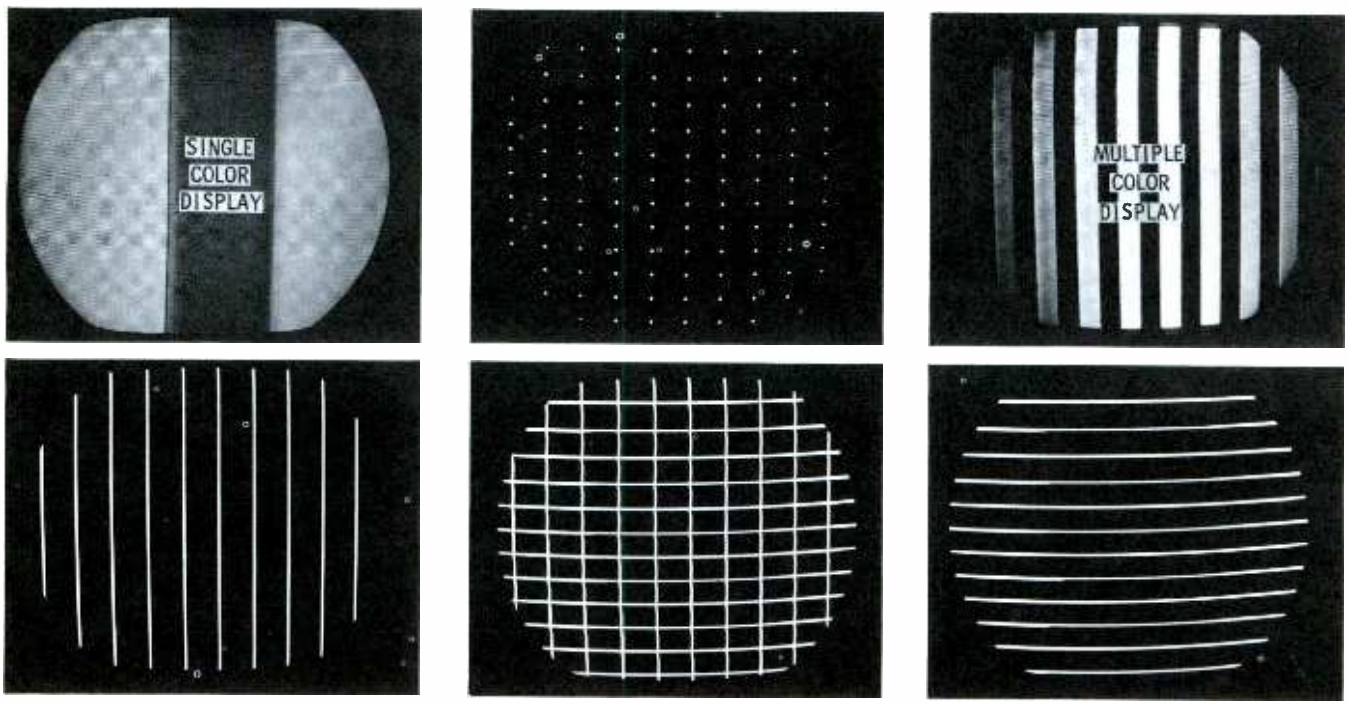


Fig. 1. Majority of bar-dot generators on the market will produce patterns similar to these.

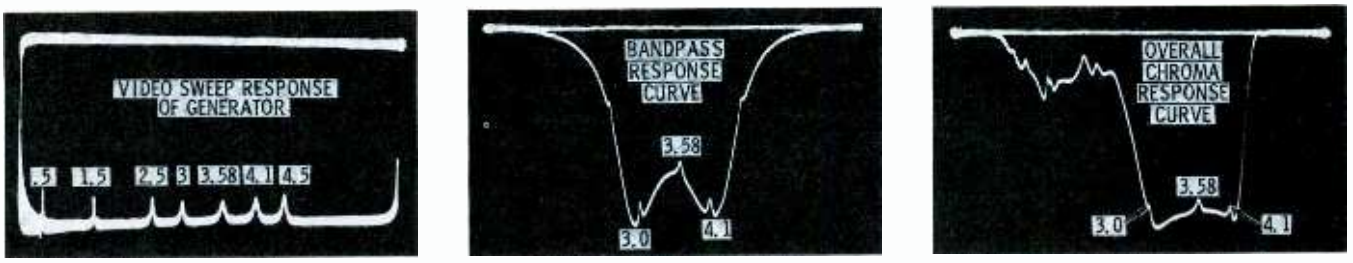


Fig. 2. Generator must be good "sweeper" to align chroma bandpass circuits in color receiver.

will produce color;

2. to locate faults by signal tracing throughout the color circuits;
3. to align the color demodulator and color sync stages; and
4. to perform operational checks in the absence of a station signal.

Many instruments have a front-panel control that can be used to vary the color subcarrier signal from zero up to twice the normal amplitude. The 100% setting usually simulates the normal amplitude of the burst signal (or fully saturated color) from a station transmitter. If the bars lose color sync at or slightly below this setting, color sync action is poor and further checking of the chroma and sync section is in order. Usually, if the color receiver is operating normally, the color bars will hold sync until the colors completely disappear from the screen.

If you have an instrument that is not equipped with a subcarrier control you can check operation of the sync and color circuits in a different manner. With the receiver tuned to the color bar signal, disconnect the generator leads from the antenna input terminals on the TV, and merely lay them in close proximity to the tuner. If the color set is operating normally, you'll still see the color bars—in sync—on the screen. Of course, the signal will be weak and snowy, but it gives a good operational check.

In addition to the color pattern, most instruments produce separate displays of dots, vertical and horizontal bars, and both types of bars combined (a crosshatch); some have only the crosshatch pattern. The photos in Fig. 1 show the video patterns available from most color-bar generators. (These patterns can also help you make vertical and horizontal linearity adjustments in black-and-white as well as color sets.)

Many generators also include some type of sound signal, mostly as an aid in tuning the receiver to the generator signal. This sound signal can usually be turned off, to prevent interference in the pattern.

In several of the instruments, you'll find additional features. Some offer a color-gun interrupter switch—operating through a plug and socket adaptor for the picture tube; for a similar purpose, others provide special clip leads for connection to the CRT grids. Certain generators have pin-jack connections on the front panel to check the waveforms at the grids of the picture tube. This feature simplifies color demodulator phasing adjustments, using a scope; it's not even necessary to remove the color TV chassis from its cabinet.

Oscilloscope

Many technicians still fail to see the servicing advantages of an oscilloscope. Some don't even own one; others do, but really don't *use* it. Why measure DC voltages at eight or ten points in a circuit, when one or two signal-waveform checks will often pinpoint the trouble? *Then* is the time for the VTVM! You may have gotten by without a scope in servicing black-and-white receivers, but one is just about a necessity for color servicing.

To properly view color receiver waveforms, you'll need a wideband scope, whose frequency response is from 10 cps to at least 5 mc. In addition, it should have a high-intensity trace and good sensitivity—say, at least 25-30 mv per inch of deflection. You'll find that most service scopes presently on the market are designed with these

● *Please turn to page 71*

Test Equipment Checklist

EQUIPMENT	WHY NEEDED	FEATURES TO CHECK FOR
Color Bar-Dot Generator	Impractical to service color receiver without one.	Types of patterns available; RF and/or video outputs; sound signal; extras — CRT gun killing provisions, variable color control, waveform jacks, shading bars, individual color signals (R-Y, B-Y, G-Y).
Oscilloscope	Necessary for color receivers; makes signal tracing, alignment, and servicing easier in other electronic equipment.	Good sensitivity; wideband vertical amplifiers.
Sweep Generator	For critical RF-IF adjustments, and for chroma bandpass alignment in color receivers.	Should be capable of delivering video sweep output as low as the range from .05 to 5 mcs (for color applications).
RF Generator	To supply CW signals needed during alignment, and RF carrier used during VSM alignment of color receiver.	Provisions for crystal calibration; outputs in 40 to 150 mc range.
Marker Adder	Provides means to superimpose marker signal on response curves, without passing marker signal through receiver circuits; it thus permits more exact viewing of marker, without distorting shape of response curve.	Separate or built-in units; usually have marker amplitude control; some have selection of different marker shapes.
Stereo FM Generator	For the alignment and trouble-shooting of FM multiplex receiver circuits.	Most instruments have similar signal outputs; some have built-in audio modulation source; some have RF carrier output.

Servicing Industrial Electronics by Leo G. Sands

ELECTRONICS in the DARKROOM

Practically every community has at least one photofinishing establishment. Since most photofinishers cannot afford to employ the manual methods used by amateurs, nearly all use electronic devices of some sort. Hence, this is another market for the electronic-equipment serviceman.

The most widely used electronic device in darkrooms is an ordinary intercom. The "hands free" remote station has been a must for a quarter century in darkrooms where personnel cannot turn on the lights to find a ringing telephone.

In the strictly photographic line, simple electronic devices that control complex machines make possible better quality prints and more production per working day. These machines print positive photographic prints on rolls of photosensitive paper and cut them into individual snapshots. Some machines also sort and mark prints, reducing manual labor in filling customer orders.

The light-meter principle is the most widely used application of electronics in photography. The intensity of light falling on a light-sensitive cell determines the voltage or current output, which can be measured by a sensitive meter. In some applications, a change in light level actuates a relay. This latter principle is used in the darkroom to control print exposure time and to control cutting and sorting of photographic roll paper.

Regulating Exposure Time

An RC circuit and a thyratron (Fig. 1) are used in various types of roll-paper printing machines to control print exposure time automatically. The thyratron shuts off the printing lamp as dictated by the time constant of the exposure controls.

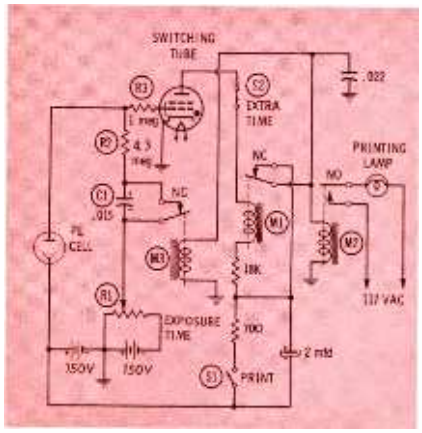


Fig. 1. RC circuit and thyratron in printing machine automatically sense exposure time.

The printing cycle is started by closing switch S1, which applies plate voltage to the thyratron. At the same time, 150 volts is applied to the coils of relays M2 and M3 through the normally closed contacts of M1. The printing lamp is turned on when M2 is actuated. At the same time, the contacts of M3 open and remove the short circuit across timing capacitor C1. Relay M1 does not pull in immediately, since

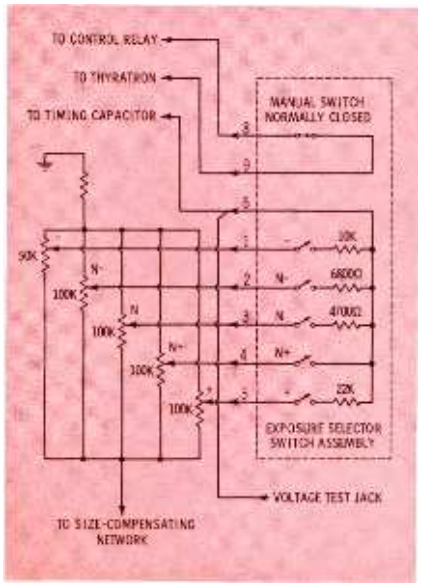


Fig. 2. Exposure time for prints is controlled by switches and preset potentiometers.

the thyratron is biased beyond its firing point by a negative DC voltage from sensitivity control R1.

When the printing lamp glows, light passes through the film negative to the photoelectric (PE) cell, which then conducts. The brighter the light passing through the negative, the greater the current through the PE cell.

When the PE cell conducts, capacitor C1 starts to charge in the polarity indicated in Fig. 1. The charging time depends upon the PE cell resistance—which is a function of light intensity. When C1 has charged sufficiently to reduce the negative potential on the thyratron to about −2 volts, the thyratron fires, causing relay M1 to pull in. Its contacts then open, releasing relays M2 and M3. The printing lamp is shut off, ending the printing cycle, and M3 short-circuits the charge in C1. The thyratron continues to conduct until S1 is released, but the printing exposure has already been stopped. If the operator wishes to expose the print longer than the time determined automatically, he pushes both S1 and normally closed switch S2, which prevents the thyratron from firing until S2 is released. At the end of the printing cycle, S1 is released; when it is again set to the "on" position, the printing cycle starts over.

A somewhat different principle is employed in the photoelectric control unit, shown schematically in Fig. 2. Instead of a simple potentiometer (R1) as shown in Fig. 1, exposure time is selected by one of five switches. Each of the switches is fed a negative DC voltage through a potentiometer which can be set individually.

In a roll-paper color printer, photoelectric cells are used for controlling printing lamps, choosing

filters, and setting exposure time. The machine seems electrically and mechanically complex, employing more than a dozen tubes, a half-dozen photocells, regulated power supplies, and numerous relays and precision resistive networks. It is designed to help control the quality of color-photo printing, utilizing 500′ rolls of photosensitive paper.

While the machine as a whole appears complicated, each of its several circuit sections is basically simple. One of the light-measuring circuits, of which there are three (for sensing red, green, or blue), is shown in simplified form in Fig. 3.

The thyratron cathode is normally biased positive to prevent conduction, but bias is also affected by a negative voltage applied to the grid from R2. When S1 is opened and light is intercepted by the photocell, it conducts and charges C1 in the indicated polarity. When the positive charge across C1 is large enough to offset the fixed and cathode bias, the thyratron fires, pulling in the relay.

The firing point is controlled by the setting of R1, which determines "resting" bias. The negative grid voltage in actual equipment is selected by a complex precision resistive network and is controlled by electronic circuits to provide the required timing slope characteristics.

Automatic Size Controls

A unique thyratron triggering circuit is used in one automatic roll-paper cutter (Fig. 4). As the paper passes through the machine, conductive graphite marks on the back of the prints are sensed by a contact assembly. The electrical signal resulting from conduction through the graphite mark initiates the paper-cutting cycle.

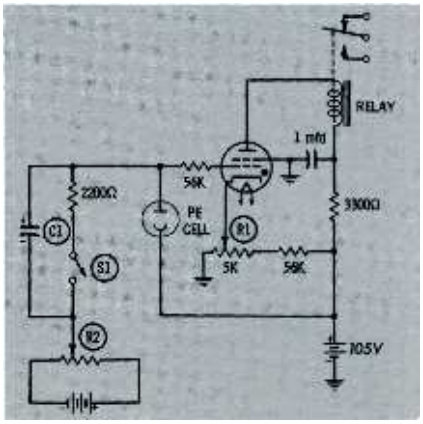


Fig. 3. One of three light-measuring circuits of color printer shown in simplified form.

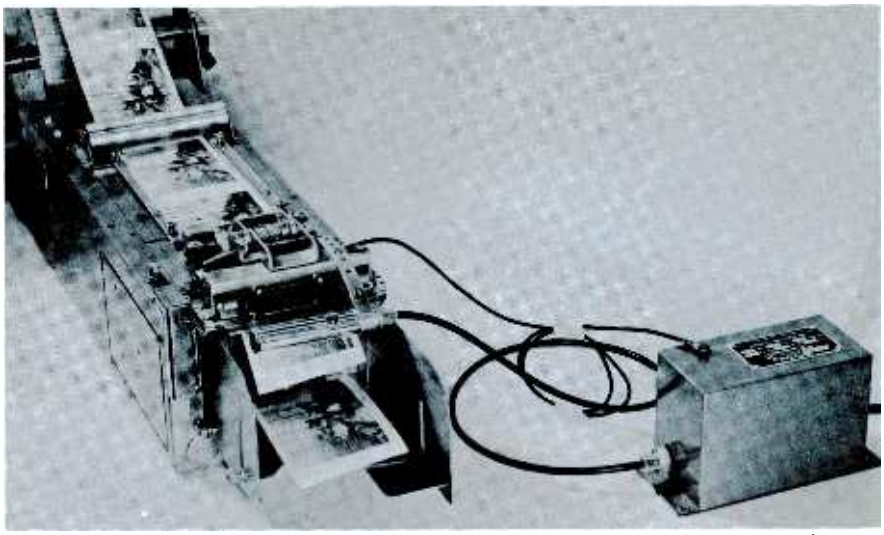


Fig. 4. An automatic roll-paper cutting machine and its associated power supply.

The sensing contacts are identified as pickup S1 in Fig. 5. Normally the circuit through S1 is open, closing momentarily when shorted by a graphite mark. The thyratron is normally biased so it does not conduct, since the cathode is connected to the junction of R1 and R2—a point which is positive with respect to the grid end of R1. When S1 is closed, the grid is grounded through R3. Since the positive instead of the negative side of the plate voltage is grounded, the grid also becomes positive when S1 is closed. The thyratron fires and pulls in the relay.

A mark-detecting scheme which is sensitive to the intensity of light transmitted through processed print paper, or reflected from it, is employed in another machine which cuts and sorts roll paper. A tiny graphite, ink, or photographic mark —in the form of a rectangle, spot, emblem, trade mark, or even a date imprint—will actuate the sensing device (Fig. 6). The mark is "seen" by a miniature photocell. The light passing through the paper, or reflected from it, is focused on the photocell by a simple optical system.

The output of the photocell is fed to an amplifier through a twisted-pair cable, shielded to minimize noise and hum pickup. The photocell is excited by a DC voltage, regulated by an NE-16 neon lamp. The sudden drop in current through the PE cell, which occurs when a mark is detected, causes the grid of V2 to receive a negative pulse. The positive-going pulse from the plate of V2 triggers the thyratron. Relay M1 pulls in momentarily, and its contacts in turn energize power relay M2.

Ordinarily, a thyratron that is operated with DC plate voltage continues to conduct until the plate voltage is removed. In this circuit, the plate voltage is in effect removed automatically. Before the thyratron fires, current flows through the high-resistance path consisting of R2, R3, and the coil of relay M1—charging C1. Current flow ceases when C1 is fully charged, and C1 maintains plate voltage at a high level.

When the thyratron is fired, C1 discharges through the low-resistance path within the tube. R1 serves as a current limiter to prevent tube damage. The plate voltage drops below the thyratron's extinguishing voltage, causing it to stop conducting. Current flows through the coil of M1 long enough for its contacts to close, allowing C1 to regain its full charge. The thyratron plate voltage is restored, but the tube will not fire again until triggered by a pulse.

In most radio receivers and elec-

● *Please turn to page 73*

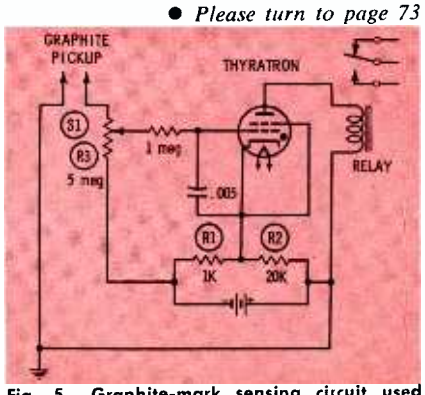
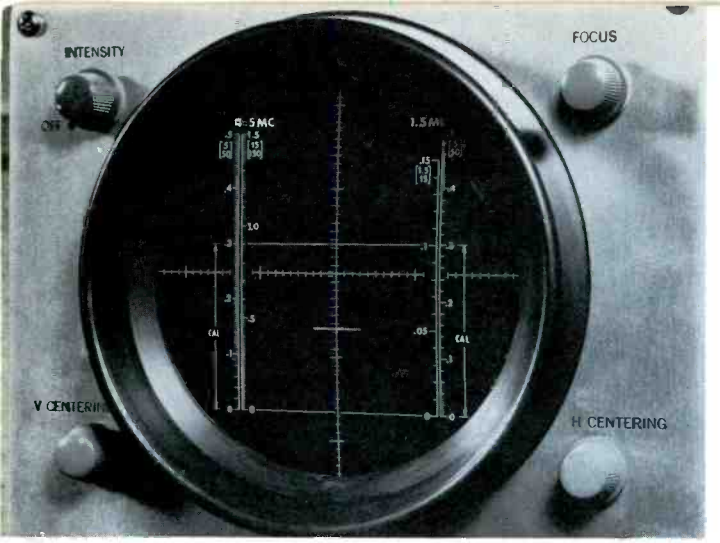


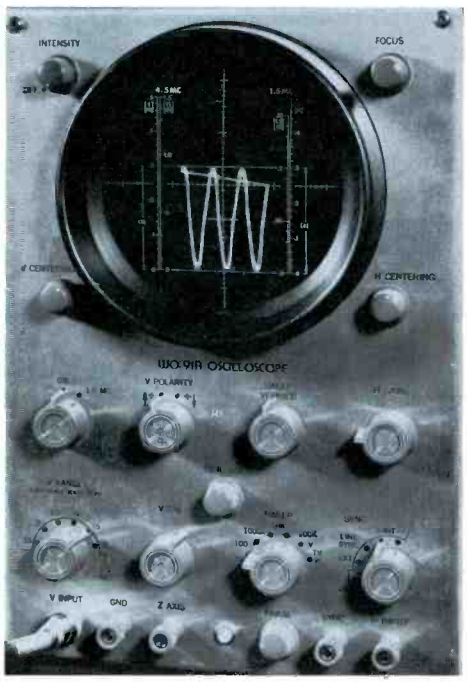
Fig. 5. Graphite-mark sensing circuit used in one type of roll-paper cutting machine.



Some scope graticules are marked for direct reading, with a numbered voltage scale; a few have several scales that correspond with settings of the vertical range switch. The graticule shown here has four scales; with the range switch set to the .5-volt setting and the bandswitch at 1.5 mc, voltages must be read from the extreme right-hand .5-volt scale.

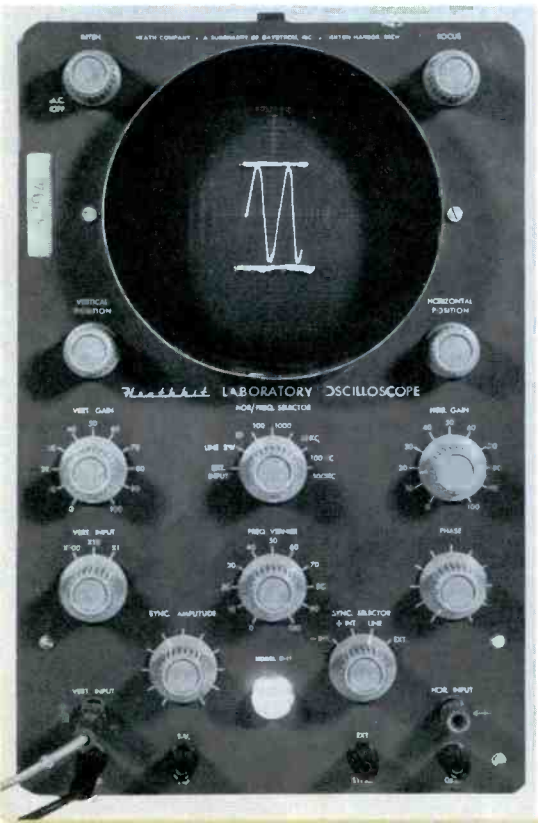
VOL MEASUR WITH A

Some scopes have a special switch setting for internal calibration. On this one, it is part of the bandswitch. With the switch set for calibration, a fixed-value sine wave is displayed on the screen. The vertical controls are then adjusted so the waveform just fits between the two horizontal lines marked for calibration purposes. With the bandswitch returned to the desired band setting, the scope is ready for measuring; the voltage value can be read directly.



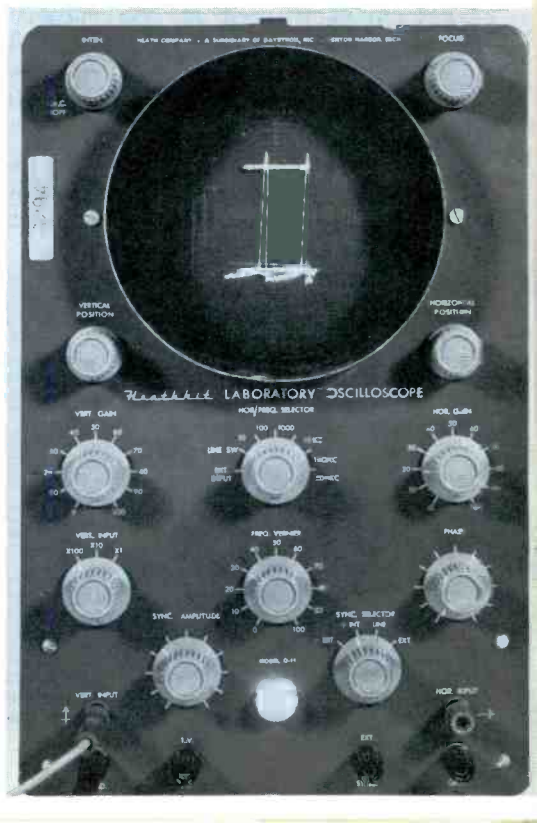
Anyone with the skill to use an ordinary VTVM can easily use his scope as a voltage-measuring instrument. In fact, certain scope functions can be likened to those of a VTVM. For instance, the voltage-range switch of a VTVM can be considered equivalent to the vertical multiplier switch of a scope, since they both determine the "full-scale" range of the voltage indicator. Also, the vertical gain control of a scope is somewhat like the "zero" control of a VTVM.

The only real difference between measuring with a scope and with a VTVM is

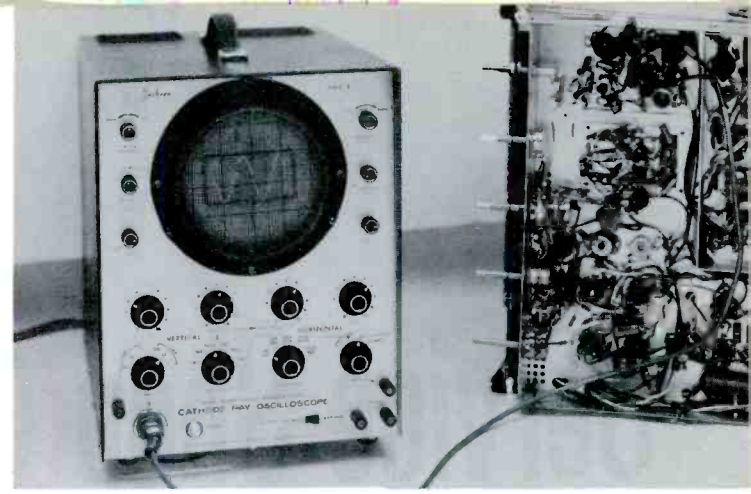


The 6.3 volt rms calibrating voltage used in this photo can be found at any filament pin in most parallel-wired chassis. The displayed waveform measures 18 volts peak to peak (2.8 times the rms value). Therefore, the gain control is set so the trace covers 18 scale divisions from top to bottom. (This graticule has been marked to facilitate setting up for exactly 18 divisions of vertical deflection.)

Initially, the vertical gain switch was in the x10 position, and each small division of the graticule equalled 1 volt, because we'd set the vertical gain control that way. Now, if we change the switch setting to x100, each scale division represents 10 volts peak to peak; therefore, the waveform shown in this photo measures about 230 volts peak to peak. In the x1 position, for measuring small signals, each scale division is made to represent .1 volt or 100 mv.

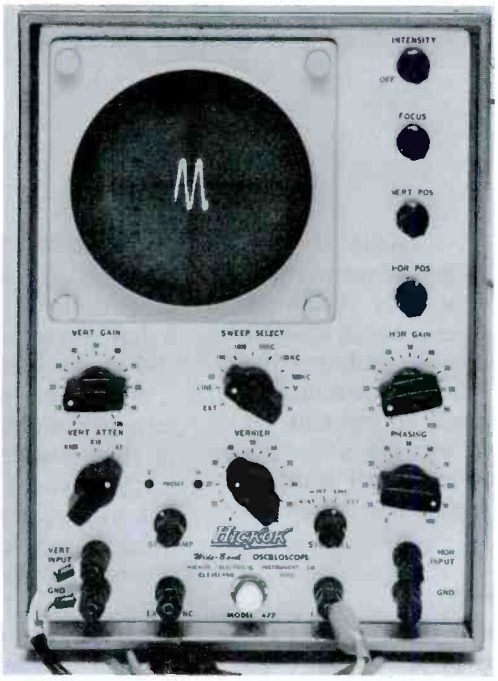


Another way to calibrate a scope of this type is to connect the vertical leads to a known external voltage, and adjust the gain switch and control so the waveform measures a certain number of scale divisions from top to bottom (peak to peak). With a reference voltage thus established, the scope is ready for measurements like those shown in the next photos.

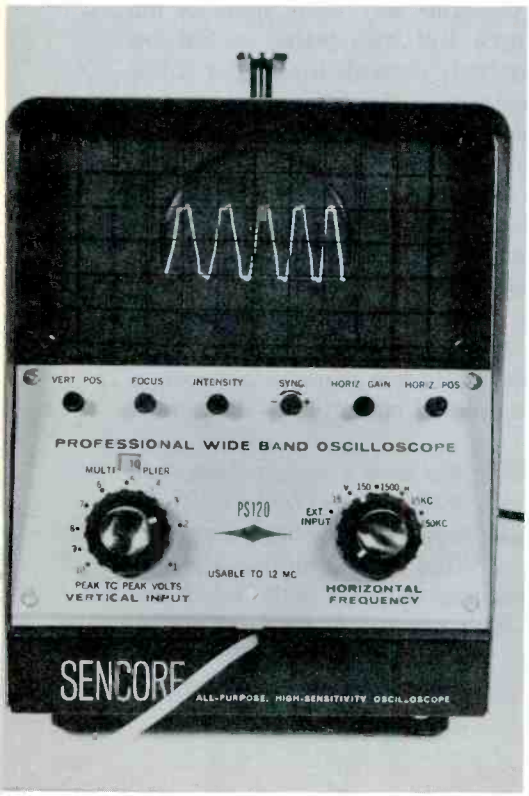


TAGE EMENTS SCOPE

in the method of displaying or indicating the voltage value. A VTVM has a numbered scale, with a needle to point out the measured value; a scope, on the other hand, has a marked screen (graticule) over the CRT face to serve as a scale, while the distance from top to bottom of the waveform serves as the indicator. From the height of the signal waveform on this graticule, its value can be measured—just as upscale travel of a VTVM pointer measures voltage. The accompanying photographs show some of the more popular methods.

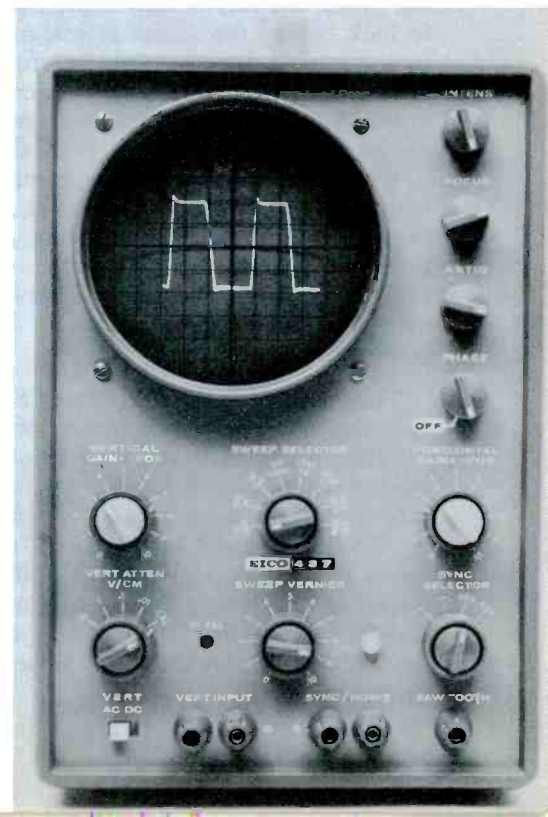


Another type of scope has a 1-volt peak to peak calibration terminal on the front panel. The vertical test lead, or a jumper, will apply the signal from this terminal to the vertical input, and you can adjust the vertical gain to obtain a trace of some arbitrary height—say one inch. Then with the same control settings, any signal corresponding to this same height is equal to 1 volt. The multiplier switch permits measuring larger voltages—as you'll see.



A completely different type of scope is shown here; this one needs no calibrating. The graticule is marked off into horizontal and vertical lines 1/2" apart, and the scope is a direct-reading voltmeter. To use it, you merely adjust the multiplier switch and gain control for a trace exactly 1" high on the CRT face, and check the settings of these two controls. The gain setting times the multiplier is the voltage of the signal—in this photo, 25 volts.

From the standpoint of voltage measurement, the scope shown here is a cross between previous types. With the vertical attenuator in the "calibrate" position, a .04 volt (40 mv) signal is displayed on the CRT. The vertical controls are adjusted so the trace covers exactly four scale divisions; then each division represents 10 mv, and the scope has been calibrated to .01 volt per division (centimeter). Other settings indicate the value of each graticule division.



Service Shop 1974

Take a squint at our freshly polished crystal ball

One decade . . . ten years . . . one-third of a generation. On the one hand, such a period seems long; on the other, it seems to have begun only yesterday. What of significance was happening ten years ago? UHF was a clumsy infant; color television was suffering the pangs of birth; transistor radios for home entertainment were hardly conceived; stereo FM was nonexistent. If the ten short years just past have brought such far-reaching advances, it is reasonable to expect startling changes in consumer electronics within the decade to come.

A Peek At Progress

If electronic development has been rapid in the past, its future should be nothing short of spectacular; the rate of "acceleration" seems to increase with each passing year. On recent field trips, we've been privileged to look behind the scenes at research that will lead to new electronic devices, vastly improved test instruments, and exotic changes in present electronics gear. And many of these new products will appear on the market in just a short time—a few years at the most.

With such startling developments snowballing, and with millions of dollars being spent on research, service businesses in 1974 will probably present a mode of operation considerably different from that of the present-day shop. Let's do a bit of crystal-gazing and eavesdrop on a conversation in a service shop ten years from now. . . .

The owner of Jack's Electronics Service looked up as Bill, the new bench man, called over to him:

"Hey, Jack, is it okay to check the plate of the vertical output tube in an old set with this new automatic scope? Or is the voltage too high?"

"Go right ahead," Jack replied, "it'll handle anything up to 1500 volts peak to peak, although it'll take just a split second longer for the pattern to stabilize at the standard 2″ height. But when it does, you can read the voltage off the dial the same as for any other waveform."

He mused to himself, "I'm glad they finally perfected that self-locking scope circuit. If it saves as much time as those range-seeking VTVM's I bought a few years ago, it will have paid for itself by the end of the year."

Bill broke into his thoughts with the remark, "This set needs a .022, 1000 volt capacitor. We're about out of those—want me to make a reorder memo?"

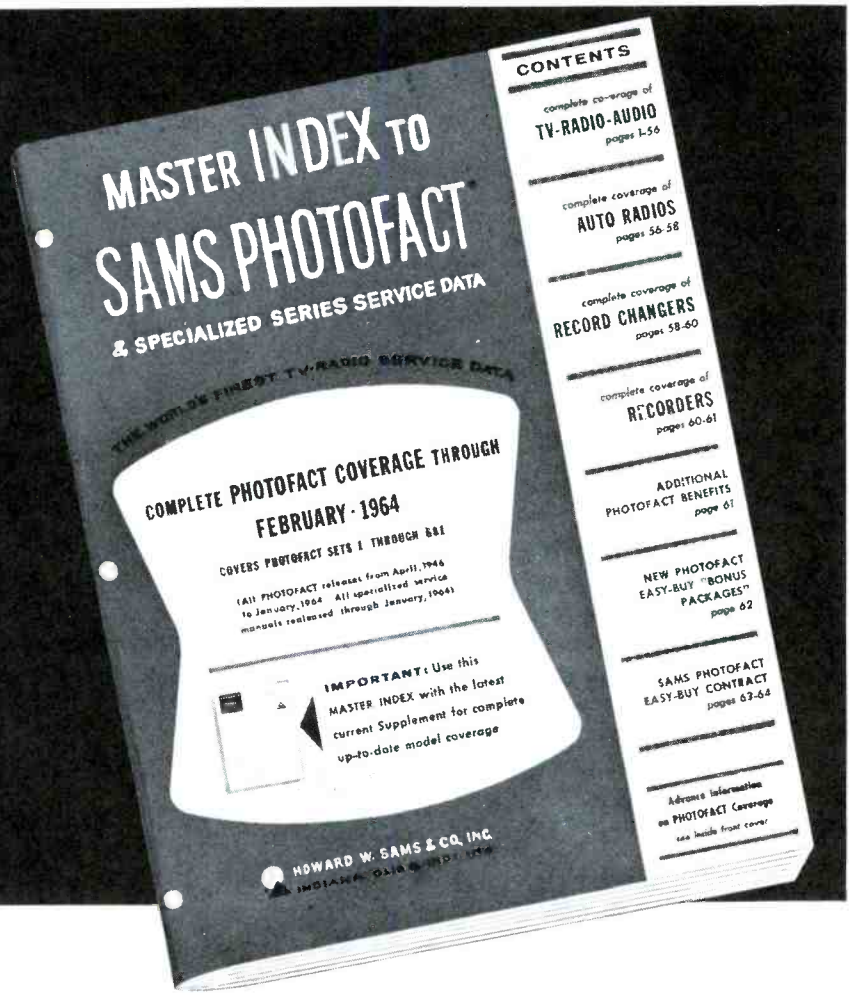
"Yes, you'd better do that," decided Jack. "I still like to keep a few tubular capacitors around the shop, even though Johnny could bring what we need within a couple of hours on his regular parts run. People are hanging on to their old color TV's and stereos, and a capacitor lets go every now and then. And if that's all that's wrong, they seem to be in favor of getting the sets fixed.

"Wish they'd feel the same way about more of the old black-and-white sets. But with prices so low on new ones, almost everybody discards a set after a few years, rather than have it fixed. It's almost as bad as with radios; I'm glad we're not trying to make our living off those things anymore.

"People may feel a little more conservative with these new, super-thin, wall-hung sets. Every model costs as much as a conventional color set, and I hear it'll be some time before they bring the prices down. Even so, this design seems to be clicking with the public. It might even bring monochrome TV back into the living room for a while, until some manufacturer comes up with a brighter wall-hung color tube—then we're off again!"

Bill interjected, "That was sure a neat-looking wall set I saw at the service meeting last Wednesday! It has a system of plug-in solid state modules along the top edge of the frame. What I liked most is the way they bring all the input and output signals out to test points on the back—with photos of the signal waveforms right alongside. The modules are all slightly different in size—so not even a do-it-yourselfer can

need reliable service data?



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plug them into the wrong connections."

"A do-it-yourselfer who tangles with one of these modular sets will be as helpless as a fish out of water," Jack observed dryly, "unless he stocks up on a complete set of replacements. I've checked into all seven brands of wall-hung sets that have appeared thus far, and only two modules in the whole bunch were alike. With so little standardization, not to mention the complex internal structure of these units, it won't be practical to design a quick-check module tester—so I don't think we need to fear a rebirth of the 'test-'em-yourself' fad.

"That type of thing was pretty well finished off by the constant turnover in tube types during the '60s. It got mighty discouraging for the average DIY to find replacements for his 'bad' tubes continually out of stock. The store owner could order a tube for him, but he wasted a day or so finding out—moreoften than not—that he didn't really need the tube after all.

"Thank goodness most set makers soldered the transistors into their sets right from the start, before anyone had a chance to get DIY transistor testers off the ground.

"We're in pretty good shape, ourselves, thanks to refining our signal-tracing techniques for closer isolation of bad stages. We can pinpoint a faulty module, tube, or what have you, and call for a replacement on the next parts run—and have the set operating in a few hours at the most.

"It's good discipline, having to be reasonably sure we need a part before ordering it; the impracticality of keeping a complete parts stock finally got through to us. I remember the huge tube caddy I used to haul around on service calls, trying to fix sets in the home. Nor was it any snap to lug those heavy old sets into the shop.

"This was why we started promoting speedy pickup and delivery service. By concentrating on efficient processing of sets on the bench, we reduced our shop service costs enough to make home service unattractive. Now only the most hard-shelled customers hold out for repairs in the home.

"To pacify them, and to satisfy those birds who insist on a firm estimate before we pull a chassis, I'm thinking of getting one of those new microcircuit *Home-Pak* testers. It will handle a complete range of tests, and the visual displays really impress this type of customer. It's expensive, but I'll make a point of setting the fees on this type of call high enough to recover my investment. Such customers will usually pay a stiff charge to get the type of service they want."

Bill interrupted, "How come you never went for those mobile shops like so many of the other shops did? They seemed like a fine way to handle service."

"I thought about that a lot, too, but it didn't make too much sense in light of the parts problem. Instead of tying up a lot of money in a big inventory, or chasing constantly after parts, I find it easier and cheaper to let Johnny and the pickup-delivery crews fight the traffic, while we concentrate on servicing.

"Staying put, right here in the shopping center, has

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many advantages. The sales department does a brisk business; we have a nice steady activity on our maintenance contracts for the music and paging systems and the home teleshopper transmitters and receivers; and we're getting more and more carry-in service trade. Already, quite a few women have stopped in, carrying a wall TV under one arm or a cartridge-type color chassis in a shopping bag. Just last week, one girl opened her purse and took out a micro-TV. Quite often we have the sets repaired by the time the customer is ready to go home for the day."

Jack interrupted his monologue to direct a question at the audio technician on the far side of the shop: "What's the matter, Sid? You look perturbed about something."

"Oh, it's the cleaning head on this supersonic dirt remover. It won't get rid of this greasy dirt long enough to let me follow the wring paths on this circuit board."

"Check across terminals 2 and 4 on the connector," Jack advised. "If the scope shows a good 150-volt signal it's probably ready for a new transducer. That's one item we do have in stock, so you ought to be able to finish this job as clean as a whistle."

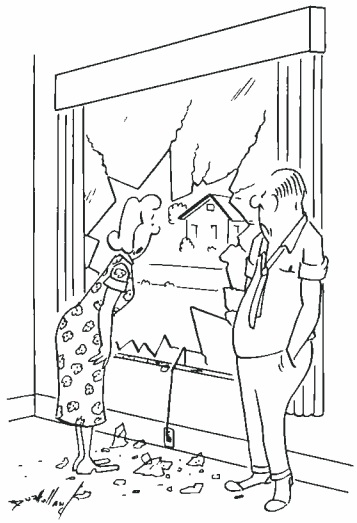
"Yeah, I know," Sid gibed, "a dog whistle."

Jack forced a smile and resumed talking to Bill. Nodding toward the 70° color CRT setup in the corner, he remarked, "We'd better get rid of that old relic one of these days; we need the space! I'm planning to get a new color test setup with a Type C fax-printer readout, and it will just about fit in that spot."

The phone chimed, and Jack spoke into it: "Jack's Electronics . . . tape recorder? . . . garbled sound . . . let's see, now, that's 18 . . . 4 . . . 34 . . . Westwood. All right, we'll have a man on the way in five minutes. Thank you for calling us."

Turning toward the dispatch console, he mumbled, "Guess I'd better flag down Jim and head him over toward Westwood."

Bill piped up, "Don't get Jim all rattled when you buzz him on that new visicom system in his wagon. He says, with that little viewing screen on the dash, he feels like Big Brother is watching him."



"You could at least have waited for the TV repairman"

Can you afford to guess

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SWEEP CIRCUIT ANALYZER
MODEL SS117

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- Horizontal Output Transformer: Checked for power transfer in circuit and read as good or bad on meter.
- Horizontal Deflection Yoke: Checked by direct substitution with adjustable universal yoke on SS117.
- Vertical Oscillator: Checked by substituting 60 cycle synchronized oscillator.
- Vertical Output Transformer: By simple signal injection for full height on picture tube.
- Vertical Deflection Yoke: By signal substitution for full height on picture tube.
- Sync Stages: Checked by synchronizing triggered horizontal SS117 oscillator from any stage. If oscillator synchronizes, sync is O.K.
- 2nd Anode Voltage: A new dynamic check using simulated picture tube load. C.R.T. does not need to be operating for current tests. No interpretations—read direct from 0 to 30 KV.
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. . . and the dream fades back into the world of stark reality. But the facts remain; equipment similar to this is already in the design and development stage. Person-to-person signalling systems, subminiature color receivers, picture-frame TV sets, electronic kitchens, both visual and aural stereo, wristwatch intercoms, autos, busses, and planes equipped with TV and stereo AM and FM plus cartridge-tape playback units, all sorts of electronic safety devices—are but a few of the countless devices that the service shop of 1974 will be called upon to service.

The Future Is Yours

The complexion of servicing will change, and many chores will be automated. As electronic devices become more exotic, so will the instruments for servicing them. More thorough, more accurate, more convenient—will be the watchword of test equipment designers.

In 1974, only a few short years from today, there will be service shops that continue to service only equipment that is several years old—just as there are service technicians today who don't service color sets, stereo FM, or transistor radios. But the progressives, those who aren't satisfied just to survive, but who insist on prospering as well, will meet each new service challenge as it arises. They will tailor their abilities and facilities to the demands of the coming changes, and supply the increased demand for capable service.

Some will feel "the devices are too complicated," and will drop out of the service business, or will be content to struggle along with antiquated equipment and ideas. A few are going to find that the business has become too competitive, for it certainly will; there will be a high premium placed on new ideas and forward thinking.

But there will be a satisfying number—larger than the ranks of competent servicers in existence today—who recognize the tremendous possibilities in a society gone electronic; these latter-day pioneers will keep the business of independent electronic servicing growing and expanding. For them, the service shop of 1974 will be truly rewarding. ▲

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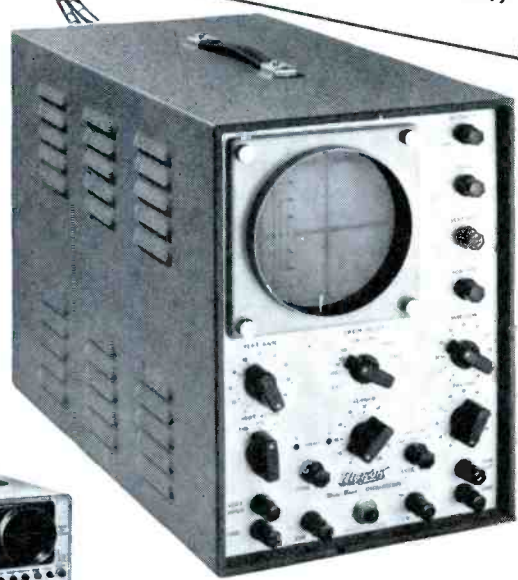
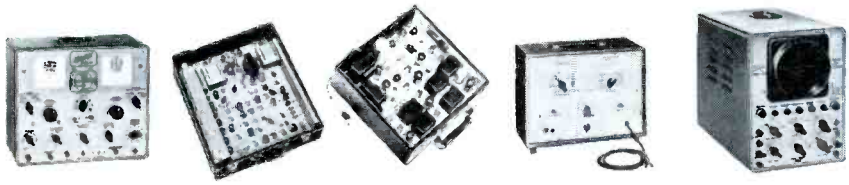


THE COMPLETE COLOR LINE



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you can Modernize your service business

By sticking to "old familiar" routine, you unknowingly waste time . . . by Wayne Lemons

Almost everyone, I suppose, would agree with the assumption that a service business should be modernized periodically. But where to start? What exactly to do? And what about the money it will cost? Perhaps the last of these questions is the logical starting place for this article, since most of us will, at one time or another, suffer from a shortage of ready cash.

On A Shoestring

It is likely that your wife has just recently moved the furniture, and it's also likely that you lodged a good-natured (?) complaint about it. Why did she do it? Simple, really; she's building her morale. She's making it an adventure to get up in the morning by eliminating part of the "old routine." Human psychology (especially that of Americans) thrives on change—even among those who steadfastly maintain it doesn't. Nothing is more stimulating to our nervous systems than change.

You can apply this psychology and play the game of "musical chairs" just as your wife does at home, and perhaps with even greater effect. Move some benches; install some new antenna outlets; purchase some new tools or a piece of needed test equipment; rearrange your office or your work space; brighten up the walls with a little paint. Then don't be surprised if you find all of a sudden that you like the service business better, your customers are a lot nicer, your cash register emits a more contented ring as it gobbles up the extra money you're making, and the thrill of owning your own business is finding its way back into your bones.

You can go further and multiply the benefits, still keeping the expense down. What about taking one of your present benches and outfitting it for some specialized job that has been a sort of hit-or-miss proposition until now? Maybe you are beginning to do a lot of transistor radio repair; why not a specially rigged bench just for transistor radios? Place the necessary test equipment where it will always be available—a power supply, a VOM or VTVM, a signal generator, a signal tracer, a transistor tester, etc. Tie the common leads of all these units together and you can make a lot of your tests on a transistor radio with a single probe.

Maybe you don't have enough transistor radio work yet to justify a separate bench; what about a bench for both transistor and auto radio work? The two together should keep the bench in almost continuous use. Or you might set up a bench specially equipped for tape recorders, record changers, or tuners. A bench of this sort is bound to increase your efficiency.

Another improvement to consider is a special color TV stall. This could be a dark corner of the shop (you actually need reduced illumination when you're making purity and convergence adjustments and setting background controls). This would also be the place for your new color test equipment, and the wiring and jigs that speed color servicing.

That Cluttered Look

No part of the country has a monopoly on the "cluttered look" that invades many radio and TV shops. Sometimes the shop owner may be "too close to the cabbage to see the cabbage patch" and so is blissfully unaware of the situation; but most shop owners know when their shops are a mess and just don't seem to know what to do about it—except be embarrassed and mumble a few words of apology.

What *can* you do about it? Generally, the cluttered look is the simple result of not having enough storage space. When space runs out, the harried serviceman starts piling the excess onto the floor or on top of a service bench; and the clutter swells like a malignant growth.

The remedy is quite as simple as the cause. Build some shelves! Build some storage space with doors! This form of modernizing can change the appearance of your shop to "neat and trim" almost overnight. (And while you're at it, why not throw away or give to charity those old sets you've been saving "for parts"? Or at least find a place to put them besides under the workbench!)

Storage cabinets with doors, dustproof or at least semi-dustproof, have other advantages besides just hiding the clutter. Many modern shops use cabinets of this sort to store equipment to be picked up by the customer. Small radios, tape recorders, and portable phonographs can be stored easily in these, and there is much less chance of breakage or misplacement. Besides, you also eliminate the embarrassing "dust-rag ritual" when the customer comes in to get his set.

What About the Floor?

Have you looked at your floor lately? (It may need only a good scrubbing.) Nothing improves the

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Tips for Technicians

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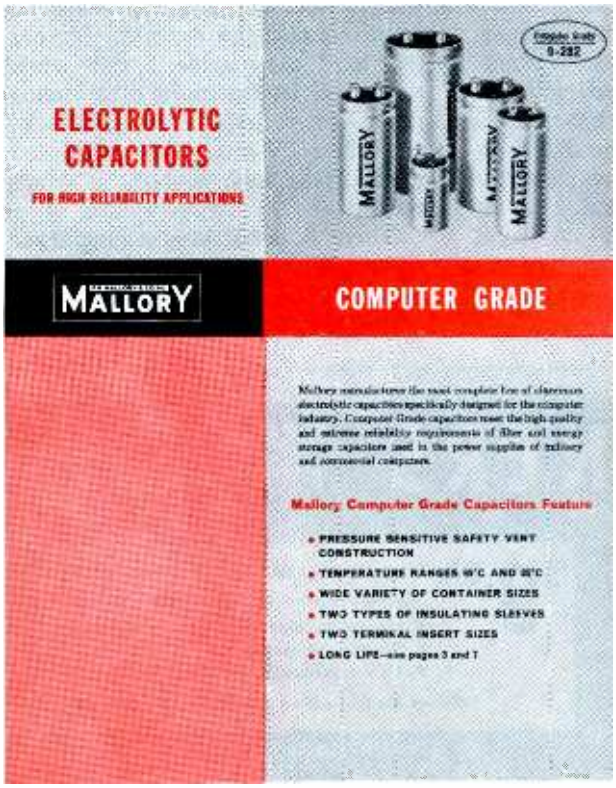
You may be occasionally confronted with the problem of finding a lot of capacitance. Maybe for a sound system where you want to squeeze the last bit of ripple out of a power supply. Or for brute-force filtering of low voltage, as in a DC supply for filament circuits.

If your first inclination is to round up a bunch of duals, triples and quads until they add up to the microfarads you need, then hook them in parallel—for the sake of your budget, resist the temptation and read the rest of our tip. For you can get a lot of capacitance in a single unit, at considerably lower cost, by using a Mallory Type CG Computer Grade Capacitor.



Ask your Mallory Distributor for Bulletin 9-282 on Computer Grade Capacitors. It lists all ratings which he carries in stock.

These are called computer grade because they were designed specifically for use in computer power supplies. But you don't need to own a computer to use them. What's special about them is the way they're made. Since they are expected to last practically forever, they are made of extra-pure materials and assembled with tender, loving care. All of which seems to pay off, for they turn out to be just about the purest microfarads you can find—very low in equivalent series resistance and d-c leakage. And life is almost unbelievable! We've tested them for the equivalent of *20 years* service at room temperature!

What *isn't* special about them is their price. In many instances, a single Type CG will cost less than half as much as the three or four conventional capacitors you would need to get the same rating. In standard stock case sizes, you can get as much as 75,000 mfd at 3 volts and 1300 mfd at 350 volts.

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appearance of a shop or showroom so dramatically as a new floor covering, or even just a paint job. Vinyl floors are easy to install and easy to clean.

For the showroom, if you sell sets, there's nothing like carpeting to give an appearance of luxury and a homelike atmosphere. One businessman, who installed carpeting over a previously unpainted concrete floor, reported he was closing almost 25% more sales than before, displaying exactly the same merchandise. If this is true, and I have no reason to doubt it, the results will pay for the modernization within a short time.

It is immaterial whether this increase resulted from customer appeal or from the owner's improved morale. Modernization can provide incentives, not only for customers but for the owner and his employees; and both changes will help increase profits and make everyone like his work better.

Put Up A Good Front

Building modernization is nearly always more expensive, but it can also pay higher dividends. Look at your building in the morning when you come to work. What could make it not only more presentable, but also more *inviting* to a prospective customer?

Look at the door and the doorway. Quite often, an otherwise presentable building is saddled with an unattractive entrance. What can you do about it? Look around your neighborhood, or at stores in other neighborhoods; you'll find a lot of ideas for improvement. A solid glass door is expensive, but it will last for years and is always a standing invitation to come inside.

What about your show window? When did you last change the display? Needless to say, the display should be somewhat more original and of later vintage than a ragged, twisted, faded, oversize "National Union" (or is it "Cunningham"?) tube carton.

Change that display. Add animation if you can. But whatever you do, change it. A show window is better closed off completely from the public eye if it doesn't have a fresh look about it. And don't forget to paint the trim.

Modernizing Service Techniques

Redecorating the building or rearranging the interior is by no means the only way to modernize. There is an area which may not be quite so noticeable to the customer but can mean a great deal more profit to you . . . what about your service techniques? Have they changed any in the last 10 years? If they haven't, you may be in for a rude awakening. Are you still saying, "I don't like to work on transistor radios" when what you mean is that you don't know *how* to work on transistor radios? Are you still saying that color is not ready yet, when what you really mean is that *you're* not ready for color?

If we are going to advance with the service business, we have to keep our thinking modern. It's not too hard to imagine a day when there will be no more tube radios made, or perhaps even no black-and-white TV sets. The undisputed reign of the tube is past—it won't return.

There is profit in servicing transistor radios. It has been proved over and over again. Color TV is really just beginning to take hold

FINEST MONEY-MAKER FOR Professional Servicemen

Multiple-Socket Speed with Gm Accuracy

PLUS OBSOLESCENCE PROTECTION

TESTS All TV and Radio Tubes —Old and New

TESTS Nuvistors and Novars

TESTS European Hi-Fi Tubes, Voltage Regulators, and Most Industrial Types

TESTS the New 10-Pin Tubes

TESTS for True Dynamic Mutual Conductance (Gm)

TESTS New 12-Pin Compactrons

TESTS BOTH OLD AND NEW TUBE TYPES—SELLS MORE TUBES PER CALL

Model 700 DYNA-QUIK DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER

All over the nation, thousands of professional servicemen rely on the "700". Once you use it, you'll be as enthusiastic as they are. *Everyday use has proved its speed . . . its accuracy . . . its efficiency.* This up-to-date, obsolescence-proof tube tester is designed for maximum use *today and tomorrow.* Provides multiple-socket section to quick-check most of the TV and radio tube types the *true dynamic mutual conductance way—plus* simplified switch section to check new tube types in Dyna-Quik emission circuit. Also includes provision for future new sockets.

Makes test under set-operating conditions. Checks each section of multi-section tubes separately. Checks for *all* shorts, grid emission, leakage and gas. Makes quick "life" test. Exclusive *adjustable* grid emission test provides *sensitivity to over 100 megohms.*

Makes complete tube test in seconds. Checks average set in a few minutes. Discovers weak tubes that need replacement. *Satisfies more customers. Sells more tubes. Saves call-backs. Insures your reputation. Pays for itself over and over again.* Net, $169.95

See your B&K Distributor or Write for Catalog AP21-R

Time-Saving, Money-Making Instruments Used by Professional Servicemen Everywhere

Model 960 Transistor Radio Analyst

Model 360 V O Matic Automatic VOM

Model 375 Dynamatic Automatic VTVM

Model 1076 Television Analyst

Model 445 CRT Rejuvenator Tester

NEW TUBE INFORMATION SERVICE

Available every 3 months, on subscription, for all B&K Dyna-Quik Tube Testers

B&K MANUFACTURING CO.

Division of DYNASCAN CORPORATION

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Circle 24 on literature card

and in perhaps just five years may represent the bulk of TV service income. Now is the time to modernize your attitudes, buy the equipment necessary to do this work, and be ready for the flood of business that will come to the man who is prepared to cope with it.

What about your test equipment? Is it up to date? Not long ago I was in a shop where the owner had spent the better part of two days trying to trace down an elusive case of "touchy vertical hold." He asked for my help. "Have you put a scope on the detector?" I asked. It turned out that his scope had been out of commission for almost a year.

I happened to have a new wide-band scope in my car, so I hooked it up. I touched the low-capacitance probe to the detector output, so I could tell whether the sync trouble was in the RF, IF, or sync circuits. The sync pulse was broken and jagged—almost unrecognizable. "It's likely AGC trouble," I said, "and since the picture isn't bending, I'd say you have an open AGC bypass." A quick check with a 2 mfd capacitor across the AGC line cleared up the scope pattern, and of course the vertical sync trouble.

Modern equipment would have turned this man's two-day dog into a profitable one-hour job.

What about the obsolete slow-setup tube tester? (Don't throw it away; it will come in handy for obsolete tubes!) Maybe you should take a long look at some of the new "speedy" tube checkers, especially for home service. They can save you time and also provide an accurate test of the most modern tubes. You can utilize the time you save to check *all* of the customer's tubes, thus increasing your tube sales and reducing callbacks.

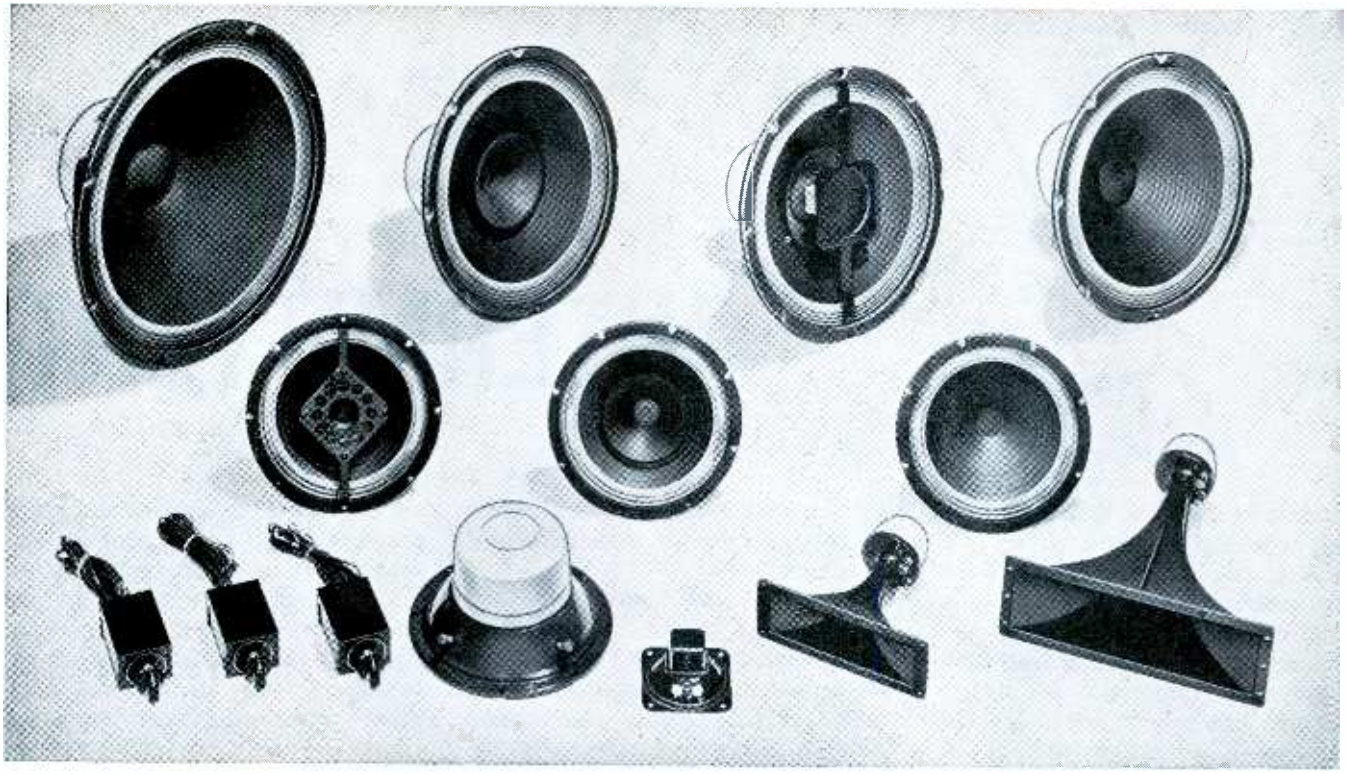
Investigate the many pieces of special equipment that have been deveioped for the service industry. Will they help you save time? Will they help you do a better job? If they will, you *need* them; it's as simple as that.

There are other ways to modernize your thinking. Take a look at your parts inventory. Is it adequate? Do you consider your time worth $5 to $20 an hour to the customer, and then spend an hour or two every day picking up a few pennies' worth of parts for routine repair jobs? With a 5-day week, at $5 per hour, an hour lost each work day means a direct loss of almost $1300 every year. Put that in your pocket.

If you have employees, find out their special aptitudes and interests. Then, if the potential business permits, let them train more in specialized fields. Get yourself a tape recorder specialist, a transistor radio specialist, an auto radio specialist, or any other that fits your needs. Buy each some books on his favorite subject, and make sure he gets to the right service meetings put on by manufacturers. There is efficiency and profit in specialization if it is handled properly.

And So . . .

Modernizing can cover as much or as little as your pocketbook and energy dictate. You can modernize your building (maybe it just needs paint), your work area (maybe it just needs cleaning up), your equipment, your inventory, your billing methods, your bookkeeping; but above all, while you are updating your facilities, don't forget to modernize your outlook. ▲



Here's the **NEW** Jensen **Concert-Fidelity**[T.M.] **Series**

MR. SERVICE DEALER:

When you need a loudspeaker with substantially higher fidelity than you can get with general-purpose units, you'll find just what you want in Jensen's new CONCERT-FIDELITY Series. It is an important part of Jensen's new complete speaker line available from your distributor.

Special cone supports, made of cloth, improve bass; there are coaxial speakers offering increased clarity of speech and music; multi-way units and crossover networks let you tailor sound quality to meet special requirements (there are more than 500 custom combinations possible). Binding-post terminals make installation fast and easy.

Get the full story—send for Catalog 1090 today.

MODEL NO.	TYPE	SIZE	FREQUENCY RANGE	IMPED. OHMS	POWER RATING†	LIST PRICE
DC-80	High-Compliance Full Range, Dual Cone	8″	40–14,000	8	11 w.	$19.95
DC-120	High Compliance Full Range, Dual Cone	12″	25–13,000	8	13 w.	22.95
KD-80	High-Compliance Two-Way Coaxial	8″	30–15,000	8	12 w.	28.25
KD-120	High-Compliance Two-Way Coaxial	12″	20–15,000	8	14 w.	33.25
W-80	High-Compliance Woofer	8″	30–2,000	8	15 w.	19.25
W-120	High-Compliance Woofer	12″	20–2,000	8	18 w.	22.25
W-150	High-Compliance Woofer	15″	20–2,000	8	20 w.	33.25
M-81	Midrange, Closed-Back	8″	600–4,000	8	25 w.	14.80
TW-350	Direct Radiator Tweeter	3½″	2,000–15,000	8	15 w.	5.95
TH-100	Compression Tweeter	—	1,000–16,000	8	25 w.	19.95
TH-200	Compression Tweeter	—	2,000–16,000	8	25 w.	17.80
XN-100*	2-Way Crossover	—	1,000 cycle Crossover	—	—	15.50
XN-200*	2-Way Crossover	—	2,000 cycle Crossover	—	—	15.50
XN-640*	3-Way Crossover	—	600/4,000 cycle Crossover	—	—	19.95

*Complete with H-F Control

†Program rating. Peak power is twice the indicated figures.

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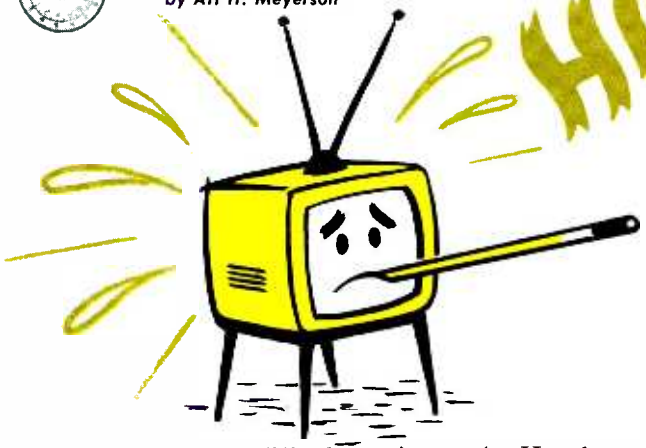
Circle 26 on literature card

QUICKER SERVICING
by Art H. Meyerson



HOT ROASTED INTERMITTENTS

Some of the most difficult servicing problems encountered by TV technicians involve heat-induced component failures that occur in receivers after several hours of operation. A defect of this kind may cause such symptoms as picture pulling, loss of contrast, loss of brightness, sound distortion—in short, any of the usual service complaints, with the added complication of timing.

You can begin troubleshooting this type of malfunction as soon as the customer calls for service. If the customer's complaint indicates an intermittent condition, you should inquire how often the trouble occurs. If it has appeared only once or twice, it would be advantageous to delay making the service call until the existence of a defect has definitely been established. Explain to the customer that it might be very difficult to pinpoint the trouble unless it occurs with some regularity. However, instruct the customer to call back if the same pattern of trouble persists.

If the customer's description gives clear evidence that the trouble is chronic, find out more about the case by asking a series of leading questions. It is important to phrase them in terms that are familiar to the customer. The questions should probe for the following facts:

1. Exactly what happens? Does the picture roll, or twist out of shape? Does it disappear? If so, is the screen still lit? Are the picture and sound both affected?
2. How long does the set operate before the trouble occurs?
3. When the symptom appears, can the customer do anything to alleviate the condition, and if so, just what?
4. Has the set been serviced before for the same or a similar condition?

After all the information is gathered and the call is accepted, arrange for the customer to have the set turned on for a predetermined length of time before you arrive. This will give the set a chance to act up, so you can verify the complaint. After diagnosing the symptoms, try new tubes in all suspected circuits, reinstall the rear cover of the set, and allow the chassis to come up to normal operating temperature. If the trouble reappears, suggest to the customer that further repairs should be done in the shop, where you can use special techniques to solve heat-induced problems more quickly and satisfactorily than in the home.

When the chassis is brought to the shop, certain bench procedures can speed up finding the intermittent fault. Begin by fitting a cardboard "hot box" over the chassis to simulate the effect of the cabinet; then let the set run until the trouble develops. Meanwhile, get out the schematic and familiarize yourself with the circuits most likely to be involved in the problem.

Typical Component Faults

Before proceeding, it is well to remember the behavior patterns of different components when they are heated. Resistors usually change slowly in value—they rarely cut in and out. Resistors carrying a fair amount of direct current (such as cathode, screen grid, bleeder, decoupling, and B+ units) are more likely to change value than are others which have only signal voltages applied. Especially susceptible to change are resistors across which high voltages, such as B+ boost, are impressed. Potentiometers often develop burnt spots after a few years, causing erratic operation.

Capacitors may cut in and out (develop intermittent shorts or opens), or they may change slowly in value. Units in high-frequency pulse circuits—such as horizontal sweep stages—are particularly susceptible to this latter fault. Some capacitors can, by developing minute leakage, upset RC networks and thereby alter circuit operation.

Printed circuit boards may develop slight cracks that expand when hot. This can cause the equipment to cut out and then return to normal operation when the set is allowed to cool slightly.

Trouble Hunting

Keeping these points in mind, you can now try to locate the trouble—remembering to check first those components that would ordinarily cause the symptoms being observed. The only difference in troubleshooting a "heat" intermittent and a so-called "normal" trouble is in the need for controlling the temperature to bring on the symptom. Removing the cabinet or "hot box" for access to the circuitry may reinstate normal operation; when this happens, heating lamps can sometimes be used to speed up the recurrence of the complaint. A small, hand-held hair dryer can also be used for the same purpose; hot air from the nozzle can be concentrated on a small portion of the suspected circuit.

If a certain resistor is suspected of changing value, turn the set off and connect an ohmmeter across the resistor. Apply heat to the resistor and see if the meter reading varies appreciably. If it does, the resistor is defective and should be replaced.

Find it and Fix it in 1/2 the time!

EASILY SOLVES "TOUGH DOGS"... INTERMITTENTS ... ANY TV TROUBLE

B&K MODEL 1076 TELEVISION ANALYST

BLACK & WHITE AND COLOR

NOW WITH KEYED RAINBOW DISPLAY

By Easy Point-to-Point Signal Injection, You see the Trouble on the TV Screen and Correct it—Twice as Fast and Easy!

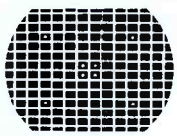
Simplified technique stops lost hours never recovered on **"tough dogs", intermittents,** and **general TV trouble-shooting.** This one instrument, with its complete, accurate diagnosis, enables any serviceman to cut servicing time in half ... service more TV sets in less time ... satisfy more customers ... and make more money.

With the Analyst, you inject your own TV signals at any time, at any point, while you watch the generated test pattern on the picture tube of the television set itself. This makes it quick and easy to *isolate, pinpoint, and correct* TV trouble *in any stage throughout the video, audio, r.f., i.f., sync and sweep sections* of black & white and color television sets—*including intermittents.* No external scope or waveform interpretation is needed. Checks any and all circuits—solves any performance problem. Gives you today's most valuable instrument in TV servicing—*proved by thousands of professional servicemen everywhere.*

Available on Budget Terms. As low as $30.00 down.

Net, $329.95

SIMPLIFIES COLOR TV SERVICING, TOO



Enables you to troubleshoot and signal trace color circuits in color TV sets, or facilitate installation.

Generates white dot, crosshatch and color bar patterns on the TV screen for color TV convergence adjustments.

Generates full color rainbow display and color bar pattern to test color sync circuits, check range of hue control, align color demodulators. Demonstrates to customers correct color values.

Time-Saving, Money-Making Instruments Used by Professional Servicemen Everywhere

Model 960 Transistor Radio Analyst

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Model 375 Dynamatic Automatic VTVM

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Model 445 CRT Rejuvenator Tester

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Circle 27 on literature card

Capacitors may be checked for an intermittent open condition by gently pulling on the terminal leads; but if leakage or a change in value is suspected, temporary substitution of a good component is a more conclusive test. Cut one lead of the capacitor in the set—leaving a small stub for reconnection—and tack in a replacement. To check the results, apply heat to the circuit, using the same method that previously made the trouble show up.

You may have to spend quite a bit of time in isolating the defective stage before you're ready to check individual parts. Here, again, the basic troubleshooting steps are exactly the same as for spotting an ordinary fault. For example, let's assume that the trouble involves loss of picture and sound, and little or no snow appears on the screen. This would indicate a fault in the video IF or AGC circuits. You can place the blame on one or the other by clamping the AGC line with a bias box; if the trouble seems to be in the IF strip, you can further isolate it by injecting a test signal at the input to each stage in turn. Finally, you can use your VTVM to search for the defective component.

You may have to heat and cool the set any number of times, depending on how many steps are necessary to pinpoint the faulty component and on whether you can make test-equipment connections without turning off the set.

Case Histories

A not uncommon type of intermittent picture distortion can frequently be traced to overloading of the first video IF. Fig. 1 shows the circuit. After the set has played for some time, the 100-mmf coupling capacitor between the tuner and the IF becomes leaky. A positive DC reading on the first IF grid is the clue. Unsolder the IF end of the ca-

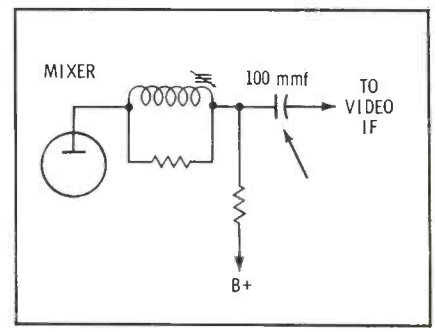


Fig. 1. Leakage in grid capacitor reduces bias on first IF and causes overloading.

CHECKS AND REJUVENATES ALL PICTURE TUBES
WITHOUT ADAPTORS OR ACCIDENTAL TUBE DAMAGE

Featuring Automatic Controlled Rejuvenation

The All New
SENCORE
CR125 CATHODE RAY TUBE TESTER

An all new method of testing and rejuvenating picture tubes. Although the method is new, the tests performed are standard, correlating directly with set-up information from the RCA and GE picture tube manuals.

Check these outstanding features and you will see why this money making instrument belongs on top of your purchasing list for both monochrome and color TV testing.

Checks all picture tubes thoroughly and carefully; checks for inter-element shorts, cathode emission, control grid cut-off capabilities, gas, and life test. Checks all picture tubes with well filtered DC just like they are operated in the TV set.

Automatic controlled rejuvenation. A Sencore first, preventing the operator from over-rejuvenating or damaging a tube. An RC timing circuit controls the rejuvenation time thus applying just the right amount of voltage for a regulated interval. With the flick of a switch, the RC timer converts to a capacity type welder for welding open cathodes. New rejuvenation or welding voltage can be re-applied only when the rejuvenate button is released and depressed again.

Uses DC on all tests. Unlike other CRT testers that use straight AC, the CR125 uses well filtered DC on all tests. This enables Sencore to use standard recommended checks and to provide a more accurate check on control grid capabilities. This is very important in color.

No adaptor sockets. One neat test cable with all six sockets for testing any CRT. No messy adaptors, reference charts or up-dating is required. The Sencore CR125 is the only tester with both color sockets. (Some have no color sockets, others have only the older type color socket.)

All six sockets, including latest color socket, on one neat cable.

Checks each gun individually in color tubes

No draggy leads. A neat, oversized compartment, in the lower portion of the CR125 allows you to neatly "tuck away" the cable and line cord after each check in the home.

Model CR125 ..... **$69.95**

MODEL CR128
For the man on the go. Same as above but in all steel carrying case $69.95

PS127 DELUXE WIDE BAND OSCILLOSCOPE
AT A
SURPRISINGLY LOW PRICE

This all new 5 inch oscilloscope offers the finest in performance, portability and appearance. Vertical amplifier frequency response, flat within 1 DB from 10 CPS to 4.5 mc and only 3 DB down at 5.2 mc insures true waveform reproduction. Vertical amplifier sensitivity of .017 volts RMS for one inch deflection on wide band (without band switching) is found only on scopes costing hundreds of dollars more. High input impedance of 2.7 megohms shunted by 99 mmfd (or 27 megohms with 9 mmfd with built-in low capacity probe), insures minimum circuit loading. For the first time, waveforms can be viewed in TV horizontal and vertical output circuits with the low capacity probe that will withstand up to 5000 volts peak to peak. To top that, the vertical amplifier attenuator controls are calibrated directly in peak to peak volts for fast direct reading of all peak to peak voltages.

Horizontal amplifier extended sweep range from 5 to 500 kc in five overlapping steps and frequency response from 10 CPS to 1 mc within 3 DB insures linear sweep and positive sync. External inputs for horizontal sweep and sync, intensity modulation, and smart two-toned case and "designer" styled controls brands the PS127 a truly professional oscilloscope.

PS127 ..... **$169.50**

Circle 29 on literature card

pacitor, connect the voltmeter probe to the free lead, and heat the circuit; if the reading goes positive, this is a sure indication of leakage.

In one case that involved a smeary picture and distorted sound, a leaky coupling capacitor between the video amplifier and sound IF was responsible. Again, a leakage test using a voltmeter was conclusive.

Intermittent sound is another complaint that can frequently be traced to thermal problems. Quadrature coils (Fig. 2) have been common offenders. In one case, the sound was distorted *until* the set had been on for a while; then it gradually became normal. Due to changes in circuit components over a long period, the coil had become detuned. Retuning the coil was all that was necessary in this case, but the solution is not always that simple. Poor solder connections at the coil terminals are common in certain chassis. The tubular ceramic capacitor across the coil is also a frequent troublemaker; if you replace it, use an NPO type.

Trouble in the quadrature coil sometimes causes either weak sound or buzz instead of distortion. If the simple remedies mentioned above are ineffective, replacement of the entire coil may save a great deal of time.

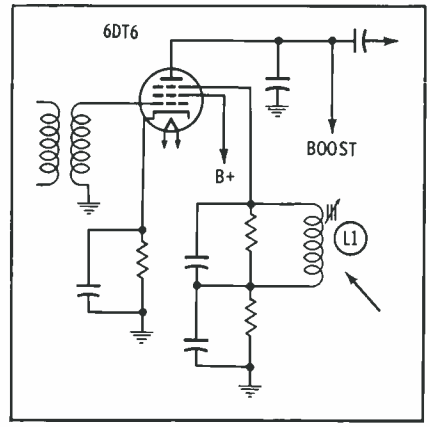


Fig. 2. Major suspect in many cases of intermittent sound trouble is the quadrature coil.

In the type of AGC circuit shown in Fig. 3, the delay resistor (R1) going to B+ has been found to change value with heat. An increase in its value can cause snow that gets worse as signal strength increases; a decrease may cause video overload or complete loss of video. Your voltmeter, connected across this unit, can detect the change as the set operates; this particular resistor will seldom shift value with only an ohmmeter supplying the voltage.

Fig. 4 illustrates a typical "hot" intermittent that causes loss of brightness, simulating the effect of a faulty picture tube. The 150K resistor in the accelerating-anode circuit opens up, removing voltage from the anode. Your voltmeter, guided by a little reasoning, will help you find this one.

Other Regular Offenders

Filter capacitors that lose capacitance or develop leakage between sections at high temperature can cause a multitude of troubles—such as sound bars in the picture, hum

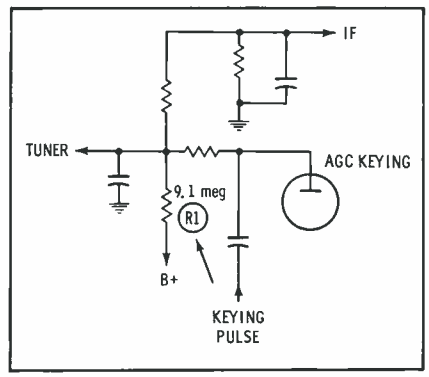
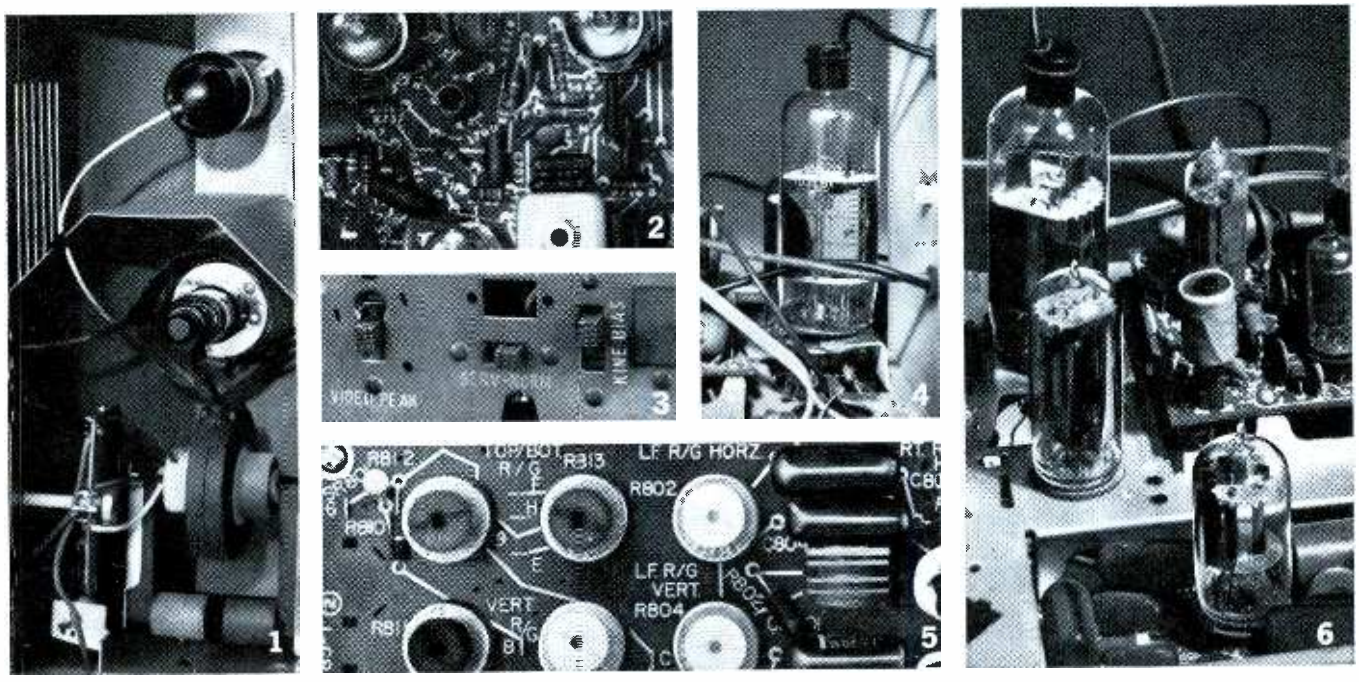


Fig. 3. AGC delay resistor frequently causes intermittent trouble by changing value.

CTC 15 Color TV Chassis gives brighter, sharper picture; has greater reliability; is easier to service... than any previous RCA Victor Color TV Chassis!



RCA Victor's new CTC 15 chassis keeps all the performance-proved virtues of the CTC 12 . . . but adds these engineering improvements that should please both you and your customers:

The picture is brighter, better. It's brighter because a new design in the high voltage section (1) gives 30% more current output at the same voltage. The picture tube circuits are designed for effective use of this higher power.

It's sharper because the picture tube screen voltages have been boosted . . . giving a smaller, sharper dot pattern with less blooming. The video amplifier has better phase response.

It's steadier because of substantially improved vertical hold circuits.

A new picture "tone control" . . . it's a video peaking switch (3) . . . offers three choices of picture quality: soft, normal and sharp. When snow and ghosts are your problem, use the soft setting for a smoother, more pleasing picture. When the signal is better, make the most of it with the normal or sharp setting.

Less color fringing results from a new clamp diode in the convergence circuit and rearranged controls are easier to use.

And UHF reception is improved by new circuitry that reduces snivets . . . those black vertical lines near the center of the picture.

Greater reliability . . . longer component life. Heat build-up has been reduced by housing the flyback transformer and the regulator tube in separate compartments.

The horizontal output tube (4) is placed on a raised "cooling shelf" outside the H.V. compartment. Its position allows free flow of air around its base. Three conventional tubes have been replaced by novars (6). They run cooler and last longer. One of them is the hardest working tube in the set—the horizontal output tube.

And dark heater tubes are used in all high-performance circuits.

To further increase life, the focus rectifier is now a special long-life selenium type.

Easier servicing. Circuit tracing is easier and faster . . . the new schematic solid-line roadmaps (2) go point-to-point, and component labels are larger.

It's easier to service the high voltage compartment . . . it has a hinged cover and better arrangement.

Color setup has been simplified by the addition of a conveniently placed 3-position bias switch (3) which accommodates wide variations of picture-tube characteristics.

RG controls (5) on the convergence board have also been rearranged for your convenience. Now you use the entire top row to make adjustments according to the horizontal lines in a crosshatch pattern; the entire second row is for the vertical lines.

Color TV is the technician's big bread and butter business . . . for years to come. We stand ready to help in every possible way to make this fast-growing business a profitable one for technicians —and for dealers as well.

See Walt Disney's "Wonderful World of Color," Sundays, NBC-TV Network.

"HIS MASTER'S VOICE"

RCA The Most Trusted Name in Television

Tmk(s)®

Circle 31 on literature card

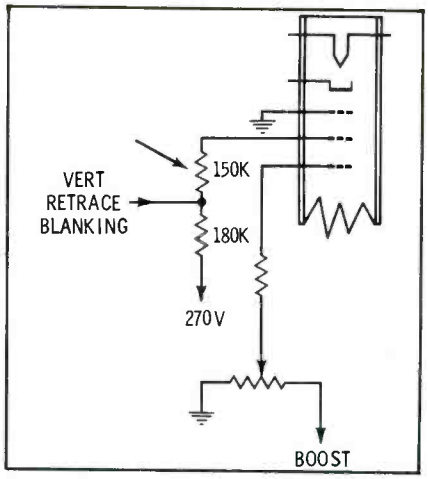


Fig. 4. Loss of accelerating voltage on CRT, due to open resistor, blanks out raster.

in picture or sound, and even sync troubles. Filters are particularly suspect in sets using "stacked" B+ supplies or in series-filament receivers using voltage doublers. Your scope will reveal any excess signal voltages across the filters.

In several instances dirty height and vertical linearity controls have been found responsible for thermal intermittents. Lightly tapping the shaft, or the control body itself, will disclose the trouble. Injections of cleaning fluid will sometimes help temporarily, but the best solution is replacement of the control.

Sync troubles are more difficult to diagnose. A scope is usually necessary to find out just where the sync pulses are being lost or suppressed. A low-capacitance probe will disturb the circuits as little as possible. After determining where clipping is occurring, you can substitute the suspected components.

If probing the circuitry "kicks" the set back into normal operation, or if a heat lamp can't keep the chassis warm enough to maintain the abnormal condition, try leaving test probes hooked to key test points and covering the whole chassis with the "hot box." This method, though a bit awkward, may be the only practical isolation technique when the possible trouble spots are scattered over a wide area.

You can greatly shorten the process of stage isolation by carefully studying the schematic, watching for interconnections (such as stacked B+ arrangements) that could explain misleading symptoms or unusual combinations of troubles. Above all, be patient. Hot, roasted intermittents can be a profitable "meal" if expertly cooked.

STOP! LOOK! SAVE!

All crystal controlled

A STANDARD COLOR BAR GENERATOR at 1/2 THE COST OF OTHERS

only $124.50

the all new SENCORE CG126 STANDARD COLOR BAR GENERATOR

A standard color bar, white dot, crosshatch generator especially made for field service on color TV . . . and at a great savings to you.

Check these outstanding features and you will see why this generator belongs on the top of your list for color TV servicing.

All patterns crystal controlled offering "rock like" stability. You'll think the patterns are painted on the TV screen.

Simplified operation speeds up every servicing job. Just dial the standard keyed bars, white dots, crosshatch, vertical bars or horizontal bars and watch them "pop" on the screen. That's all there is to it.

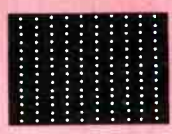
Exclusive adjustable dot size. The white dots can be adjusted to the size that satisfies your needs by a screwdriver adjustment on the rear. No need to argue about dot size anymore. Just select the size that you like to work with best.

Pretuned RF output to Channel 4. Other low channels can be selected if Channel 4 is being used in your area by simple slug adjustment. Patterns are injected directly into antenna terminals, simplifying operation and saving servicing time.

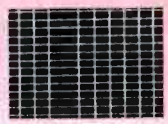
Reserved output on color bars for forcing signal through defective color circuits. The color output control is calibrated at 100 percent at the center of rotation, representing normal output. A reserve up to 200 percent is available on the remainder of rotation.

Smaller and more portable. With color receivers weighing much more than black and white TV, portable equipment becomes essential for home servicing. The CG126 weighs less than 10 pounds and measures only 11" x 8" x 6".

Ten standard keyed color bars (RCA type) that automatically provide all colors at specified NTSC phases . . . but without need of interpretation when servicing.



Stable white dots with new exclusive dot size adjustment in rear.



Stabilized crosshatch pattern for simplifying convergence adjustments.

10 thin white vertical lines for horizontal dynamic convergence adjustments . . . often missing on other generators.

14 thin horizontal lines for vertical dynamic convergence. Also missing on many high priced generators.

March into your local parts distributor and demand the CG126 Sencore color generator that sells at ½ the price of others. Don't let him switch you.

SENCORE

426 SO. WESTGATE DRIVE • ADDISON, ILL.

Circle 33 on literature card

Swinging Voltage

It is often desirable for the service technician to raise or lower AC line voltage fed to a set. For instance, a customer might bring a TV set to the shop with the complaint that it loses sync when several appliances are on at the same time. Many times, low line voltage contributes to unsatisfactory viewing, whereas in the shop the customer's complaint doesn't become evident. What to do? Lower the line voltage with a variable adjuster like this Terado "Polaris." By doing so, the technician can effectively simulate fluctuating line voltage conditions as they exist in the home with "insufficient power." Conversely, he can increase the line voltage and observe component performance under increased stress.

The "Polaris" can also be used to dim lights for unusual promotional display effects or for varying the speed of power tools.

Rated at 300 to 500 watts, this Terado Model 50-204 sells for $13.95. It has a switch that selects direct line voltage, either of two reduced values of line voltage, or either of two higher values. The unit has its own line cord: the appliance connects into the socket on the voltage adjuster itself. ▲

For further information, Circle 66 on literature card.

TARZIAN RADIO-TV TIPS:

How to achieve trouble-free replacement of Selenium with Silicon Rectifiers

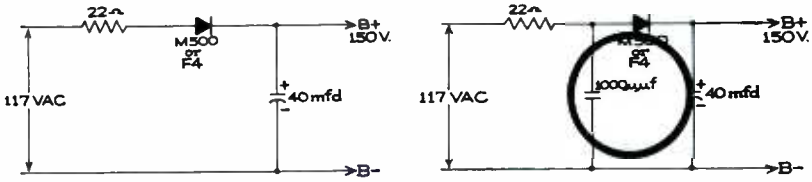
■ Substituting silicon for selenium rectifiers is highly desirable, but silicon units have extremely low impedance. When the rectifier conducts, a heavy pulse of current passes into the capacitor and through the power line. You can see this if you connect an oscilloscope across the surge limiting resistor. The strong pulse can cause interference by mixing with incoming video or radio signals.

Here are the symptoms you will notice, and here is the simple way to eliminate them.

POSSIBLE TROUBLE

Objectionable hum in radio,
or,
TV picture brightness fluctuates during pulse,
A black or white horizontal bar is generated across the picture tube (and can be shifted from top to bottom of picture by reversing ac plug),
The bar may interfere with the sync signal and the picture will pull out of vertical synchronization.

RADIO



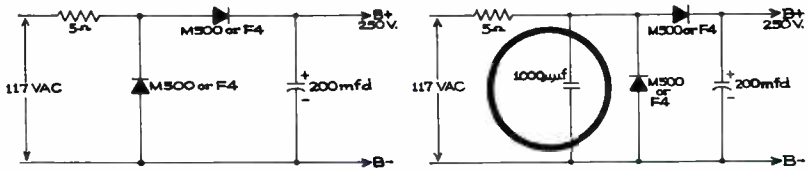
Before — After

SOLUTION

Install a 1000 mmfd capacitor between the resistor and the rectifier, from the rectifier end of the resistor to the negative line (see circles). The RC combination provides necessary filtering action.

You'll also notice a sharp reduction in rectifier failure formerly caused by transient voltages fed in off the line.

TELEVISION



Before — After

The Tarzian Replacement Line includes silicon rectifiers and conversion kits, tube replacement silicon rectifiers, and "condensed stack" selenium rectifiers. Immediately available from distributors throughout the nation, in the quantities and ratings you want most.

FREE CATALOG 61-DL-3 contains complete information on all Tarzian Replacement Line Rectifiers. Send for your copy today—be sure your files are up to date on the rectifier line voted first choice among service technicians throughout the United States.

SARKES TARZIAN Inc.

World's Leading Manufacturers of TV and FM Tuners • Closed Circuit TV Systems • Broadcast Equipment • Air Trimmers • FM Radios • Magnetic Recording Tape • Semiconductor Devices

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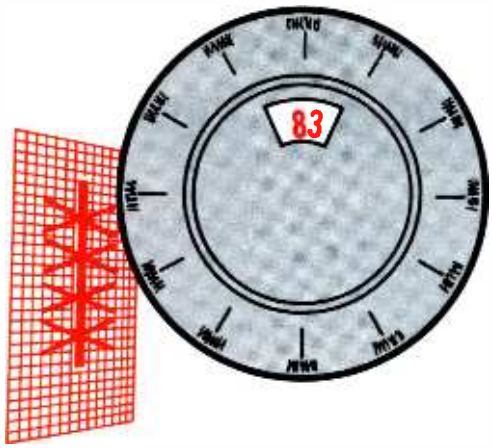
Circle 35 on literature card

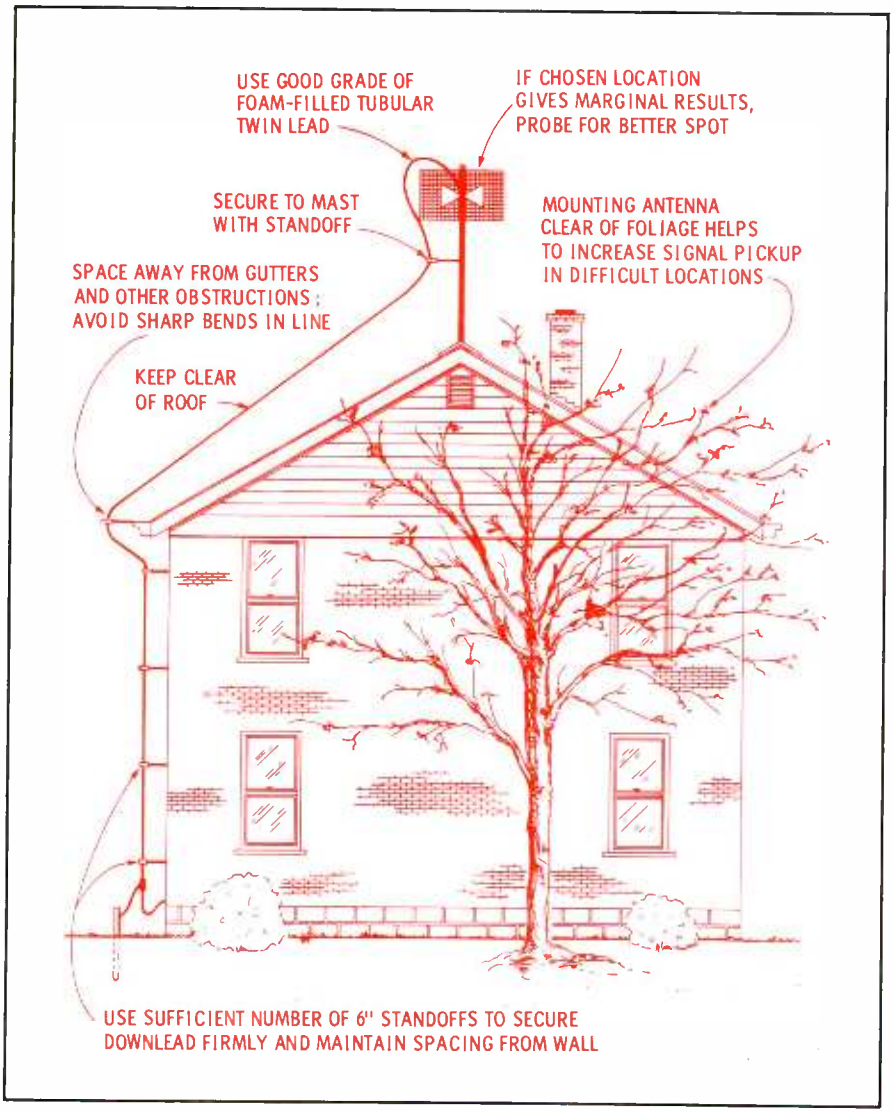


getting ready for . . . UHF

THIS WILL BE A BIG YEAR FOR U

by Thomas A. Lesh

In the 11 years that have gone by since the first commercial UHF television station went on the air, the existence of UHF has been generally ignored in most localities. Its "stepchild" status will come to an abrupt halt next May 1, when TV manufacturers will begin equipping *all new sets* with built-in UHF tuners to comply with Federal law. Suddenly, everyone concerned with buying or selling TV receivers will become very much aware of UHF. Servicemen, too, will feel the immediate impact of the all-channel ruling, and should be prepared for U-Day.



Careful installation of UHF antenna insures maximum signal transfer to receiver.

Getting ready for UHF, 1964 style, will be extremely simple—no new equipment to buy (for the time being, anyway) and no complex theory to study. The serviceman will merely need to be:

1. *Aware* of current developments in UHF television.
2. *Alert* to new business opportunities that may be created in his locality as new UHF stations take advantage of the upswing in all-channel viewing.
3. *Able* to answer customers' questions about UHF.

The sudden $20-$30 rise in the price of new TV sets, and various reports about "many new stations soon to go on the air," will take most consumers by surprise—and you can bet they'll be asking plenty of pointed questions. Servicemen will be in a better position than anyone else to give impartial, well-informed answers that will help to quell rumors and allay suspicions.

Only A Beginning

TV reception is not going to change overnight; the ruling that all new receivers must contain UHF tuners is simply the first step in a long-range plan to promote freer expansion of telecasting. It'll be several years before many UHF stations take to the air in areas that are presently served by VHF. However, you can assure a new-set purchaser that he can expect to get some use out of the UHF tuner, well within the set's lifetime. Once the UHF ball starts rolling, the economy will be able to support many more stations than the 12-channel VHF band can

Let's Get The Facts Straight . . .

RUMOR	FACT
All television broadcasting will soon be shifted to UHF.	Possible—in the distant future—but there are no definite plans for any curtailment of VHF service.
VHF-only sets can still be produced for use with master antenna systems.	True in only one special case: Schools have been granted a temporary exemption that allows VHF sets labeled "For School Use Only" to be obtained.
A TV manufacturer can produce VHF-only sets for sale in the state where the factory is located; such sales are legal.	True, since the Federal all-channel ruling can be applied only to interstate commerce. However, it's doubtful whether many will take advantage of this loophole and manufacture obsolescent sets.
Every set sold by a dealer after May 1 must include a UHF tuner or converter.	False, because the new law applies to shipment of sets from the factory. A set manufactured prior to May 1 will be labeled with this fact, and can legally be sold by a dealer at a later time.

accommodate. Gaps in the existing three-network system will be filled, and additional program sources will be able to live up to their full growth potential.

Why hasn't it been possible to develop UHF without a nudge from the Government? The apparent technical problems of utilizing the ultra-high band are only part of the explanation. *Any* new-station owner faces formidable obstacles to success when he begins on a small scale, as most UHF operators must do. Construction and operating expenses are almost as high as those of a large station, but revenues—proportional to the size of the audience—are much lower. He finds it difficult to win viewers away from more powerful, better established stations in the area, since he doesn't yet have the resources to offer more popular programming.

In the past, a UHF operator has had to bear the added burden of persuading viewers to buy converters or all-channel sets at extra cost, just to watch his station. This factor alone has frozen UHF stations out of many markets. The Federal Government has come to the conclusion that eliminating the conversion problem is the most effective way to give UHF a fighting chance; this is the reason for the all-channel ruling.

Sets capable of receiving UHF will increase at a rate of over 5 million per year; as they accumulate, they will provide more and more incentive for new ventures into UHF telecasting. Free competition will determine when and where these additional stations will go on the air, what type of programming they will offer, and how great a toehold they will be able to secure in their markets.

Confidence in the future of UHF has already begun to rise, and a modest number of new stations have recently gone into operation. Some are conventional network outlets, but others cater to a variety of specialized interests with such features as home-town news and sports events, foreign-language programming, and educational TV. These are just a sample of the wider choice of programs that can be made available by utilizing the UHF channels.

When Opportunity Knocks

Servicemen will be the "attending

physicians" at the birth of every new UHF station. With their technical background, they will find it easy to dispel confusion among dealers and set owners by explaining UHF tuning procedures and antenna arrangements. Service shops will find managers of new stations extremely eager to cooperate in setting up advertising campaigns and working out reception problems.

Antennas

A casual check of UHF reception as a regular routine on home calls—"Let's see how the new station comes in on your set"—will give the station a needed boost and promote antenna sales. A special type of indoor antenna works well for local UHF reception in a surprisingly large number of homes, but an outdoor installation often gives sufficient improvement to be worth demonstrating. The picture obtained with a good outdoor UHF antenna is often clear enough to make viewers discontented with the performance of rabbit ears on VHF—thus arousing interest in outdoor installations for both bands.

Except in fringe areas, TV servicemen are used to working with a superabundance of RF signal strength that makes it possible to tolerate great losses between antenna and receiver. Similar conditions exist in UHF primary areas, with one important difference: Losses caused by objects close to the lead-in are much greater at UHF than at VHF, and they increase more sharply in wet weather. Special UHF installation techniques (see illustration) have been devised to keep signal losses at a minimum. These are not especially difficult or time-consuming, and their habitual use is the best way to attain consistent satisfaction with UHF installations.

Pointers on choosing the best antenna for a particular spot were given in "UHF Antennas—New Boom Ahead?" in the October, 1963 PF REPORTER.

Converters

For several years to come, there will be a good market for converters that enable older sets to receive UHF stations. Two distinct types are manufactured—low-priced, one-tube units that use a local oscillator and crystal mixer to change the UHF signal to VHF, and two-tube units that have an added stage of

VHF amplification for better results in fringe areas. Converters in the home-call service caddy will not only be hot sales items, but will also serve as handy test instruments for checking built-in UHF tuners by substitution.

Technical Quality

Many persons who wrote off UHF as a failure 10 years ago will be startled or dismayed to see it attempting another large-scale comeback. They'll naturally wonder if there has been some major technical breakthrough that promises UHF a greater chance of success on the second try.

Actually, no way has been found to erase the basic differences between VHF and UHF signal propagation, which have handicapped UHF in the past; however, the industry has been finding out how to make the most of UHF's capabilities. It's encouraging to note that both transmitting and receiving equipment have been proved (and improved) by 11 years of practical field experience, covering several million receivers served by around a hundred transmitters. When UHF was still new and untried, many users and broadcasters gave up before all the bugs were fully worked out. Now, however, its dependability and usable range have definitely been increased by modern technical developments.

Early disappointments with UHF helped to bring about an increase in the sensitivity of VHF sets to satisfy the heavy demand for better fringe reception. Ironically, the improved sensitivity of VHF front ends is now contributing to better performance in UHF fringe areas.

The pesky problem of short-lived 6AF4 oscillator tubes, which greatly hindered UHF television in its early days, has been outgrown. Several improved types of 7-pin miniature tubes, nuvistors, and even transistors are found in currently produced tuners. Continuous tuning over the UHF band is still the rule, but pushbutton and detent-action tuners that provide easier channel selection are on the horizon.

Generally, there's good reason for ultra-high hopes that UHF television will finally come to maturity. ▲

two way talk

by Patrick M. Craney

WIRE-LINE REMOTES For Two-Way

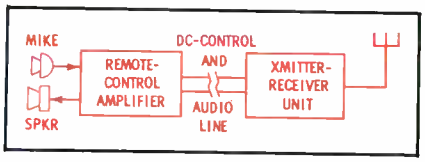


Fig. 1. The two-way radio is remotely controlled by the use of a special amplifier.

Unlike remotely controlled devices such as the garage door and the TV set, the two-way-radio base station is remotely controlled for reasons born of necessity rather than convenience. All too often, the radio operator's office is too far from an effective antenna site for use of transmission line without encountering excessive losses. In such cases, it is often better to use a remote control device and locate the transmitter and receiver as near as possible to the antenna.

The Remote Amplifier

To operate a two-way radio remotely, it is necessary to provide for carrying audio to the transmitter and for operating transfer relays. It is also necessary to provide a path for receiver audio to come back to the operator. These requirements can be met by connecting a special remote console to the radio set via a two-wire line, as shown in Fig. 1.

Basically, a remote console supplies a DC voltage for actuating function relays in the radio, and amplifies audio in either the transmit or receive condition. Without audio amplification, control-line losses would seriously affect the audio signals available at either end.

Notice in Fig. 1 that only a single pair of wires are used to handle both audio and DC. When the microphone is keyed, DC voltage is impressed on the lines and actuates one or more function relays at the radio. These relays connect the amplified microphone signal to the transmitter and disconnect the receiver output from the line, switch B+ from the receiver to the transmitter, and transfer the antenna connection from the receiver to the transmitter. When the microphone push-to-talk button is released, the relays are de-energized, and received messages return down the control lines from the receiver to the remote console.

Circuits

The typical remote console diagrammed in Fig. 2 contains a three-stage amplifier. Two of the three stages amplify incoming or outgoing audio; the third is a mike preamp. The DC control voltage is developed within the power supply circuitry.

In most remote consoles, there is an adjustment (not shown) for controlling the DC voltage to meet the requirements of different base stations and to compensate for line losses. There are usually two audio controls: one for microphone gain and the other for speaker volume. The mike gain should be adjusted to the average loudness of the operator's voice. In multiple systems, if the mike signal is excessive, messages may be too loud with respect to those from other remotes. Also, too much mike signal will cause excessive clipping of the audio waveform in the transmitter speech limiter.

The volume control is adjusted for comfortable listening to incoming audio. Since not all people speak with the same volume, an agreeable listening level may be difficult to achieve; a soft voice will be weak, while a loud one fairly booms. If you adjust for the loud one, the soft one may not be heard. The technician can achieve the nearest practical approach to an ideal situation by setting modulation adjustments on all transmitters to the same level, and instructing the operators how to use their microphones properly.

Notice also in Fig. 2 that the functions of the console are controlled by a "transmit-receive" relay. When the microphone button is depressed, this relay is actuated at the same time the mike is connected into the audio circuit. The mike preamp is connected to the first audio amplifier through contact 1, the output of the second amplifier stage to the control lines through contacts 3

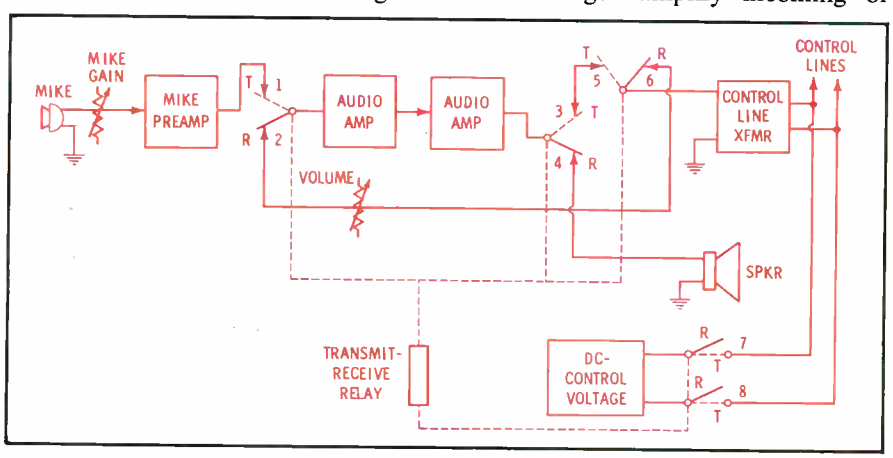


Fig. 2. Relay contacts control operation of remote console and radio equipment.

and 5, and the DC control voltage to the control lines via contacts 7 and 8.

When the mike button is released, the relay de-energizes and the system returns to the receive condition. The input of the first audio stage is disconnected from the preamp and switched back to the control line. The control voltage is disconnected, and the speaker is once again in the output circuit of the audio amplifier.

Control At Base Station

It was mentioned that to operate the radio system from the remote console it is necessary to actuate certain relays which, in turn, cause normal operation of the transmitter or receiver. These relays and their associated circuits are on a separate chassis in the main radio cabinet, and are connected into the base station circuitry by means of terminal-board clips and screws. Thus, any two-way station may be converted to remote operation by using this additional control chassis and a remote control console. The radio can still be operated directly from the location of the main cabinet, even though one or more remotes are on the line. Thus, when a technician needs to check operation, he has full control of the station right at the main set; he can even temporarily disable the remotes, if he desires.

Fig. 3 shows how the control lines are connected to the control chassis across special line transformer T1. This transformer, like its counterpart in the remote amplifier, serves a threefold purpose. It couples audio from the receiver to the remote line when relay M1 is at rest, couples audio from the remote line to the transmitter when the relay is energized, and prevents control-line DC from flowing in the transmitter or receiver audio circuits. When DC control voltage is applied, relay M1

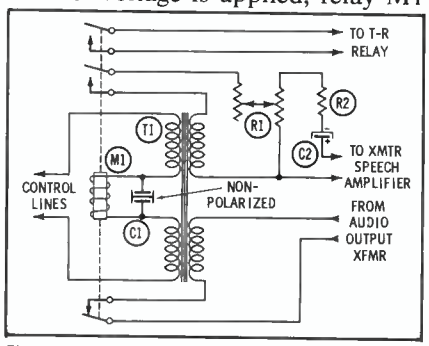


Fig. 3. The system control lines are terminated in a coupling and isolating transformer.

will energize and transfer its contacts from the positions shown in Fig. 3. All the necessary transfer functions described earlier will be performed, and the transmitter thus actuated. Nonpolarized electrolytic capacitor C1 keeps audio voltages out of relay M1.

Intercoms

When more than one remote amplifier is used to control a station, the remotes can also be used as intercoms. As shown in Fig. 4, if two or more consoles are connected in parallel, they can originate and receive either transmitted or intercom messages. When one transmits, all others hear the message. This has the advantage that no one operator will unknowingly interfere with another's transmission by interrupting.

If a message is to be sent to another remote without being transmitted, a control-panel switch is depressed to the "Intercom" position. Amplified microphone audio, but no control voltage, is coupled to the control line. The message is thus heard only at the other remotes. Audio is present at the radio too, but can't reach the transmitter because the relays aren't energized.

Special Features

Some remote control consoles have a tone-alert feature which allows a 1000 cps tone to be transmitted ahead of the message. This tone notifies personnel at the receiving stations that a message is forthcoming.

Other audio equipment sometimes used with the console includes a tone-call unit. In a tone-coded system, each vehicle or station receiver is assigned an audio tone of one particular frequency to actuate only that receiver and no other. The

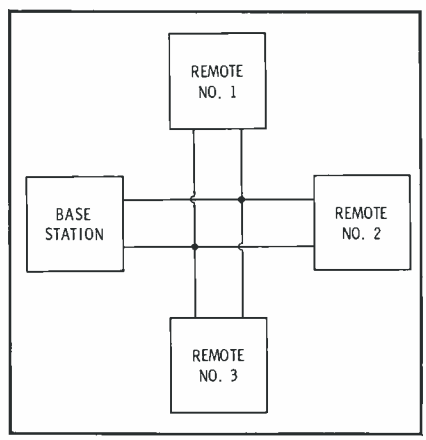


Fig. 4. Intercom connection for several parallel remotes using the same control lines.

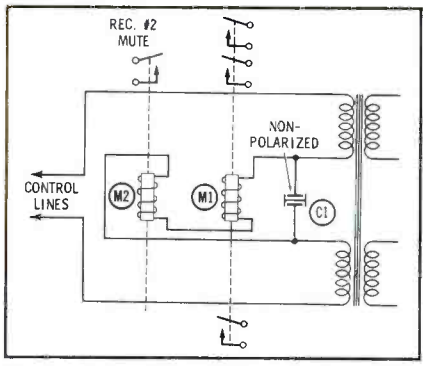


Fig. 5. Series relays allow use of a single wire-pair for multiple control functions.

remote is outfitted with a separate console which contains a multifrequency audio oscillator. When a particular tone is generated, the corresponding receiver is the only one in the system that hears the transmission.

More elaborate remote chassis include a relay to mute audio coming from one of the two frequencies received by two-channel base stations. If a message is being received on one channel, and the other has traffic at the same time, the operator can quiet the interfering one by pressing a button on the remote console; this sends a control current through the lines to energize a relay in the control chassis and "kill" the offending audio.

Although it might appear that the voltage would also actuate the transmit-receive (T-R) relay, Fig. 5 shows how this is avoided. The mute and T-R relays are in series. It takes more current to energize the T-R relay than to energize the mute relay; therefore, reduced line current causes only the mute relay to pick up while not affecting the T-R unit. Of course, a larger current will energize both relays; but this puts the transmitter on the air, and both receivers are disabled.

Trends

As with most electronic equipment today, the trend in two-way-radio remote systems is toward solid-state circuitry. This allows a remote console even smaller than with tubes. There are few features on transistorized remotes that aren't included in the older models. However, with all that extra space now available, other features are bound to be developed—perhaps a programmed tape recorder that will automatically dispatch a full day's deliveries. Wireline remotes, too, are going modern! ▲

DOLLAR & SENSE *Servicing*

by Harold J. Ashe

As a TV-radio service shop owner, regardless of your financial circumstances, you should make it a practice periodically to review both the amount and kinds of insurance protection you have on your business. Because conditions change so rapidly, once a year isn't the least bit too often. What might have been sufficient insurance only a few years ago may now be inadequate against certain hazards. Even the passage of a few months may result in sharply changed circumstances, and expose you to greater possible losses.

Most shop owners carry some type of insurance on their business. Often, the amount is too small to afford total protection against the possible loss. Furthermore, the extent and nature may be woefully inadequate because of the number of different business hazards needing coverage. After all, insurance against fire won't help if you're being sued because a patron has been injured on the premises.

Insurance protection is usually insufficient for one of three basic reasons: (1) underestimating the amount of loss that you can sustain in a particular disaster; (2) failure to recognize the existence of an insurable risk; and (3) avoiding the cost of adequate protection.

So, in reviewing insurance protection, you should examine carefully the amount of any possible loss you could incur. Next, you should find out if the particular hazard is insurable. Finally, you'll want to know how expensive the premium will be for the protection desired. Following are the kinds of insurance you should investigate and discuss with your insurance agent.

Public Liability

Every shop owner should be covered by a policy protecting him against a damage suit that might arise from injuries sustained by persons on his business premises. While a policy for a small amount may reassure the shop owner, it may be inadequate. At least $25,000 coverage should be carried, and even a larger amount is justified.

Some shop owners take a dim view of such coverage because of their limited financial resources. They wrongly assume a plaintiff thus couldn't get much of an award. How very wrong! A jury could hand down a deficiency judgment that may take the defendant his remaining lifetime to satisfy.

is your Insurance

UP-TO-DATE ?

Auto Liability

Auto insurance is also a "must," and is required by law in many states. Any such policy should provide at least $50,000 for any one person and $100,000 for more than one. Limits of $100,000 and $200,000 add only a few dollars to the premium. In addition, the policy should provide at least $5,000 for property damage, and medical payments for each person of at least $2,000. Be very sure your insurance company knows you are using the car for business, or certain accidents might not be covered.

If any employee uses his own car for business, either regularly or occasionally, you should have nonownership coverage. Some employees may carry only the minimum liability coverage; others may carry none. If an employee has an accident while driving his own car on your business, you will likely be named as codefendant in any damage action.

Fire Insurance

Fire and extended coverage should be carried on the business—including building, equipment, and inventory—as well as on any nonbusiness properties and your home, furnishings, and other personal possessions. In establishing the amount of insurance to be carried, you must keep in mind that the value of your possessions, in the aggregate, is probably increasing. It is true that older assets are wearing out and are becoming less valuable, but you must consider the value of more recently acquired replacements and additions. A successful shop owner is likely to reflect this success by a substantial increase in personal possessions over the years.

Likewise, if your business is expanding and growing, you are probably plowing back some earnings into additional equipment and inventory. As a result, after a policy has been in force for two or three years, it may seriously understate the true amount of possible loss.

Replacement-Cost Policy

Standard policies, covering fire and other physical damage or loss, pay off on actual *cash value* of the insured property at the time the loss is sustained. Now, thanks to inflation and other economic factors,

such an insurance settlement may not come even close to taking care of true replacement costs. Cash value, as applied to insurance policies, means the replacement cost *less depreciation*. Depreciation alone may considerably reduce the amount of insurance proceeds.

A new type of policy is being written by some insurance companies to include depreciation. This policy insures against serious capital losses by providing funds with which to fully restore any property so insured.

Insurance Packages

Premium savings can be effected by combining certain types of separate coverage into one business insurance package. This system covers several specified risks and, in doing so, reduces the combined premium to less than the sum of those on separate policies covering the same risks.

Business Interruption

Even though he is well protected against direct loss, a shop owner may be exposed to a far heavier indirect loss because the accident interrupted his business. One type or another of business interruption or use-and-occupancy insurance will protect him against these indirect losses due to temporary stoppage of his business. This type of insurance has been termed "business survival insurance" because it often means the difference between keeping the business going or ceasing operations permanently. Very few small businessmen consider this a necessary protection; but because of their limited resources it is especially valuable to owners of small shops. Covered losses may include estimated net profits, fixed expenses, and costs of moving to temporary premises while the damaged or destroyed premises are repaired or rebuilt.

Burglary

Because of the relatively high value of his inventory and much of his equipment, and because it is so easily removable, a shop owner certainly should have burglary insurance. This covers losses from forced entry, but does not cover those due to pilferage by those having access to the premises.

Other Considerations

There are innumerable other risks from which you can be protected by insurance. Many of these involve relatively small possible losses. If the maximum loss that can be sustained is limited, you may prefer to take a chance and assume any loss yourself. An example of this is the "$50 deductible" clause in auto insurance. Unfortunately, this practice of self-insurance often causes shop owners to fail to get protection on losses that might be unbearable.

In considering premium costs, a shop owner gets a slight bonus on such expenses—insurance premiums on business properties are tax-deductible. Thus, if you are in the 22% bracket, such insurance will actually cost you only 78 cents on the dollar! This helps make insurance a real bargain. By throwing a protective umbrella over your holdings, preserving your capital investment, and relieving you of various liabilities, adequate insurance can give you peace of mind that's without a price tag. ▲

Modern Bench

(Continued from page 31)

necessary features. A good scope is invaluable in the modern service shop, not only for tracing color signals, but for the exacting alignment needed for correct operation of a color set.

Sweep and RF Generator

Sweep alignment equipment, to be suitable for critical adjustments in the front-end stages of a color receiver, should have certain features. To properly align chroma bandpass stages, a sweep generator must produce sweep signals in the low video-frequency region. The color bandpass circuit operates in the 3 to 4 mc range, and to view the response of this circuit, your sweep generator must be capable of sweeping from .05 mc (50 kc) to 5 mc with a center frequency around 3.58 mc.

Fig. 2 shows a few of the bandpass waveforms and a video sweep response curve obtained with a generator of this type. If your present generator will not sweep through these frequencies, you'll have a tough time aligning and checking chroma bandpass circuits. This type of generator is also necessary to align color receivers by the *overall* Video Sweep Method (VSM) as described in the June, 1962 issue.

The CW or RF generator, used for marker signals in conjunction with your sweep generator, should have provisions for crystal calibration. The accuracy of this instrument determines how precise your alignment will be. In a color receiver, accuracy is *demanded*—not to mention the same need in aligning other types of receivers.

If you've ever used a *marker adder* during alignment, you're probably aware of its convenience. You might call this type of instrument a luxury, but it certainly makes sweep alignment accurate and easy.

The marker signal inserted with an adder unit does not pass through the receiver; therefore, response curves of the set cannot be upset or distorted by the marker signal. Also, the marker signal can be made large enough for easy viewing, even in trap notches.

A vivid illustration of the convenience of a marker adder is shown in Fig. 3. Here, you see a couple of sweep alignment waveforms; one was obtained with the marker amplitude control adjusted for a strong marker signal. Notice that, even at this high marker amplitude, the response curve is virtually unaffected. As you're probably aware, the true response curve would be swamped by this marker signal if the marker and sweep signals were both passing through the receiver; using the

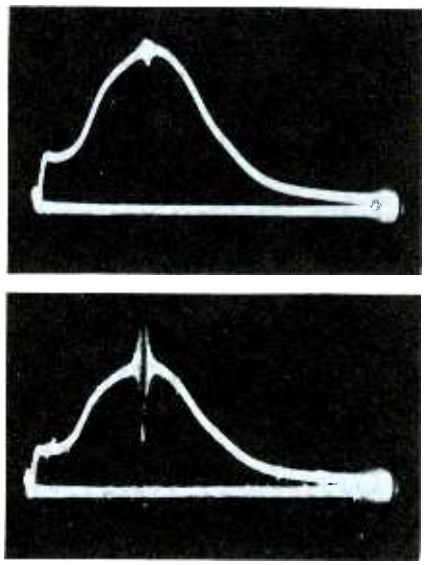


Fig. 3. Viewing marker signal is a pleasure when adder unit is used with equipment.

marker adder, only the sweep signal affects the receiver circuits.

You'll find some sweep generators now include the adder feature as an integral part of the instrument—it's already built in.

Stereo FM Generators

Like the color receiver, this new type of receiver also demands special test equipment all its own. Usually, a test generator for multiplex receivers is designed to service and align *only* FM multiplex receivers and/or adapters. Regardless of whether it's called a multiplex generator, stereo FM signal generator, or stereo FM simulator, this instrument simulates parts or all of the signals transmitted by a stereo FM station: 19 kc pilot, 67 kc subcarrier (for setting SCA traps), L+R audio signals, L−R 38 kc sidebands, and a composite multiplex signal. Most instruments have switches to permit selecting any combination of the above signals.

Generally speaking, you won't use a generator of this type for other service applications. However, if FM servicing is a part of your business, and you intend to keep up with the industry, you'll want a generator of this type.

Summary

It's impossible to describe all the many different features now available in modern test equipment. However, it is well to know the basic requirements of equipment needed to service modern electronic apparatus. Use the accompanying checklist (page 31) to appraise your present test equipment, and to remind you of features to look for in new equipment. ▲

"I had to cut out the happy pills, Doc. I made 16 free calls in a week."

Darkroom

(Continued from page 33)

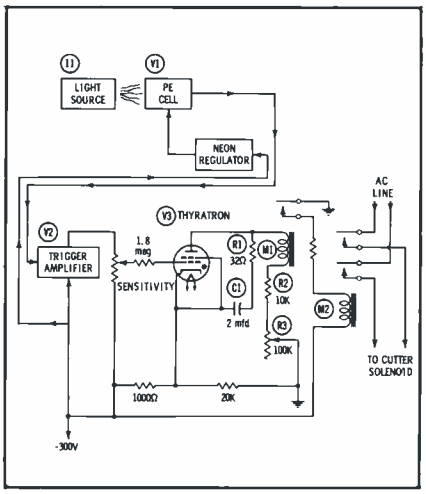


Fig. 6. This light-sensitive mark-detecting scheme uses a photoelectric sensing cell.

tronic devices, the negative side of the plate-voltage source is grounded. The positive side is grounded in the circuits shown in Figs. 5 and 6, however, because of greater compatibility with associated equipment.

Other Units

The electronic devices used for controlling most darkroom equipment are generally packaged as separate units which can be serviced independently of the machine itself. Some independent devices are for use with conventional enlargers. For example, the *Densi-Timer* shown in Fig. 7 is a combination densitometer and timer which controls an enlarger. Instead of measuring time, it measures the reflected light projected by the enlarger to the easel while a print is being exposed. When the instrument determines that enough light has been projected, it automatically turns off the enlarger.

The *Densi-Timer* consists of two separate units—a scanning head which contains the light-sensing element, and a control box. To give a wide range of timing adjustments, two control knobs are provided: one for coarse settings and the other for fine adjustment.

A more elaborate densitometer has been designed for analysis of color photos and determination of exposure time. It can also indicate which filters are required to obtain good enlargements from a color negative of unknown characteristics.

The color densitometer consists of an optical head and a control

box. The optical head is placed on the enlarging easel, in the center or near one side. The light projected from the enlarger enters the optical head through a small aperture and reaches an integrating sphere. After mixing in the sphere, the light is measured by a light-sensitive tube. Push buttons select the color of the light to be metered (white, red, green, or blue), by automatically placing a corresponding color filter into the optical system. Another push button opens the shutter, which protects the optical system from bright light when not in actual use.

The control unit is equipped with a 7½" meter—calibrated in percentage of transmittance and exposure time in seconds. Sixteen calibrated controls are provided for setting color standards, and two for setting black-and-white.

Conclusion

The circuits used in most darkroom electronic devices consist primarily of RC timing, current-measuring, and triggering circuits. When a schematic diagram is available, an experienced technician should have little trouble in understanding the circuits and diagnosing trouble. Main causes of equipment failure or malfunctioning are defective tubes and changed values of resistors or capacitors.

Electronic darkroom devices are used by serious amateur photographers, as well as by photofinishing establishments. Therefore, the potential market for the electronics serviceman is large enough to be worthy of serious consideration. Start with local photofinishers who, while expert in optics and chemistry, seldom are able to service their own electronic equipment. ▲

Fig. 7. Automatic *Densi-Timer* consists of a scanning head and electronic control box.

Product Report

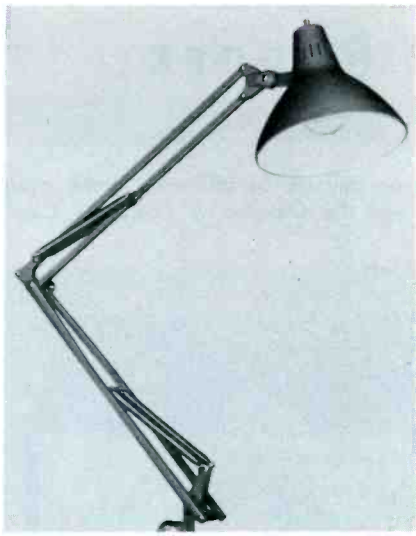
For further information on any of the following items, circle the associated number on the Catalog & Literature Card.

Automatic Multiplex Tuner (133)

A transistorized FM multiplex tuner, the 4312, is a new product of **H. H. Scott.** Featuring a nuvistorized front end for sensitivity in excess of 1.9 uv, and transistorized wideband IF and detector stages for maximum selectivity and limiting, the unit boasts the Scott time-switching multiplex system. Specifications include a signal-noise ratio of 65 db, harmonic distortion of 0.5%, frequency drift of .02%, frequency response of 20-20,000 cps ±1 db, and a capture ratio of 2 db. The adjacent-channel selectivity of the 4312 is in excess of 35 db, while spurious response rejection is 85 db; audio hum is —66 db (referenced to 1 volt), AM suppression is 60 db, and channel separation is better than 30 db. Featuring a net price (east of the Rockies) of $365.00, the tuner has an aluminum chassis, a stereo threshold control that switches the tuner automatically to the monophonic mode at a minimum acceptable stereo performance level, and individual level controls for each channel.

Silicon Rectifier Pack (134)

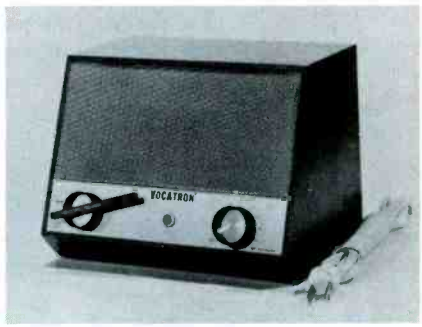
Here is a silicon rectifier unit that will substitute directly for 5AU4, 5AW4, 5AZ4, 5T4, 5V4, 5W4, 5Y3, and 5Z4 rectifiers. This new device, manufactured by **International Rectifier,** is equipped with an octal tube base to allow direct replacement (with suitable dropping resistor) of its tube counterpart. Rated at 1600 peak inverse volts and 1130 volts rms, the ST-14 will handle a maximum output current of 0.75 amp. The unit is priced at $5.06.



Portable Work Lamps (135)

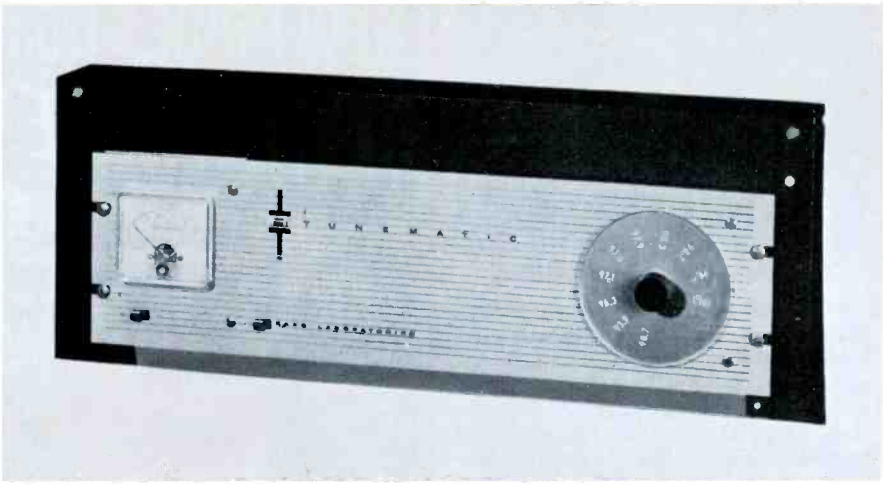
A new line of flexible-arm work lamps by **Tobey Mfg. Corp.** includes incandescent, fluorescent, and magnifying lamps in a variety of models and colors. These lamps feature smooth-working, spring-balanced flexible arms, with springs easily adjustable to prevent bothersome falling of the arm. One model, the compact magnifying lamp, has a "Circline" fluorescent tube and a 5"polished-glass lens with 3-diopter, distortion-free magnification. A second lens adapter increases magnification to 7 diopters.

The new Tobey lamps are equipped with a universal bracket that can be clamped or screwed to any surface—horizontal, vertical, or sloping. A desk clamp and a table base for the incandescent lamps are also available.



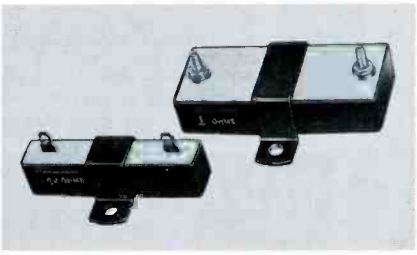
Quiet Intercom (136)

This wireless intercom is designed to eliminate the power-line buzz and noise caused by various types of electrical appliances and light fixtures. Built by **Vocaline,** the "Vocatron" Model CC-100 is capable of picking up the slightest whisper from any point in a normal-sized room, and yet remains completely silent when no audio is being received. Each unit in a system, being independently controlled, is portable in that it requires only a connection to a 110-volt AC line—no interconnecting wires are needed. Housed in a cabinet of solid walnut, the CC-100 carries a suggested retail price of $54.95.



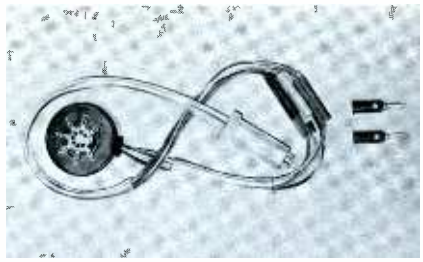
Crystal Controlled Tuners (137)

Three new crystal controlled AM and FM tuners have been developed by **Karg Labs** to distribute radio programs throughout hotels or motels. These tuners feature long-term stability in unattended locations, accurate tuning for minimum distortion, and fail-safe operation by nontechnical personnel. Each unit mounts in a rack-panel, and requires only 5¼" of space.



Potted Resistor (138)

A heavy duty resistor, with the resistance winding imbedded in a high grade potting compound, is now available from **Milwaukee Resistor Co.** With ratings starting at 25 watts, the resistor is especially useful where extremely heavy duty operation is required. The unit can be furnished with quick-connect terminals, standard tabs, or studs.



In-Circuit Test Adapter (139)

Three new universal harness testing adapters manufactured by **Pomona Electronics** make possible in-circuit measurement of voltage, resistance, and signals at tube pins. Each adapter consists of a male plug that fits both shielded and unshielded tube sockets, a molded phenolic tube base, and a 24" cable with a wire for each tube pin. Each wire contains a connector midway in its length for inserting a meter to measure current without unsoldering tube-socket connections. Socket pin numbers are easy to read, and connections are exposed for connecting meters easily. The Model 1737 is for 7-pin tubes, the 1738 for 8, and the 1739 for 9; each is priced at $14.95.

Pin-Up Fuse (140)

A medium-acting fuse that projects a silver-plated indicating pin from one end when it "blows" is a new idea from **Littelfuse, Inc.** The pin, available either uncolored or in red, can be used to make physical contact with an annunciator alarm circuit, or as merely an indicator that the fuse has opened. This 3AG fuse measures 1¼" x ¼" and has a ceramic body which provides excellent insulation, eliminates carbon tracking, and resists moisture. Ratings of this 334000 series range from ¾ amps at 125 volts, through 20 amps at 32 volts.

Fuse Pullers (141)

"Duo-Tongs" is the name aptly applied to **GC Electronics'** new universal fuse pullers. Handy grips at each end of the new tool accommodate fuses from standard miniature to ¾"—including conventional screw-in types used in the home. Molded of nylon, "Duo-Tongs" are nonconductive and nonflammable.

INDEX TO ADVERTISERS

Guns and Capacitors (142)

A free Wen Soldering Pistol is being offered by **Arco Electronics** to service dealers with the purchase of 140 dipped Mylar®-paper (DP) capacitors. The most popular replacement values are included in 28 transparent "5-Pak" bags. A service dealer discount net price of $23.75 reflects a 50% discount from the list price of the capacitors.

Cleaner-Degreaser (143)

This new aerosol "Cleaner-Degreaser" from **Krylon** features a solvent that destroys adhesion between grease or oil and surface areas. By simply spraying on the chemical and rinsing with water, the surface is cleaned completely. Cleaner-Degreaser's spray gets into irregular, hard-to-reach areas that are missed by the brush-on degreasers. Priced at $1.89, it is effective for chassis, changers, auto engines, garage floors, greasy barbecues, and other applications.

FREE Catalog and Literature Service

*Check "Index to Advertisers" for further information from these companies.

ANTENNAS & ACCESSORIES

66. *ANTENNACRAFT*—Catalog sheet, illustrated in color, with information on connecting a UHF and a VHF antenna together using intercoupler G1483W.*
67. *BLONDER-TONGUE*—Brochure describing booster designed especially for stereo-FM reception and other TV-FM amplifiers.*
68. *FINNEY CO.*—Brochure describing *Finco* 3000 Series set couplers, traps, filters, and transformers for antenna installations.*
69. *GALLO*—Product sheets on line of antennas for color and black-and-white TV, VHF and UHF; includes information on compact indoor types and transistor amplifiers.
70. *GC ELECTRONICS*—Brochure C-120 describing *Colormagic* fringe antenna.*
71. *JERROLD* — Catalog sheet describing *Paralog* broadband TV-FM antennas.*
72. *JFD*—Specifications and operating information on *Transis-tenna* and newly designed, long-range LPV log-periodic TV antennas. Illustrated brochure showing entire line of indoor antennas and accessories for TV and FM. Data sheets on UHF antennas.
73. *MOSLEY ELECTRONICS* — Illustrated catalog giving specifications and features on large line of antennas for Citizens band and amateur applications.*
74. *TRIO*—Illustrated sheets showing line of antennas for TV and FM reception; also includes information on *Color-Brite* line of UHF antennas for color reception.
75. *WINEGARD*—Illustrated catalog giving specifications and features on large line of antennas for Citizens band and amateur applications; includes information on UHF converters and antenna system amplifiers.*
76. *ZENITH*—Informative bulletin on new line of log-periodic vee-type antennas for FM, and monochrome and color TV.

AUDIO & HI-FI

77. *ATLAS SOUND*—Data sheet describing *Columair* sound columns for use in auditoriums, churches, and similar areas with acoustic feedback problems.
78. *BOGEN*—Descriptive literature on deluxe home intercom systems.
79. *ERCONA*—Catalogs on *Leak* hi-fi components and *Ferrograph* professional tape recorders; includes specifications and applications on line of microminiature microphones and replacement speakers.
80. *JENSEN MFG.*—24-page, 2-color catalog describing stereo and monaural hi-fi loudspeakers, headphones, speaker components, and speaker systems.*
81. *MINNEAPOLIS SPEAKER*—Descriptive catalog on *Red Line* hi-fi loudspeakers; includes information on weatherproof *Music Mini-Speaker* for indoor or outdoor use, and new 8" speaker.
82. *OAKTRON*—"The Blueprint to Better Sound," an 8-page catalog of loudspeakers and baffles giving detailed specifications and list prices.
83. *QUAM-NICHOLS* — New hi-fi catalog listing specifications and response limits for coaxial, extended-range, low-frequency woofer, and tweeter speakers, in addition to other components.*
84. *RMS ELECTRONICS*—Features brochure on two-station wireless intercom system, for use in home, office, restaurants, etc.
85. *SHURE*—"Fact and Fiction Guide" detailing characteristics and performance pertaining to cardioid microphones.
86. *SONOTONE* — 4-page brochure containing information on *Velocitone Mark IV* stereo cartridge.
87. *SWITCHCRAFT*—Product Bulletin 136 describing new stereo adapter cables for converting sockets on European-made recorders, radios, amplifiers and pre-amps to mate with American-made headphones, microphones, and speakers.
88. *UTAH*—Catalog listing complete line of speakers and accessories for high-fidelity and public-address equipment. Also contains speaker replacement data.

COMMUNICATIONS

89. *CADRE*—Complete 4-page catalog on line of two-way radios and associated accessories.*
90. *E. F. JOHNSON*—Booklet 838, entitled "All About Two-Way Radio for Business or Personal Use."
91. *POCKETRONICS*—Brochures describing line of portable paging equipment: receivers, rechargers, encoders, adapters, and leather cases.

COMPONENTS

92. *BUSSMANN* — Bulletin SFB; 24-page booklet giving detailed information on line of *Buss* and *Fusetron* small dimension fuses and fuseholders.*
93. *CORNELL-DUBILIER* — 144-page component selector guide describes line of capacitors, filters, delay lines, relays, vibrators, and power supplies.*
94. *HEATH*—1964 catalog lists and describes over 250 audio, radio, and test equipment kits.
95. *IEH MFG.*—Catalog No. 63A listing CRT brighteners, test instruments, couplers, antenna switches, extension leads, and electronic hardware.
96. *JENSEN INDUSTRIES* — Replacement-cartridge catalog, listing complete line of snap-ins and standard types, including cross reference charts.
97. *LITTELFUSE*—Catalog No. 15 showing specifications on complete line of fuses, fuse holders, and merchandising aids, includes technical data pertaining to uses and construction of different type fuses.*
98. *MERIT*—General catalog and replacement guide, listing manufacturers' part numbers, with cross reference to replacements.*
99. *QUALITONE*—Information about packaged assortment of sapphire and diamond phonograph needles.
100. *SANGAMO*—Product catalog on line of paper and oil capacitors.
101. *SONOTONE*—Literature describing sintered-plate, nickel-cadmium battery modules.
102. *SPRAGUE*—Latest catalog C-615 with complete listings of all stock parts for TV and radio replacement use, as well as *Transfarad* and *Tel-Ohmike* capacitor analyzers.*
103. *TRIAD*—Informative engineering bulletin on transformers for applications in transistorized power supplies.

SERVICE AIDS

104. *CASTLE*—How to get fast overhaul service on all makes and models of television tuners is described in leaflet. Shipping instructions, labels, and tags are also included.*
105. *PRECISION TUNER* — Literature supplying information on complete, low-cost repair and alignment services for any TV tuner.*
106. *WORKMAN* — General catalog No. 102; fusible resistor and circuit breaker cross-reference guides; information on transistorized auto ignition system; and power converter sheet No. 25C.*
107. *YEATS*—The new "back-saving" appliance dolly Model 7 is featured in a four-page booklet describing feather-weight aluminum construction.

SPECIAL EQUIPMENT

108. *ACME ELECTRIC*—Complete specifications and applications for control-type magnetic amplifiers with capacities from 5-1000 watts and voltage ranges from 24-160 volts.
109. *ATR*—Descriptive literature on selling new, all-transistor *Karadio*, Model 707, having retail price of $29.95. Other literature on complete line of DC-AC inverters for operating 117-volt PA systems and other electronics gear.*
110. *DIAMOND ELECTRONICS* — Illustrated brochure on closed circuit television and accessories.
111. *GATOR-PROBE CORP.*—Literature describing new test probe that features interchangeable tips and adjustable length, permitting one pair of tests leads to serve for several jobs.
112. *GREYHOUND*—The complete story of the speed, convenience, and special service provided by the Greyhound Package Express method of shipping, with rates and routes.*
113. *TERADO*—Sheet depicting wide line of voltage adjusters.*
114. *VOLKSWAGEN* — Large, 60-page illustrated booklet "The Owner's Viewpoint" describes how various VW trucks can be used to save time and money in business enterprises; includes complete specifications on line of trucks.

TECHNICAL PUBLICATIONS

115. *CLEVELAND INSTITUTE OF ELECTRONICS* — "Pocket Electronics Data Guides" with handy conversion factors, formulas, tables, and color codes. Additional folder, "Choose Your Career in Electronics," describes home-study electronics training programs, including preparation for FCC-license exam.*
116. *HAYDEN BOOK CO.*—New 1964 catalog lists and describes books published by John F. Rider and Hayden Book Co.
117. *HOWARD W. SAMS*—Literature describing popular and informative publications on radio and TV servicing, communications, audio, hi-fi, and industrial electronics; including special new 1963 catalog of technical books on every phase of electronics.*

TEST EQUIPMENT

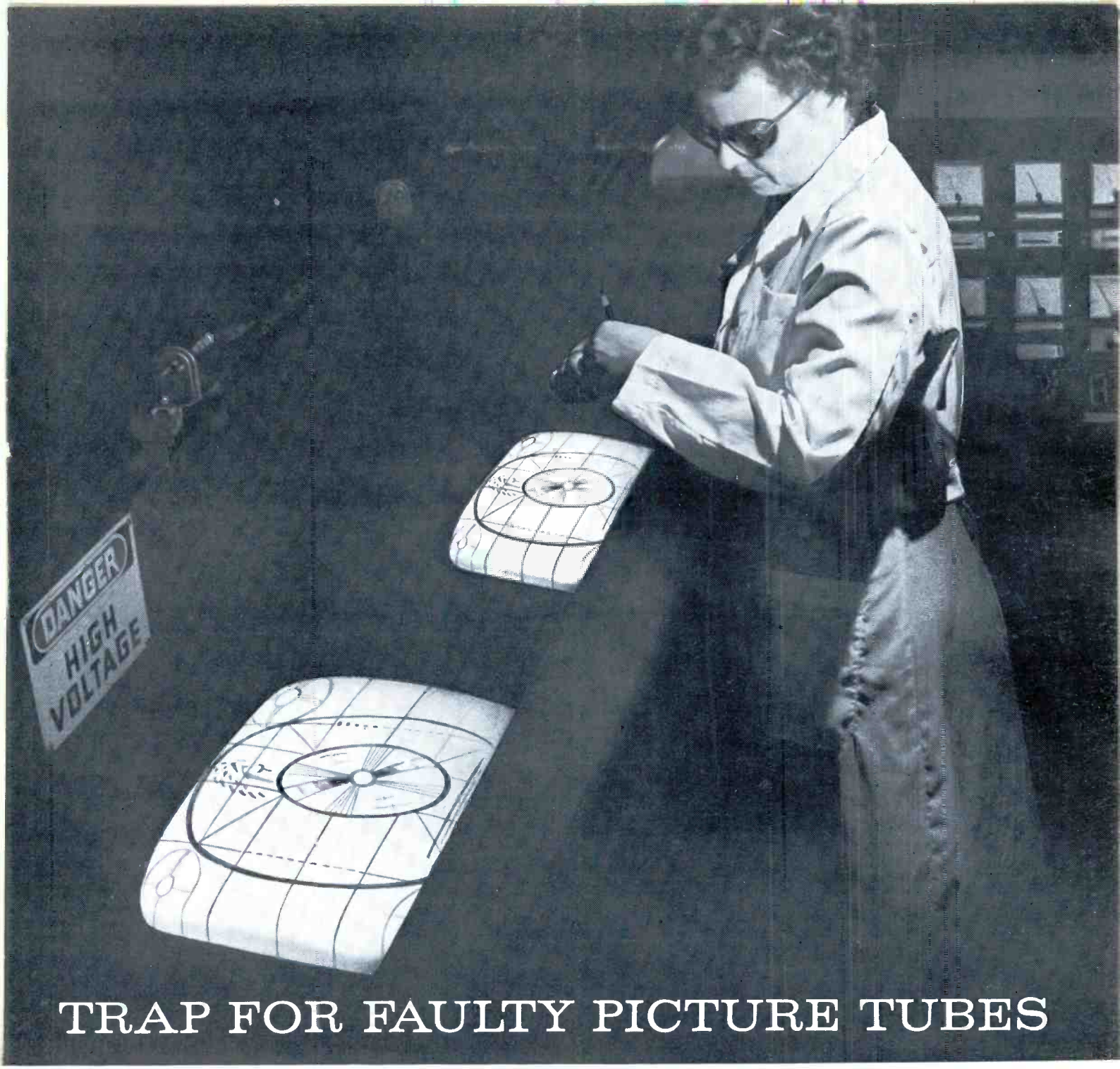
118. *B & K*—Catalog AP-21R describing uses for and specifications of new Model 1074 Television Analyst, Model 1076 Television Analyst, Model 850 Color Generator, Model 960 Transistor Radio Analyst, new Model 445 CRT Tester-Rejuvenator, new Model 250 Substitution Master, Model 375 *Dynamatic* VTVM, Model 360 *V-O-Matic VOM*, Models 700 and 600 *Dyna-Quik* Tube Testers, and Model 1070 *Dyna-Sweep* Circuit Analyzer.*
119. *EICO*—New 32-page, 1964 catalog of test instruments, hi-fi components, tape recorders, Citizens band, and amateur radio equipment.*
120. *HICKOK*—Complete descriptive and specification information on Model 661 *Chrom-Aligner* standard NTSC color-bar generator; Model 677 wideband oscilloscope; Model 470A VTVM; Model 660 white-dot generator; Model 656XC white dot-bar generator; question-and-answer booklet on NTSC color presentations is also included.*
121. *IDEAL METER CO.*—16-page catalog describing line of *Ideal* meters for all types of electronic applications.
122. *JACKSON*—Complete catalog describing all types of electronic test equipment for servicing and other applications.*
123. *SECO*—8-page bulletin describing company's complete line of modern tube testers.*
124. *SENCORE*—Question-and-answer bulletin on new Model MX-129 *Multiplex Analyzer.**
125. *SIMPSON*—Latest series of VOM's are described in test-equipment bulletin; also information on line of automotive test equipment.*
126. *TRIPLETT*—Brand new test equipment catalog No. 45-T, listing complete line of testers and accessories.*

TOOLS

127. *ARROW FASTENER*—Leaflets describing Model T-18, T-25, and T-75 tackers for speeding cable and wire installations. Illustrations show methods and models used for various wire thicknesses.
128. *BERNS*—Data on unique 3-in-1 picture-tube repair tools, on *Audio Pin-Plug Crimper* that enables technician to make solderless plug and ground connections, and on new-style *ION* adjustable "beam bender" for CRT's.*
129. *ENTERPRISE DEVELOPMENT*—Time-saving techniques in brochure from Endeco demonstrate improved desoldering and resoldering techniques for speeding up and simplifying operations on PC boards.
130. *SWING-O-LITE*—Two brochures listing information on magnifier and all-purpose lamps for servicing or office use.
131. *XCELITE* — Bulletin S960 describes straight-nose and curved-nose seizers ,with snap-lock device.

TUBES & TRANSISTORS

132. *GRODEN INC.*—New, condensed semiconductor catalog listing complete line of components.



TRAP FOR FAULTY PICTURE TUBES

RCA Guards Against Callbacks 26 Ways

Under the watchful eyes of trained inspectors, RCA Silverama® Picture Tubes are carefully scrutinized for screen quality and focus.

All Silverama replacement picture tubes as well as those destined for original equipment undergo a battery of 26 automated tests. These include: warm-up, emission, gas, leakage, electron-gun performance, and other critical factors that can spell the difference between long-term performance or costly callback. Tubes failing a single test are automatically tagged and rejected. In addition to automatic testing, every tube lot leaving the RCA plant has been sampled by Quality Control.

Nothing is left to chance; part by part, inside and out, from base to faceplate the quality of each tube has been carefully controlled and assured prior to assembly. Even the Silverama envelope is carefully inspected prior to re-use, and is internally scrubbed, buffed, and restored to the peak of its optical capabilities. Result: a superior picture tube, an RCA Silverama. Make it your next installation choice.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N. J.

The Most Trusted Name in Electronics

Circle 64 on literature card

CARRY EACH SILVERAMA FACTORY-FRESH INTO YOUR CUSTOMER'S HOME. New Foam-Lined RCA Picture Tube Tote Bag makes scratched, marked, or scuffed faceplates a thing of the past. Makes carrying both easier and safer. Two sizes: one for 16" to 19" tubes, one for 20" to 24" tubes.

SEE YOUR AUTHORIZED RCA PICTURE TUBE DISTRIBUTOR FOR DETAILS

See the caddy

See the fuse box through the caddy

See the fuses through the fuse box through the caddy

See more profits through

LITTELFUSE

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