# Radio and Television Maintenance

SEPT. 1951
7th Year

TRADE JOURNAL FOR RADIO AUDIO VIDEO

# Editor's Page

## Standardize Now?

ONE of the big problems plaguing the service technician today is the absence of standardization of essential parts. For the small and medium-size service company, the stocking of parts is becoming just about impossible.

Some service companies are trying to get around this problem by accepting work on a limited number of manufacturers' TV receivers. However, even these outfits run into trouble when an old customer asks for service on a set they don't usually handle.

It has been suggested by some servicemen that standardization be attempted in the matter of yokes and transformers to help ease the parts-stocking problem.

Standardization is a difficult problem for the manufacturer. Television is so new and so many advances are being made in circuit designs and parts each day that it is hardly likely that manufacturers could or would attempt to standardize. Standardization usually comes in any industry when a fairly static condition exists in the engineering of new parts.

For instance, in the automotive field, carburetors, fuel pumps, and electrical systems are standardized because the changes from year to year are insignificant. In the electronics field, improvements take place almost hourly.

It would be a disservice to the industry to demand standardization now!

No one is satisfied that we now have about the best TV picture we can get. No one believes that present circuits make the most economical use of components. Each manufacturer is still searching for more efficient circuits which he fully expects to have soon.

Should servicemen clamor for standardization now and lend their weight toward slowing engineering advances? Who is to set the standards, now?

→ to page 78

# NEWSLETTER

**TV LINK WITH SOUTHWEST NEXT YEAR.** The transcontinental TV hookup will be expanded to include the Southwest late in 1952. The American Telephone and Telegraph Co. has announced that Tulsa, Oklahoma City, Fort Worth, Dallas, San Antonio and Houston will be added to the existing network. Both microwave radio relay and coaxial cable will be used on the extension southward from Kansas City.

**SENATOR DROPS BILL TO CONTINUE FREEZE.** Senator William Benton (D., Conn.) has abandoned the bill he introduced several months ago to continue the freeze on TV station allocations for one more year. He still wants to set up a National Citizens Advisory Committee on Radio and Television to act as lobbyist for the audience. His new bill drops the freeze extension but retains the committee feature. FCFC Chairman Wayne Coy is said to favor the new bill.

**LITTLE RAW MATERIALS FOR COLOR CONVERTERS.** The National Production Authority's Consumer Durable Goods Order (M-47A) will put the skids under any ambitious attempt to manufacture adapters or converters for color television. The order prohibits switching the use of steel from item to item and a manufacturer wishing to make converters would not be able to transfer the use of steel from any other item. The NPA indicates that material to be permitted for converters will probably be very low. Said a spokesman: "We are not catering to ambitious projects." With a tight materials situation "it would not be desirable at present" to allow any greater use of materials than necessary for "survival."

**OKAY SCARCE PARTS FOR HAMS.** The Electronic Parts and Components Distributors Industry Advisory Committee has approved, at a meeting with the National Production Authority, a proposed order which would give amateur radio operators priority assistance in obtaining electronics equipment. The order, drafted at the request of the committee, would make it easier for ham operators associated with the civilian defense and other disaster programs to obtain scarce parts or maintenance and repair parts for their receivers, NPA reports.

# NEWSLETTER

**FIREWORKS EXPECTED ON TINTED SCREENS.** So-called color television screens which are currently being marketed may bring a lot of grief to current sellers of the item. The screens, multi-colored plastic, which merely fit in front of the picture tube and tint the black-and-white picture, have been merchandised in some places as color TV converters. Some in the radio industry who believe the tinted screens might confuse the public on real color and discourage future color-receiver sales are preparing to stop misleading statements about the screens through Better Business Bureau action and postal regulations.

**TV RACKET IN SAN FRANCISCO HIT.** Irving Reichert, Jr., assistant district attorney, San Francisco, charges that second-hand TV sets have been sold as new, low-priced sets are advertised that do not exist, sales agreements are not fulfilled and sales gimmicks with contests are not giving the prizes to winners. The district attorney's office is working with the Better Business Bureau, which has been getting 100 complaints a month, it is reported. Last month, one TV dealer was found guilty of petty theft in substituting a used set for a new one.

**RCA EXPANDING SERVICE CONTRACT PLANS.** RCA Service Company has added several new policies for service of RCA TV receivers. One of the new plans guarantees the picture tube for one year from date of purchase at $5.00 (for 17-inch tube).

**APPROXIMATELY A MILLION TV SETS IN INVENTORY.** New television sets in the possession of retail dealers are estimated to have ranged between 900,000 and 1,150,000 units at the beginning of August. This estimate includes between 350,000 and 450,000 table models and between 550,000 and 700,000 other TV receivers. The total U. S. retail inventories of new home radios are estimated to have ranged between 1,400,000 and 1,700,000 units at the beginning of August, and the retail stocks of new battery portable radios ranged between 375,000 and 450,000 units. Dun & Bradstreet conducted the inventory survey for a group of manufacturers of sets and component parts.

**'LIVE' TELECAST FOR 95 PERCENT OF TV HOMES.** The transcontinental microwave relay link means that 95 out of every 100 TV homes in the U. S. can be served by "live" telecasts, according to NBC research department. Based on preliminary estimates for Sept. 1, there were 11,360,000 TV sets installed in the present 48-city interconnected area. The linking of Los Angeles and San Francisco, San Diego and Salt Lake City provides 1,380,000 additional sets, leaving only 710,000 sets elsewhere in the U. S. not served by direct network facilities. NBC also reports a gain of 178,100 TV sets in the hands of the public during July.

→ to page 8

## *"We are adding thousands upon thousands—"*

**FRANK M. FOLSOM**
President, Radio Corporation of America

*"By a simple person-to-person canvass, we are adding thousands upon thousands of serious savers to our Payroll Savings Plan. Our employees are eager to contribute to the strengthening of America's defenses while they build their own security.*

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# *Radio and Television Maintenance*

**RADIO AND TELEVISION MAINTENANCE**
is published monthly by International Publishing Corporation at
16 Union St.,
Somerville, N. J.,
U. S. A.
EXECUTIVE OFFICES
Ambassador Hotel
Atlantic City, N. J.
Phone: 4-3474
Entered as second class matter October 16, 1950, at Post Office, Somerville, New Jersey, under Act of March 3, 1879.
PUBLISHER
Paul Roberts
EXECUTIVE EDITOR
Robert Letwin
EDITOR
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EASTERN EDITOR
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168 No. Michigan Ave.
Financial 6-0993
West Coast
Keith H. Evans
3757 Wilshire Blvd.
Los Angeles 5, Cal.
DUnkirk 8-2981
Subscription rates: U. S. and U. S. possessions, $4.00 per year by mail. Canada, $5.00 per year by mail. All other countries, $6.00 per year.

# RADIO and TELEVISION maintenance

## CONTENTS

Are Your Installations Fire Traps?..... 9
—By Richard L. Browne
Radioactive Materials and FM Report Mountain Top Snow Depths..... 15
What You Can Expect After the Freeze..... 17
—By Dr. W. R. G. Baker
Low-Power 2-Way Radio for Industry..... 21
Self-Adjusting Mixer for Field Intensity Meters 22
An Inside Look at General Electric's Picture Tube Plant ..... 60
Stability of Germanium Diodes..... 63
Development of the Tri-Color Television Tube 67
Country's First VHF (CQ) Radio Network.... 71
Line Carrier Simplex System..... 82

## Technical Section

Television Front End Design and the 40-50 Megacycle IF ..... 26
—By David T. Armstrong
Beating AC Hum in Tube Heaters..... 32
Fix on the Facts..... 36
—By John T. Frye
Frequency Compensation in Video Amplifier.. 39
—By Bruce Richards
The Meaning of Time Constants..... 42
—By David A. Leonhardt
Bypass Capacitors and Bypassing..... 44
—By Richard H. Anderson
Second Anode Voltages for TV with Selenium Rectifiers ..... 47

## Departments

Editor's Page ..... 2
Newsletter ..... 3
Out of the Editor's Mailbag..... 7
Products for the Trade..... 48
What's Your Problem ..... 72
Trade Literature ..... 84
What They're Saying ..... 89

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### Satisfied Reader

Dear Editor:

I feel you are doing a very good job in the fine information you give in RTM and think the 5½ x 8½ size is a great help to all in the radio and television field—easier to relax and read and much less bulky to file away.

I am in a TV fringe area which is not good as yet and like articles on AM and FM better than TV at present.

I know you are in a tough spot trying to give all your readers just what they like. I think you are doing a wonderful work.

A very much satisfied reader and subscriber.

Glenn T. Burgess
New Martinsville, W. Va.

—RTM—

### Easier to Read in Spare Time

Dear Editor:

Please extend my subscription for two more years.

I have received your magazine for one and a half years and enjoy it very much.

Your new smaller size is very good. It's a lot easier to carry around to be read in spare time.

J. Sherwood
Aurora, Ill.

—RTM—

### Unfair to Father of Twins?

Dear Editor:

T'aint fair! I just received your July issue advertising the old subscription

→ to page 94

# NEWSLETTER

→ from page 4

**ALMOST ALL PICTURE TUBES SOLD ARE 16 INCHES OR OVER.** Ninety-nine percent of all television picture tubes sold to receiver manufacturers in July were rectangular in form and 16 inches and larger in size, the Radio-Television Manufacturers Association reports. July sales to manufacturers, however, were considerably less than the preceding month due to plant shutdowns for vacations. July cathode ray tube sales totaled 89,144 units valued at $1,858,930 compared with June sales of 221,759 tubes valued at $4,664,744. Manufacturers' purchases during the first seven months of 1951 totaled 2,641,179 units valued at $68,387,203, RTMA reports.

**NEW MODELS, NEW PRICES FOR TV RECEIVERS.** TV set manufacturers are introducing new models and lower prices for the Fall buying season. Price cuts for various models range from $20 on Admiral's new 17-inch receiver to $150 on RCA's 19-inch combination. Only a few manufacturers have abstained from price reductions, while some cut prices only on present models and haven't shown new models.

**CRACK DOWN ON TRADE-IN OFFERS.** The Federal Reserve Board is expected to crack down on all radio dealers who accept trade-ins as down payment on new sets regardless of the actual value of the item. The Senate-House Committee on Defense Production has ruled that it was the intent of Congress that trade-ins must have a bona fide value and cannot be used as a device to get around credit rules. Better Business Bureaus have already jumped on retailers who promote and accept trade-ins of radios and TV sets of little or no value as full down payment on credit purchases of new sets.

**RCA TO TOP INDUSTRY IN TV PRODUCTION.** Television set production this year is estimated at 5,300,000 units as against a volume of 7,500,000 units in 1950, according to the annual industry survey released by Television Shares Management Company, investment advisor of Television-Electronics Fund, Inc. The ten principal manufacturers will produce a total of 3,780,000 units as against their estimated 1950 output of 5,337,000. RCA will again top the industry with production of 700,000 units as against 950,000 in 1950, followed by Admiral and Philco tied both years for second with production this year for each estimated at 625,000 as against 875,000 last year. Emerson, General Electric and Motorola are tied for third place with 400,000 units against production last year of 550,000, 425,000 and 660,000 respectively.

**The results of insufficient guying. A windstorm knocked over the antenna mast, and it hit the power lines in the background, charring the building in the two places shown on the outside, and causing more damage inside the building.**

# Are Your Installations FIRE-TRAPS?

**It doesn't cost the customer much extra for a really safe installation and he'll thank you for guarding him against lightning, fires and the other hazards of improper setups**

By RICHARD L. BROWNE

JUST what do you need for a really *safe* television installation?

That's the question that should be asked by every installer or serviceman, every time he puts up an antenna or brings a set into a customer's house.

But unfortunately, there aren't enough men who are conscientious enough, or who have time, or who feel they are able to charge enough, so that they bother with adequate guying, sufficient protection against lightning and wind

damage, and the other details that are not only desirable, but actually essential to a good installation.

Too often, the installer concentrates entirely on the quality of the received picture—he spends his installation time in trying to orient the antenna so that the set owner gets the best deal in reception.

Consequently, it happens that the installation is not done carefully enough from the point of view of *safety*—a factor that should be considered to be of at least equal importance with the quality of the picture and sound received.

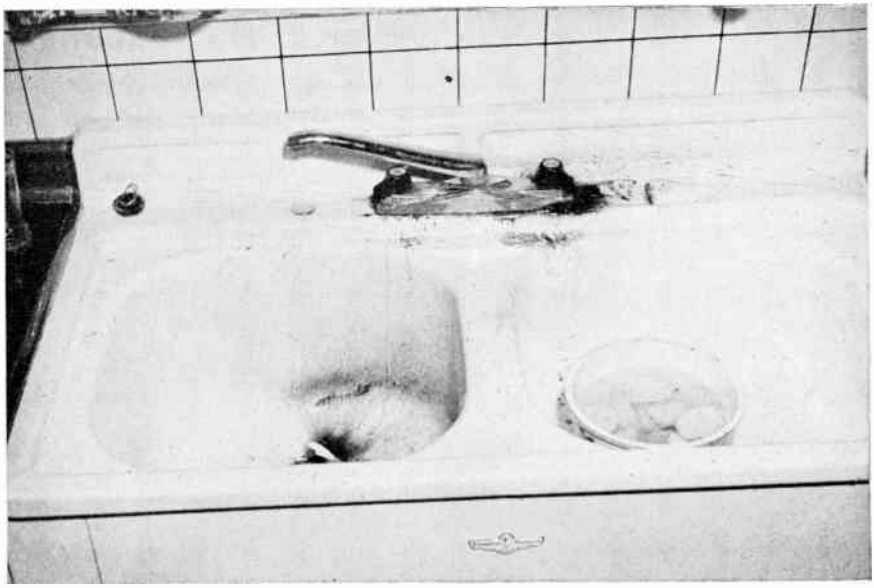
### Sets Without Arresters

For example, there are thousands upon thousands—and the figure may even run into millions—of TV installations without a lightning arrester. And a good many of the existing setups that use arresters, are connected so that the safety units do little, if any, good.

This is a situation that must not be allowed to continue. It's easy enough to provide adequate protection in all but the most difficult cases, and technicians throughout the country must be made aware of the little things they can and must do to avoid risking a customer's house and his life with a haphazard arrangement.

It really isn't too complicated or difficult to do the job right, and the few things that make it right won't add to the cost of the installation appreciably.

With this in mind, the National Fire Protection Association, a group of all kinds of industrial organizations, insurance firms, and government bureaus, has put out a little pamphlet that covers the subject of safety from every angle. For those who are interested in procuring the booklet, it is available for 25



**What can happen when a mast falls over onto power lines. The current entered the house both on the signal leadin and on the antenna rotator control wire. The householder was severely burned and could have been injured even worse.**

**The installer and the owner of this installation are asking for trouble. If the mast should give way, it could fall onto high-tension lines in any one of three directions, and could set the house on fire or electrocute the occupants.**

cents from the Association, which is located at 60 Batterymarch Street, Boston.

The booklet, gotten together by NFPA's electrical field engineer, Charles L. Smith, is a compilation of pertinent sections of the National Electrical Code, with some data from other sources on non-electrical precautions that should be taken with the installation of TV and FM antennas.

## Mast Grounding

First off, it tackles the subject of grounding masts for antennas. Masts,

according to the book, should be "permanently and effectively grounded." Well, anybody already knows that. *But*—the question is, what is a permanent and effective ground connection? The code states that the ground wires from an antenna structure must go in as straight a line as possible, to the "nearest lightning conductor."

A proper ground, however, is not just the nearest hunk of iron or steel. The ground has to be something that goes deep into the earth, below the frost line and below the moisture level. Not only that, but the ground connection is ideally of "copper, aluminum, copper-clad steel, bronze, or other corrosion-resistant material." The ground lead from the mast does not need to be insulated from the building itself, or even run outside the building; it can be inside the building for part of its length, but it has to be firmly fastened with an approved ground clamp, such as the kind that cuts through paint or any other interfering substance, to the well-grounded "electrode."

### Straight Leads

The ground lead, however, should run in a fairly straight line, if that is practicable. The code specifically states that "no bend in a conductor which embraces a portion of a building, such as an eave, shall have a radius of less than eight inches. The angles of any turn shall not exceed 90 degrees and conductors shall everywhere preserve a downward or approximately horizontal course."

The sum of all that is, of course, just to say that, if you can do it, bring the ground lead from the mast in a direct line to the ground.

The grounding electrodes that are recommended in the code include water pipes that are connected to a community or other water system underground, gas pipes, well casings, and "made" electrodes. This is a little surprising, considering that the TV industry itself is pretty well down on connecting grounds to any kind of pipe except a cold-water line; in such a case, though, the best practice is always to follow the more stringent recommendation. When in doubt, hook the ground wire to a cold water pipe. Then you don't have to worry about it.

### 'Made' Electrodes

"Made" electrodes are pipes, rods, plates or other metallic structures that are buried in the ground specifically for the purpose of grounding a piece of electrical equipment. For best protection, the made electrode, if it is a pipe or rod, should be galvanized or otherwise protected against corrosion, and it should be driven into the ground about eight feet. Four feet is considered the minimum depth for such a connection. Under no conditions should pipe be painted or covered with any other poor conductor.

Plate electrodes, buried in the earth, should present at least two square feet of surface to the soil, the code says, and should be at least one-fourth of an inch thick, if made of iron or steel. If the electrode in question is made of copper, brass, or another non-corrosive material, then it doesn't have to be so thick.

It is well to use a separate ground electrode for each individual need in the building. Separate uses would be for the antenna mast, the lightning arrester ground, a lightning rod, a telephone ground, and amateur radio ground, plus a ground for machinery housings. But underwriters' Labora-

tories experts believe that all the separate grounds should be bonded together to prevent "side flash."

### Lightning Arresters

Lightning arresters should *always* be a part of the installation. They don't cost much, can be installed in a matter of minutes, and they may make the difference between the building's being safe and its burning to the ground. Or they might save the television set from complete ruin.

Remember that in most cases, one side of the AC power line in the house is grounded. This means that lightning, if it should hit the antenna, will seek the shortest path to ground, and if the shortest path happens to enter the limits of the set itself, that set is a goner. This is one reason that it is very poor practice to install the arrester on the mast, near the antenna array.

As approved by the authorities, the arrester should *always* be attached to the outside of the house *at the point where the leadin enters the building,* and should be connected straight, firm, and direct to a good ground connection like the electrodes outlined here

The purpose of this rule is to ensure that charges accumulating on the array will run off into the ground instead of into the receiver. A rule of thumb is to make sure that the arrester connection to ground is shorter than the length of leadin wire between the arrester and the receiver.

### Mechanical Setup

The mechanical setup of the mast and the array is something that deserves plenty of attention, too. Any technician who has watched the effects of a good, heavy storm on a large number of TV antennas will bear witness that, for the most part, a high wind makes a mess of a sub-standard installation.

And there are plenty of antennas that are given only the most nominal support and stiffening against such things. The trouble here is that when you are planning to make something secure against weather, you have to take the utmost precautions. There are very few man-made forces that come anywhere near to matching the terrific strength of the elements.

All antennas, therefore, have to be given the maximum support. The taller they are, the more guying and other stiffeners they need. No one would deny this. Yet how often do we see the antennas that are put up just any old way, without proper basing or guy fastenings?

The matter of making the assembly mechanically strong is important from more than one angle. The first thing generally considered is probably the cost of the equipment, and the cost of replacing it if it should be knocked over.

### Secondary Damage

Perhaps more vital, though, is the secondary damage that can be done if an improperly-erected antenna and mast come down. There are a good many cases now on record—far too many—where a loosely constructed mast assembly has come smashing down onto power lines, creating thousands of dollars' worth of damage by fire, and endangering the lives of the occupants of the house. In connection with this, it might be mentioned that a family of three were all electrocuted only a few weeks ago when they were trying to put up a TV antenna and it fell across a power line.

Another thing to bear in mind is

that the chimney installation is not always such a good idea. It's very common practice, unfortunately, to strap the antenna mast to a chimney. This often involves drilling the masonry for bolts, which can further weaken a chimney that isn't in perfect shape anyway, and it always brings in the risk of adding to the wind-resistance load of the chimney. With the added weight, although it seems negligible, and the added wind resistance, a deceptively strong-looking chimney can topple, perhaps killing or injuring bystanders and certainly doing a great deal of damage.

### Points to Remember

The points to remember, then, for a safe TV or FM installation, are:

1. Make sure the antenna mast has a good ground.

2. Don't depend on guessing; if there is no cold water pipe near at hand for a ground, drive a rod or a pipe into the earth and clamp the ground lead to it with a regular ground clamp, specially made for the purpose.

3. If there are overhead power lines anywhere in the vicinity, shift the installation so that it could fall without contacting any of them, even if it means a slight loss in reception. This should be a must for all TV installations using tall towers.

4. To prevent any toppling of the mast, give it a solid foundation in woodwork or masonry that you know to be in good condition. Unless it is absolutely necessary, don't mount the mast on a chimney. Then guy the mast properly, using two sets of guy wires if necessary, and using a "floating collar" for the turning portion of the mast if a rotator is part of the assembly.

5. Mount a lightning arrester next to the spot where the lead-in enters the building, and give it its own ground, separate from the ground for the mast itself. Then tie the two ground connections together.

If these rules for safety are borne in mind and followed, there should be no complaints, and the antenna should give no serious trouble.

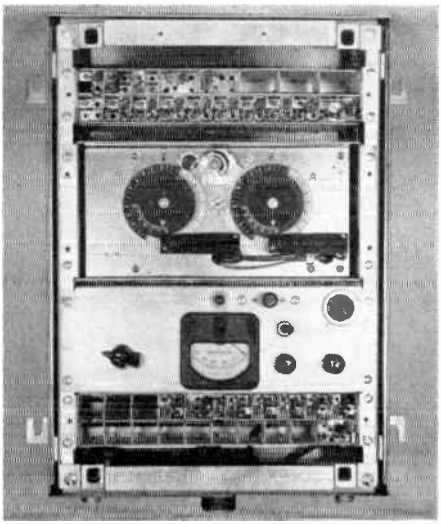
## How About That, Doc?

WHEN a doctor recently was handed a bill for repair of his TV set, he became highly indignant.

"All this for a few hours work?" he stormed. "Why you charge more for your work than we of the medical profession do!"

"Well, now," consoled the TV technician, "that's just about the way it should be. You doctors have been working on the same old model since time began, but we've got to learn dozens of brand-new models every year!"

# Radioactive Materials And FM Report Mountain Top Snow Depths



**Complete repeater stations. Units from top to bottom: (1) ½ watt FM transmitter using patented cellular construction, (2) control and meter panel, (3) jewelled-escapement, spring-driven time switch wound periodically by small electric motor, and (4) FM receiver.**

### Vital knowledge of future water supply automatically supplied through repeater channels

ONE OF the most recent unique applications of supervisory control and telemetering equipment is that of transmitting snow depth measurements from mountain tops and other isolated points.

From an economic standpoint, it is vitally important to use all the water from natural precipitation with greatest efficiency, particularly in the western states.

This requires accurate measurement of the moisture as it falls and as it is stored in the snow pack in the mountains.

In the past this has been accomplished only by laborious sampling and an insufficient number of measurements.

#### New Development

During the past two years, however, the U. S. Weather Bureau and the Corps of Engineers have developed a thickness guage using radioactive isotopes of common metals to measure the water equivalent of snow.

These artificial radio-active elements have recently become available in practical quantities as a result of the development work undertaken by the Atomic Energy Commission.

The isotopes, like natural radio-active elements such as radium, may emit alpha, beta, and gamma rays. Of these, only the gamma rays appear to have sufficient energy to penetrate a deep snow bank.

The isotopes are planted beneath the ground surface. By measuring the intensity of the radiation of the isotopes after it has passed through the snow, the depth of the snow in terms of water equivalent can be determined.

**Complete recording station showing Motorola receiving equipment and scaler-divided unit for indicating count from remote radio-active snow gage stations.**

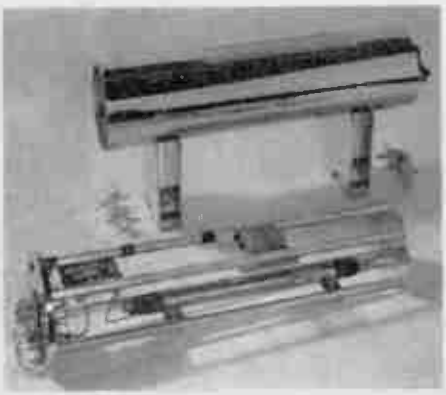
The Geiger-Mueller tube was chosen as the sensing device to measure the radiation intensity because it is rugged and can withstand the conditions of operation imposed upon it. It is simple and provides an output that can be readily used in electronic circuits.

So that no one has to be present at the measurement point, usually in an isolated mountainside, Motorola radio equipment is used to transmit the data automatically to the central recording station.

### Battery Transmitters

The battery operated transmitters and receivers are mounted in small stainless steel cases which themselves are weatherproof. Nickel-cadmium storage batteries were chosen to furnish power because of their excellent low temperature characteristics.

→ to page 94



**Outdoor sensing unit disassembled showing, top to bottom, (1) housing and mounting clamps and (2) chassis with Geiger Muller tube, impedance transformer tube circuit and magnetically operated beta standardizing source, all mounted.**

**Typical repeater station located on a mountain for receiving signals from several radio-active snow gage stations and sending them on to the recording station.**

# What You Can Expect
# AFTER THE FREEZE

It may be two years or more before new TV stations get on the air after the freeze, says Dr. Baker, and an all-electronic compatible color receiver will not be ready when the thaw comes

By DR. W. R. G. BAKER

*Vice-President, General Electric*

*Ed. Note: This article was prepared as an address before the National Electronic Distributors Association Convention in Cleveland last month. Because Dr. Baker's views vary considerably with others expressed in the industry, and because he offers some interesting facts and conclusions, we believe RTM readers will find this article of value in thinking in terms of the future.*

WE are living today in an era of expansion. Scientists advance the theory of an expanding universe. We have, and hope to continue to have, an expanding national economy. Some of our cities are expanding at so rapid a rate that planners talk of our exploding communities.

But, important as expansion of universe, economy and cities might be, none, I'm sure, will have as great an effect upon our lives, and the lives of our children, as will the expanding area of electronic science.

Within the general field of electronics there are a dozen different topics I believe would be of interest to you. But few could be more important at this time than the question of what may happen when the freeze on television stations is lifted.

### Disappointment for Some

At the close of this month, the freeze on construction of new television stations will be three years old. The television industry has blamed many of its ills upon the freeze to the extent that many persons look upon the lifting of it as the palliative, if not the cure-all of those ills. Some of these people are going to be disappointed.

First, let us take a short look at what did happen during the three years of the freeze. As more and more of the 107 television transmitters now operating in the United States went on the air, some 92 set manufacturers began manufacturing television receivers as fast as they could, and set dealers in the broadcast areas were beating off customers with clubs.

This was wonderful. This was a dream come true. But then—what was supposed to have been a never ending

stream of set customers dried up, and this last summer, almost disappeared entirely.

### TV Set Owner Dissected

At this point we have a rather strange situation. The television set owner has no more privacy than a statue in the park. Opinion researchers and survey experts have dissected him, examined him, analyzed him, reported on him. They know how many hours he watches television each week, what he eats for breakfast, how he parts his hair, and, if he has hair. They know how many packages of cigarettes he smokes each week, how old his children are, whether he uses cream in his coffee, and a thousand other things about him.

Knowing all of these things about the TV owner, you would think someone would be able to answer the question as to why the prospective TV owner stopped buying TV sets, and perhaps more important, how to get him started buying TV sets again.

I think you would be interested in some of the figures about the owners of television sets. Since I'm sure all of you who live in broadcast reception areas have sets, here is what one study says about you. It says you make $664 a year more than the man who doesn't own a television receiver. You bought nearly 75 per cent of the new cars sold in the past six months. You buy more beer and orange juice. You use more hair tonic and shampoos and deodorants. You have more children, and you spend two and a quarter hours a day watching television programs. And I really don't see how you do it.

### Would Even Blame Sunspots

But, as I said, no one seemed to know why more television sets weren't being purchased, in the areas where television reception existed today. The high cost of living; regulation W, which tightened credit restrictions; the color controversy; the federal excise tax; prospective higher personal income taxes; all were blamed for the slump. The season of the year was blamed and if the slump could have been blamed on sunspots, it would have been.

### Look at the Facts

The present television areas are saturated, some said. "Let's lift the freeze and have another gold rush," others said. But these are opinions, these are conjectures. It is about time we took a look at some facts, and then perhaps, decide what the end of the freeze can and cannot do for the electronics industry.

These facts can be divided into four major calssifications: (1) economic; (2) political; (3) production, and (4) scientific.

Let's take them up one by one. What are the economic facts concerning early 1952, when, according to the chairman of the Federal Communications Commission, the freeze will be lifted.

We will still be in the middle of an expanding economy, with our national gross product reaching a new high of some 310 or more billion dollars a year, due in part to the heavy federal military expenditures, to the government's deficit spending and to a dropping, but still fairly adequate supply of consumer products, and a high level of disposable income.

The political fact that concerns us most is that we are, and barring an all-out war, will be in 1952 living in a garrison state, a controlled economy, with definite limitations on the amount

of civilian production and with controls on profits, wages and prices.

### Less than 5 Million Sets in '52

And that leads us to the third classification—production. If the present pattern of mobilization is followed, there will not be available for manufacture of television, sufficient of the critical materials for industry to produce more than five million sets in 1952. It may even be four million or less, if proposed restrictions on critical materials are adhered to rigidly. It might even be fewer sets if nickel is unavailable for receiving tubes. It takes a long time for many of the military contracts to build up to any volume, and that is particularly true for complicated military electronic equipment requiring a large amount of engineering. The major drain on the supply of critical basic materials will fall most heavily in 1952 and in early 1953.

### Scientific Advancement

The last of the four classifications which we must consider before we make any predictions as to the future of television after the spring thaw, is the scientific; in other words, the state of the advancement of television. Improved black and white receivers for ultra high frequency as well as VHF will be available. Picture tube sizes are still increasing. No compatible color receiver of an all-electronic type will have been developed to the point that it will be in quantity production by the time the freeze is unfrozen.

These are the basic facts, the principal factors affecting the growth of television within the United States once the artificial restriction of the freeze is lifted. Some are limiting factors, others will work for more rapid expansion.

### 400 Applications Pending

According to the allocation plan set forth by the Federal Communications Commission, there could be at some indefinite time in the future, approximately 2,000 TV transmitters established in some 1,400 cities. At the present time there are approximately 440 applications pending, many of these from cities which do not have television stations at present, and many of which are not within broadcast reception areas.

Let me name a few of these cities presently without a transmitter—Mobile, Alabama; Tucson, Arizona; Sacramento, California; Denver, Colorado; Augusta, Georgia; Peoria, Illinois; Ft. Wayne, Indiana; Des Moines, Iowa; Wichita, Kansas; Shreveport, Louisiana; Portland, Maine; Flint, Michigan; Akron, Ohio; Allentown, Pennsylvania; Columbia, South Carolina; and many, many others.

When the unthawing comes, how soon will transmitters go on the air in these cities? Some of the areas they will cover are now receiving television signals from adjoining areas. Present coverage ranges from Allentown, Pennsylvania, which is already 47 per cent saturated with TV receivers, to Denver, Colorado, where there are none.

### Rule of Thumb

In other words, how soon will these areas become gold mines, and to what extent? There is one rule of thumb that can be used but that would only indicate probabilities. If a city is a good market area; if it is on the coaxial cable, or relay network, or within one microwave link of the cable; if it has only one applicant for permission to construct and operate the station, then, according to our market research experts, it has a pretty good chance of getting on

the air in the next two years. If any one of these items is missing, it may be five years.

If five years is a little too long in your way of thinking, let's take a look at what we probably will have two years after the end of the freeze.

There are now 107 VHF stations operating. At the end of two years we can expect to see 141 more VHF stations on the air for a total of 248 VHF transmitters. There are now no UHF stations operating, with the exception of some experimental transmitters like our own at Electronics Park. At the end of two years after the freeze is lifted, we can expect a minimum of 36 UHF stations will be on the air.

### Doesn't Agree With Predictions

At the end of five years I think we can look forward to a minimum of 343 VHF stations and 166 UHF stations or more than 500 stations in the United States. This doesn't agree with many predictions ranging as high as 1,500 transmitters in five years and I'll admit the estimates are conservative. If materials including construction materials, should be in free supply, then these estimates could be quite low.

It has been said that any area large enough to support a daily newspaper can support a television station. The proposed allocation plan would place several transmitters in areas that have only one newspaper.

In cities not within any reception area today, and where establishing a station provides a new service to the community, the building up of the audience in the area will, of course, follow the pattern established in other cities. The audience build-up may be sharper and quicker because people nationwide are pretty much "pre-conditioned" to the advantages of television.

### Forecasts Realistic

You may consider these forecasts to be pessimistic. On the contrary, they are realistic, not based alone on what industry members think can be produced, as many surveys are. Perhaps the other side of the picture may be a little happier one. We also believe there will be 44.5 million wired homes in 1955, or 14 per cent more than 1950. We believe that by the end of 1955, nearly 80 per cent of these homes, or approximately 35 and one-half million families will be within range of a television station. And, there is a possibility that nine out of ten of those more than 35 million families will own at least one television receiver.

What does that mean to the distributors? The best figures I have been able to find indicate electronic parts and components distributors did a gross business, not including set sales, of approximately 320 million dollars in 1950. In 1951, this will jump to 475 million dollars. But by 1955 distributors gross business on an annual basis is expected to be in the neighborhood of one billion dollars, or more than triple the 1950 figure.

### Industrial Electronics

Don't overlook the possibilities of industrial electronics. I know it is hard to look at the electronics picture without being blinded by the reflected glare of television. Manufacturers see the untapped market for receivers. Distributors consider the untapped market for components and parts. Advertisers think of the tremendous impact upon the buying public. Educators see television as the instrument for raising the intellec-

→ to page 97

The Motorola low-power industrial Uni-Channel Sensicon Dispatcher is available either as a single package unit with built-in speaker and control head, shown left, or with individual speaker and control head as pictured on the right.

# Low-Power 2-Way Radio For Industry

A NEW low-power two-way radio that utilizes the "Uni-Channel Sensicon" receiver has been designed by Motorola to meet the accelerating demand of industrial radio installations.

The unit meets FCC regulations that allow a maximum power input of three watts to the final amplifier for those industries where all two-way radio communications are carried on within a single plant area.

The low-power hookups can be installed either as base stations or as mobile units.

They can be mounted and used on fork-lift trucks or other intra-plant vehicles to speed material movement, eliminate "deadheading" time, and reduce the total number of vehicles needed.

These compact transmitter-receiver units are available either as a single package with built-in speaker and control head, or with individual speaker and control head. Models are available for operation from either 6-volt DC, 12-volt DC or 117-volt AC primary power source.

The new 2-way radio for industrial application shown mounted on a fork-lift truck.

# Self-Adjusting Mixer For Field Intensity Meters

## Feedback Circuit Prevents Gain Calibration Drift

A NEW type of feedback mixer that will retain calibration over a reasonably long period of time has been developed at the National Bureau of Standards.

The device helps correct the serious defect of long time calibration instability common to many units used for the continuous recording of radio field intensity.

The mixer is equally applicable to other types of frequency selective measuring equipment.

In the operation of the circuit, gain stabilization is brought about by using, as negative feedback, the difference in frequency voltage from the output of a superheterodyne mixer.

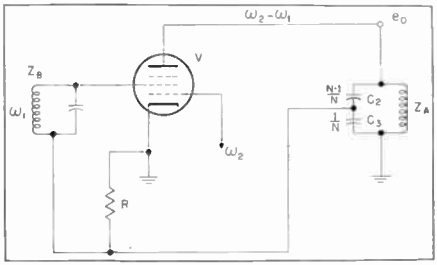



**Fig. 1. Schematic diagram of a single-tube feedback mixer using the gain stabilization principle. Negative feedback voltage is derived from a capacitive voltage divider in the plate circuit, returned to the tuned signal grid, and amplified in proportion to the average value of amplifier transconductance. When a 6SB7-Y is employed as the mixer tube, with a plate supply of 100 volts or greater and 26 Db of feedback, the gain variation is less than 5 percent of that which would be experienced without feedback.**

As an approximate explanation of its performance, the mixer tube may be considered similar to a voltage feedback IF amplifier.

### High Gain Stability

When a high degree of feedback is maintained, excellent gain stability is achieved. The conversion gain is also stabilized to the extent that the conversion transconductance is linearly proportional to the average value of amplifier transconductance.

When high feedback is employed, the gain is essentially not a function of the tube transconductances but is approximately proportional to the ratio of two constants determined by the switching or modulating function of the mixer tube.

One constant relates to the average value of amplifier transconductance and and the other refers to the conversion transconductance.

Variations in the constants are chiefly due to tube aging but are also effected by changes in circuit impedances, oscillator and supply voltage instability, etc. However, there is little effect upon the gain with feedback provided both constants are similarly changed by approximately the same percentages.

This appears to be the case with tubes

such as the 6SA7 and 6SB7-Y. With other tube types there may be appreciable differences in the percentage change of the constants, resulting in a change in the center frequency voltage gain which had not been anticipated.

The effect may be considered as a limiting factor for stability improvements with some mixer tubes. Fortunately, the tubes used during the course of the experimental work did not appear to suffer appreciably from this possible limitation.

## Experimental Circuit

In an experimental single-stage circuit, a 6SB7-Y was employed as the mixer tube. With a plate supply of 100 volts or greater (300 volts normal) and 26 Db of feedback, the gain variation was less than 5 percent of that which

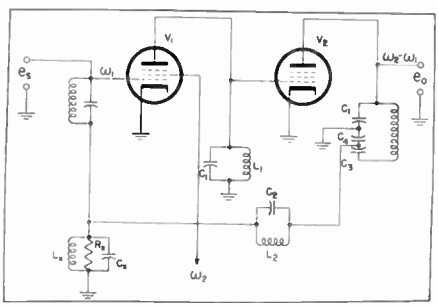



**Fig. 2. Circuit diagram showing an extension of the gain stablization principle developed at the National Bureau of Standards to a mixer couple. Gain stabilization is brought about by using, as negative feedback, the difference voltage from the output of the superheterodyne mixer. The feedback voltage is derived from a capactive voltage divided in the tuned plate and is returned to a junction between a grounded shunt circuit and a parallel-tuned grid circuit. The shunt circuit is composed of resistance, inductance and capacitance and its purpose is to furnish the correct terminating impedance for the feedback circuit as well as to provide a sufficiently low impedance at the signal frequency to bypass the grid return.**

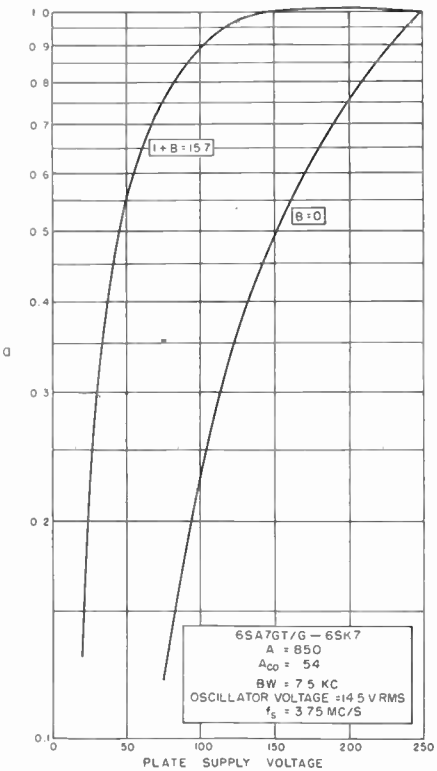



**Fig. 3. Graph showing the improvement obtained by using the gain stabilization principle on a mixer couple operating at a frequency of 3.75 Mc. The normalized gain is plotted against the plate supply voltage for a couple composed of a 6SA7 and 6SK7 and shows the gain in the circuit without stabilizing feedback and again with it. On the graph, B represents a value related to the magnitude of feedback; 1 + B is defined as the magnitude of feedback. In the legend, $A_{co}$ represents the center frequency voltage gain of the mixer couple, A is the gain without feedback, BW is the bandwidth of the circuit, and $f_s$ is the signal frequency. The ordinate a is the normalized gain.**

would be experienced without feedback.

This particular single tube mixer experiment indicated that a large change in conversion transconductance resulted in a relatively small change in voltage gain.

It should be noted that in order to improve substantially the gain stability, a relatively high degree of feedback is required. For this reason a tube with a high conversion transconductance should be selected. In addition, the tuned plate circuit should have a high impedance and a high Q if a relatively narrow bandwidth is desired.

### Principles Extended

The gain stabilization principle may be extended to mixer couples or possibly to mixer triples as well. For example, if feedback is applied over two stages using practically obtainable coils of high Q, a relatively narrow bandwidth with improved flatness will result.

The feedback voltage is derived from the capacitive voltage divider of a tuned plate circuit and is returned to the cathode of the first stage through a parallel resonant circuit. The cathode return is used to obtain the correct phase relationships. The resulting improvement in gain stability for the mixer couple operating at 3.75 Mc with 23 Db of feedback is greater than that obtained in the single tube circuit.

When the mixer tube is operated with a fairly large cathode resistor, degeneration of both signal and oscillator voltages will be appreciable. To avoid this difficulty, the phase of the feedback voltage is reversed by suitable means and the feedback applied to the signal grid of the mixer.

This circuit is similar to the mixer couple previously described except the feedback voltage returns to a junction between a parallel tuned grid circuit and a grounded shunt circuit composed of a resistance, inductance, and capacitance.

The purpose of this shunt-connected R, L, and C is to furnish the correct terminating impedance for the feedback circuit as well as to provide a sufficiently low impedance at the signal frequency to bypass the grid return. This arrangement has been used to maintain a constant feedback ratio over a frequency range of 1 to 20 Mc.

Compared to a cascade, synchronous, single-tuned mixer-amplifier arrangement, the NBS mixer couple provides improved gain stability, increased gain-bandwidth product and a gain-frequency characteristic which more nearly approaches an ideally rectangular shape.

## Man the Pumps: FCC is Flooded

SINCE the Federal Communications Commission has asked for briefs to be filed on TV station allocations and requires 50 copies of each brief, the flood of literature is about to sweep the staff out of the windows.

Some of the briefs, including complete data and exhibits are running to hundreds of pages, and besides the 50 copies for FCC, 30 copies are required for distribution among engineers.

*Radio and Television Maintenance*

# TECHNICAL SECTION

Television Front End Design and 40-50 Megacycle IF

Beating AC Hum in Tube Heaters

A Couple of Bromos for the Auto-Radio Headache

Frequency Compensation in Video Amplifier

The Meaning of Time Constants

Bypass Capacitors and Bypassing

Second Anode Voltages for TV with Selenium Rectifiers

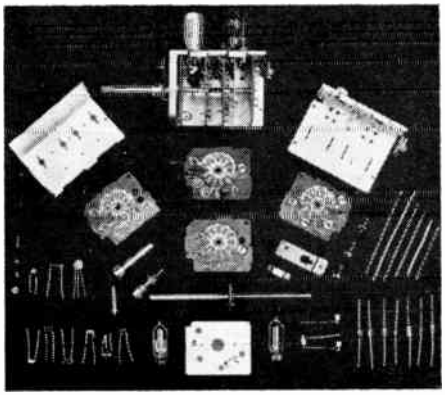
Many TV problems being minimized with new developments including new standardized IF values

# Television Front End Design And the 40-50 Megacycle IF

By DAVID T. ARMSTRONG

THE ADOPTION of the 40-50 Mc IF as the standard frequency for television receivers necessitates some changes in the front end by virtue of the fact that the output must now be 41.25 and 45.75 for picture and sound, respectively.

While there are disadvantages attached to any change in the components which affect other portions of the television receiver, there is a decided advantage the manufacturer of front ends may achieve as a result of the new IF.



Parts of the 500-A-10 front end tuner.

Over the past few years there have been many new ideas and developments which affect front ends with respect to design and performance.

But in a highly competitive market manufacturers for the most part could hardly afford to redesign the tuner to incorporate the improvements.

They have kept them in mind, however, against the day when changes would be possible, or for the time when tuners for the new bands in the higher frequency spectrum are made available.

Because the oscillator had to be changed to provide for the output at 41.25 and 45.75 Mc, the tuner could be substantially redesigned so that a better product could be made available to the consuming public. (At the same time, there have been some new developments in television channel selectors, or front ends, as they are known in the trade.)

There are many reasons for changing to the higher IF, but chief among them are the following:

1. Oscillator radiation effect is virtually eliminated in the receiver itself. This means better reception for neighbors.

2. There is increased immunity to FM interference, and image interference is reduced to a negligible point.

3. Industrial and diathermy interference are reduced or eliminated in many cases.

### RF Input Circuits

There is a great lack of standardization in the television industry—three types of antenna; 75 ohm, 150 ohm, and 300 ohm impedance are common. Two common types of leadin, 72 ohm coaxial cable and 300 ohm twin lead are found, as are other complicating elements. These factors make it difficult for the receiver manufacturer or for the front end manufacturer to control the variables precisely.

The result is an unhappy compromise by means of which the front end tuner is designed to cover the range of impedance variations to be found in any practical field setup.

Obviously, it would be much better all around for the front end manufacturer, the receiver manufacturer, the serviceman, and the consumer, to have some standardization that would give him the most of the best for his money.

And in the attempt to accommodate the many variations the genius of the front end component makers has been taxed. Many theoretical solutions have been propounded and some fairly good practical ones worked out.

The "tapered-line" antenna coupling network used in the Philco-Sickles tuner is one example of an RF input circuit designed to match either a 72 ohm or a 300 ohm line to the grid of the RF amplifier tube.

The coupling network provides a voltage gain between the antenna terminals and the RF amplifier grid; this tuner has the additional positive effect of minimizing the standing wave ratio in the transmission line.

There is considerable variation between the antenna input impedance and the RF amplifier input impedance from channel 2 to channel 13.

For example, a simple dipole antenna, a half wave length long and fed from its center, has an impedance of approximately 72 ohms. At twice the frequency for which it was designed, the antenna is a full wave length long and has an impedance of approximately 2000 ohms at its center. The use of one input transformer for the low band and another input transformer for the high band with the switching controlled automatically by the station selector helps improve the mismatch situation between the antenna leadin and the RF amplifier.

### Broadband-Coverage Tuner

Tuners with broadband coverage have never been popular for television; engineers are wary about designing a receiver to use them. The recommendation of the 40-50 Mc IF has stirred up interest in their use, but the chief reason for not recommending a broadband tuner for the front end is that the local oscillator radiates a signal. Elimination of such radiation is one of the chief reasons for the recommendation of the new IF.

The appealing element in the use of

a broadband tuner is that it provides a reasonably flat RF response for channels 2-6 and 7-13, and that tuning is accomplished merely by varying the local oscillator frequency.

This offers a reduction in the total number of critical low-tolerance tuning members, as well as a lower manufacturing cost.

But the cost that may be saved in the use of such a front and may have to be made up in the IF strip; it is there that adjacent channel signal rejection must be accomplished, and this is not so easy a problem in the 40-50 Mc region.

### Design Considerations

New receiver developments exert considerable influence upon front end tuner design. The possibility of UHF channels also has an effect upon design which shows up by the use of snap-in inductances, or double conversion; and there is the perennial search for simplification which will show up in reduced cost of fabrication.

There is considerable difference in the design of a front end, depending upon whether it is to be used with intercarrier sound or with a separate sound strip. In the simplification of the TV receiver many manufacturers have designed receivers for the intercarrier sound system with the 4.5 Mc sound modulation taken off at the plate of the video detector, or even the video amplifier. With intercarrier sound, small amounts of local oscillator drift are not so noticeable. Part of the reason for this is that the 4.5 Mc beat frequency containing the sound modulation is fixed at the transmitter. For this reason both AFC systems and special local oscillator refinements are usually eliminated entirely or included in simplified form for intercarrier type systems.

When separate video and sound IF strips are included in the receiver an oscillator must be stable enough to permit the converted sound carrier to pass through the narrow sound IF amplifier and the FM detector without appreciable distortion or loss.

Such design considerations impose severe restrictions upon oscillator stability and make desired stability difficult to attain with currently available tubes and components; commercial manufacturing tolerances are too great.

Thus, in order to maintain reasonably good stability highly refined local oscillator circuits are included, or AFC systems should be built into the front end.

### Microphonics

Shock mounting of the entire tuner is usually necessary when separate sound and video IF strips are employed. Shock mounting of the oscillator tube and related components, which might set up vibrations of the oscillator tube, is also desirable.

The reason for these recommendations is that microphonics can be extremely severe and vibrations of the local oscillator tube are likely to cause frequency variations in the local oscillator. Some manufacturers use a heavy lead shield over the oscillator tube to dampen any vibrations that might reach it.

Since the loudspeaker is a common source for vibrations which might set

up microphonics in the oscillator tube it is desirable to mount it on rubber grommets, even when it is fixed to the cabinet and not to the chassis.

With dual triodes like the 6J6 or the 12AT7 used as combination mixer-oscillator, triode section 2 (plate pin 1, grid pin 6 for the 6J6) should be used as the oscillator section.

The other triode section has a getter support attached to the plate and therefore would be more susceptible to microphonic disturbances if used as an oscillator.

It is also desirable that the heater be at the same RF potential as the cathode to avoid heater-cathode microphonics; the circuit shown in Figure 1 indicates how this may be done, for both series and parallel heater circuits.

Where intercarrier sound is used the entire shock mounting may be eliminated and the mechanical design of the tuner may be simpler and more economical.

### Mechanical Improvements

Recent design trends are toward compactness and simplified tuning. Small size provides the receiver manufacturer with greater flexibility in chassis layout and cabinet style possibilities.

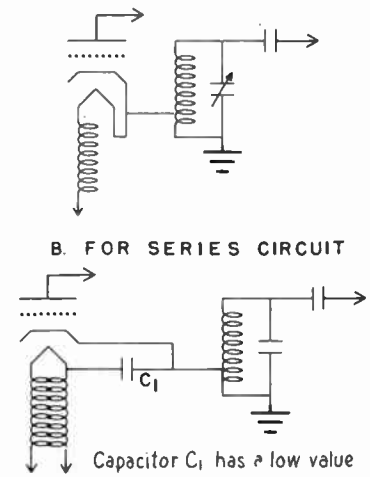
Compactness has been achieved by capitalizing on the contributions miniaturization has made, by using more carefully engineered circuits which do the same job better with fewer or smaller components, and by planning the layout for maximum utilization of space.

Servicing is simpler with some of the newer type tuners. In the turret-tuners of the RCA Victor and Standard Coil type, the replacement of an entire coil strip is easily and readily accomplished.

Continuous tuning still plays a significant part in modern television receivers. It is likely to continue to hold a place in the field with the announcement by Crosley that their continuous type tuner makes possible the reception of UHF channels with a simple device which takes the UHF input and changes it to a 122-132 Mc signal.

This is made an interchannel reception spot between the low and the high bands on the Crosley type continuous tuning front end. The tuning is still done with either a variable inductance or a variable capacitance.

Some turret-tuners utilize a variable dielectric principle. Other vernier tun-




Capacitor $C_1$ has a low value which makes a practical short circuit from filament to cathode tap on oscillator coil.

FIG. 1 ·RTM·

ing methods vary the capacitance in the oscillator by changing the spacing or the effective area of the condenser plates.

These turret assemblies are using printed circuits because it is claimed that this type of construction makes the tuner less susceptible to microphonism and permits greater uniformity in assembly line manufacture of tuners.

### Tube Improvements

Television has accentuated the demand for better tubes, and tubes with closer tolerances, for the front end.

As receivers become more complicated and as the frequency at which a tube is expected to operate increases, the quality of each associated component must also be improved. Every tuner is designed around the tubes currently available at a good price.

Newer tubes with high transconductance and low loading effect provide higher efficiencies in tuner operation. The trend has been to miniature type tubes with the 6CB6, 6BC5, 6AG5, and 6AK5 leading the field.

These tubes are popular because they provide excellent high frequency performance characteristics. Lead inductance effect and interelectrode capacitance give them a decided advantage over the formerly used tube types.

### UHF

Currently produced television receivers, notably Zenith and Crosley, have built-in provisions for reception of television on the UHF channels. One of the turret type tuners has circuits incorporated in a channel strip.

This strip may replace one of the unused strips already in the tuner and will enable the receiver to operate in the UHF region.

Front end UHF designs will depend upon developments in circuits, improvement in tubes, better coils, capacitors, and resistors. Coils, capacitors, and resistors must be considerably improved for UHF operation because the higher the frequency the less difference there is between a coil, capacitor and resistor.

### Front End Changes for 40-50 Mc IF

In addition to changing the oscillator coil from a 20-30 Mc output to a 40-50 Mc output, there are a few other changes required at the new frequency. Grid-plate capacity neutralization of the mixer tube is desirable, at least with the 6J6.

This is an important matter. One of the theoretical difficulties with the 40-50 Mc IF is regenerative feedback. This may occur in an amplifier tube when the plate circuit is coupled to the grid circuit of the same tube in such a way that the signal is fed back in phase with the signal in the grid circuit.

It is usually solved by adding a neutralization coil which will nullify the voltage fed back through the inner-electrode capacitance of the amplifier tube by providing an equal voltage of opposite phase. With the 12AT7 tube used as combination mixer-oscillator in the GE front end, no neutralization is necessary in the converter circuit.

This may not be true for other tubes; if it is, it might be well to design the front end to use a type like the 12AT7.

### Examples

The Sarkes-Tarzian tuner was the first front end with the 40-50 Mc IF output. To date there have been over

half a million field proven units, and all of them meet the RTMA radiation specifications. These tuners are supplied to Westinghouse and Arvin as complete assemblies, while Zenith and General Electric manufacture their own tuners using similar techniques.

The tuner employs "incremental inductance step tuning." It is one of the smallest and most compact tuners on the market.

The tube complement includes a 6J6 as a combination mixer-oscillator, while the RF amplifier may be either a 6AG5, 6AK5, 6BC5, or a 6CB6.

Sarkes-Tarzian engineers report that they find the 6CB6 deficient in some respects for upper channel use.

### Franklin Airloop Style

The Franklin model 500-A-10 is a die stamped device with all tuned circuits on low-loss bakelite wafers. The wafers snap into position on the chassis and may readily be removed for servicing or replaced to cover additional channel allocations.

The receiver tuning mechanism is rugged and simple; it is a four section rotary wafer switch, on which all contacts are silver plated.

The tuned circuits, and this includes the inductances and associated wiring, are die stamped by a patented process which employs a heated die. The die, made in the form of the circuit configuration, cuts and forms the circuit from a sheet of pure copper.

The copper has a coating of plastic adhesive on one side which bonds the circuit to a sheet of insulating material. These compounds may be seen in the illustration.

One advantage of the use of this type tuner is that there is quality control uniformly between individual tuners. All tuned circuits will be alike; lead lengths will be similar in size and placement, and all tuners will have identical amounts of stray wiring capacitance effect.

This helps maintain high performance quality and insures uniformity on any production assembly line where these tuners are being used.

Five connections are necessary to make electrical continuity between this and the remainder of the television chassis; these include the antenna, B-plus, filament, AGC, and IF output.

The RF amplifier is a 6BC5, employing double tuned bandpass coupling to the mixer grid. The mixer is one section of a 6J6 triode used with oscillator output capacitively coupled to the mixer grid.

The oscillator is the other section of the 6J6 triode used in a single-ended Colpitts oscillator circuit with a grounded cathode. The output circuit is a single tuned IF coil, the primary of the first IF transformer, and is suitable for stagger-tuned IF amplifiers of either the conventional or the intercarrier sound type.

The IF coil may be used in conjunction with an identical secondary coil and a coupling capacitor to provide overcoupling.

Other common and conventional methods of coupling to the IF amplifier may also be used.

Test results show heater hum *can* be eliminated through tube and circuit changes

# Beating AC Hum In Tube Heaters

HEATER-induced 60-cycle hum in AC operated low-level amplifiers can be reduced to less than 1 microvolt by suitable choices of tubes and circuitry. Yet less fortunate tube-and-circuit combinations may give heater-hum levels of more than 500 microvolts.

These are conclusions of an investigation of heater hum recently made at the National Bureau of Standards electronic instrumentation laboratory.

Undertaken because of the need for low-hum amplifiers for instrumentation work, the study has yielded useful practical data for designing such amplifiers. Emphasis was on cataloguing heater hum characteristics of various tubes and circuit arrangements, rather than on investigating the causes of the hum.

## Eleven Types Studied

Eleven tube types, in various circuit arrangements, have been studied so far. Included were single triodes 6F5 and 6SF5; dual triodes 6SL7, 7F7, and 5691; and pentodes 6J7, 6J7G, 6J7GT, 6SJ7, 5693, and 6SH7. In general, only four to six tubes of each type were checked, although tubes of several manufacturers were included wherever possible.

Data were discarded for occasional individual tubes which, because they showed wide deviations from the mean, were not believed representative.

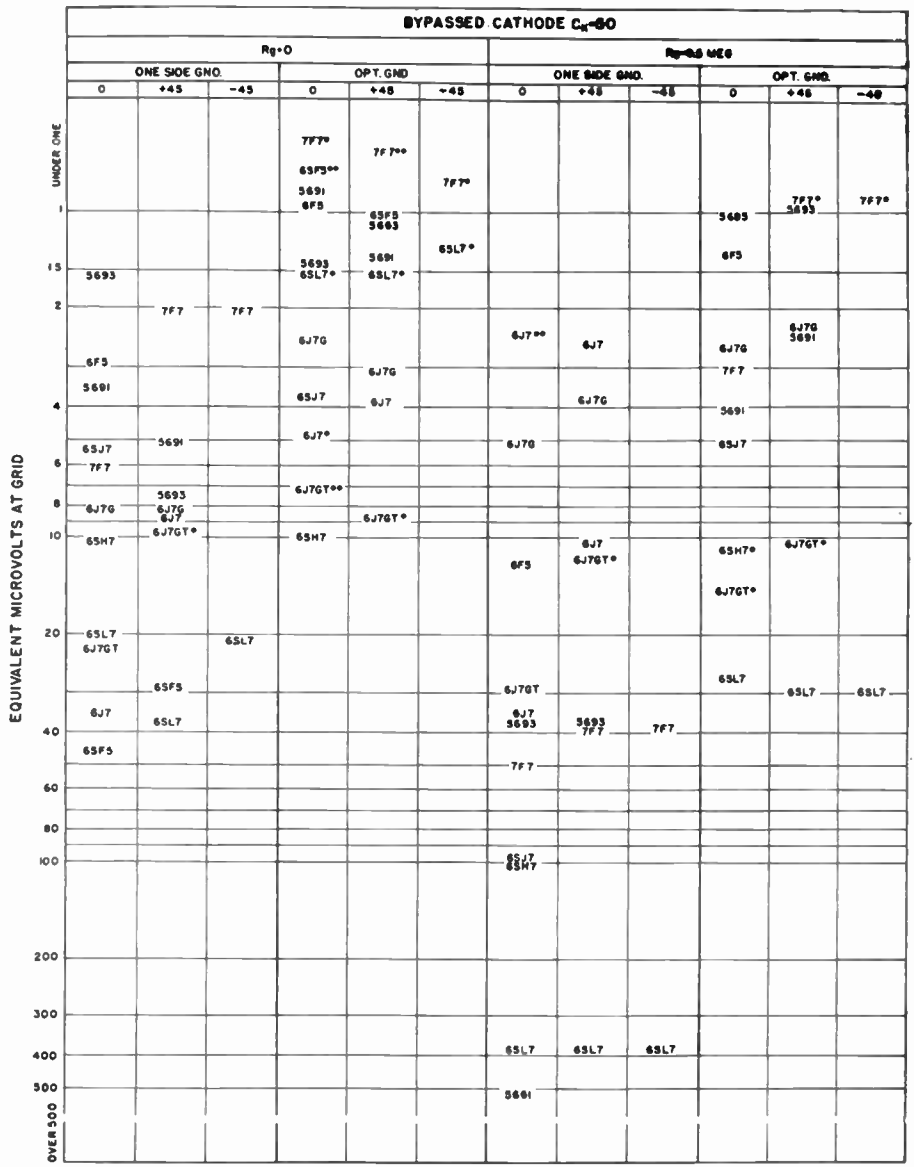
Circuits were varied with respect to cathode bypass capacitance, heater return tie point, heater return potential, and grid circuit resistance. The cathode resistor was either bypassed with a 50 $\mu$f capacitor or left unbypassed. Input grid resistance was either zero or 0.5 megohm.

The heater return was either to one side of the heater, or through the adjustable arm of a 100-ohm potentiom-

**Results, for bypassed cathodes, of National Bureau of Standards measurements of heater-induced hum in eleven tube types in various amplifier arrangements. The vertical position of the tube on the chart indicates the 60-cycle hum in equivalent microvolts at the grid for the several circuit variations. Data were obtained with grid circuit resistance of either zero (left half of chart) or 0.5 megohm (right half). Measurements were made alternatively with one side of the heater grounded or with an "optimum ground" through a tap on a potentiometer connected across the heater for minimum hum. In addition to connecting the heater return lead directly to ground, figures were obtained with the heater returned to ground through 45 volts, both positive and negative.**

## HEATER-INDUCED HUM IN VOLTAGE AMPLIFIER TUBES

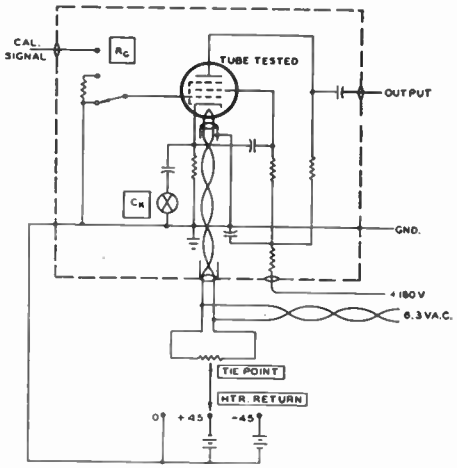
60 CYCLE COMPONENT




NOTES:

* ACCOMPANIED BY APPROXIMATELY EQUAL HARMONIC CONTENT

** ACCOMPANIED BY HARMONIC CONTENT GREATLY IN EXCESS OF 60 CYCLE VALUE




**Typical low-level amplifier circuit used in measurements of heater-induced hum at the National Bureau of Standards. Both triodes and pentodes were investigated. For each of a number of tubes, hum measurements were made with various conditions of grid circuit resistance, cathode bypass capacitance, and heater return.**

eter placed across the heater supply and adjusted for minimum 60-cycle output. Heater return potential was either to ground, to 45 volts positive, or to 45 volts negative. Hum measurements were made with various combinations of these circuit variations.

### Wave Form Observed

In the test set-up, the 60-, 120-, and 180-cycle hum components of the output of the amplifier under study were measured on a vacuum-tube voltmeter, using appropriate amplification and filtering. At the same time, wave form was observed on a cathode-ray oscilloscope. Gain was measured by applying a known signal to the grid of the test amplifier; hum level could then be expressed in terms of equivalent microvolts at the grid.

Provision was made for switching from AC to DC heater supply for calibration and comparison.

To obtain the desired measurements of heater-induced hum, external AC hum was reduced to a negligible value, using recognized shielding precautions; heater leads were twisted and shielded and kept away from the grid circuit, which was also shielded.

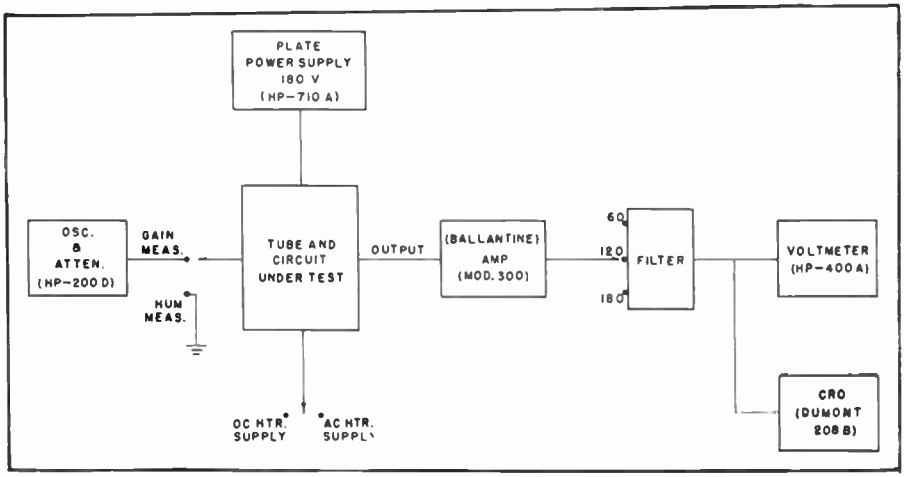
Circuit components were based on median values given in manufacturer's manuals. Preliminary checks indicated that hum is not significantly affected by the usual variations in components—plate, screen, and cathode resistors, and cathode and screen bypass capacitors—required to match different load impedances.

### Best Amplifiers

The most hum-free amplifiers investigated used either of several triodes (6F5, 6SF5, 7F7, or 5691) or a pentode (5693), in a circuit including bypassed cathode, heater grounded through an adjustable potentiometer, and low grid impedance.

Wide hum differences were found for different tube types, as well as for different circuit arrangements. Apparently, however, the 60-cycle equivalent input hum of almost any tube type tested, whether triode or pentode, can be reduced to 10 microvolts by suitable circuitry; and *all the triodes tested* could be brought below 2 microvolts.

The 60-cycle components were measured because of their importance in low-level power-frequency amplifiers, often required in instrumentation applications. Some of the low 60-cycle values measured at NBS were accompanied by




**Block diagram of the complete measurement arrangement used for investigating heater-induced hum at the National Bureau of Standards.**

harmonics no greater—or even substantially less—than the 60-cycle figure; in other instances the harmonics were many times greater than the 60-cycle component.

## General Results

The general effects of the circuit variations were not unexpected. Without the cathode bypass condenser, hum was of course much greater; a sufficiently large bypass condenser is obviously desirable for all low hum applications.

Return of the heater circuit through an adjustable potentiometer connected across the heater supply, when adjustment was optimum, reduced the hum to as little as 1/20 or even 1/50 of the initial value.

Returning the heater circuit through 45 volts, either positive or negative but preferably positive, reduced hum somewhat in most cases. Increased grid circuit resistance tended to give greater hum in triodes, while in pentodes hum in general either showed no change or else decreased with increased resistance.

Various theoretical and practical aspects of heater hum have been treated in the literature. The NBS investigation, however, provides more practical data than have been generally available on tube and circuit selection for minimizing heater hum in low-level amplifiers. The study of other tube types is planned by the bureau.


# A Couple of Bromos For the Auto-Radio HEADACHE

THE OTHER evening I was browsing at the drug store newsstand when my attention was abruptly taken away from a picture of Dagmar by the only thing that could have done it: mention of the word "radio." It came from the conversation of two men at the cigar counter behind me.

"Say, Homer," one said to the other, "who is a good man to take an auto radio to? Mine conked out on me today."

"It's not a case of picking out a *good* man to work on it," Homer replied. "It's more a matter of finding a servicement who will take it at all. Radio men just don't want to be bothered with an auto radio service these days—as I found out when my car radio quit last spring."

### Technicians Unwilling

I mulled this over on my way home and came to the rather shocked conclusion that Homer knew what he was talking about. In my mind I checked over a dozen or so radio and television servicemen in this town and could think of only two who solicited auto radio work, and one of them had no facilities for driving a car inside his building. The rest of them either would not do car radio work at all or would only work on these sets on the bench. They would not work on the set in the car, remove it from the car, or put it back in the automobile after it had been repaired.

Now none of these fellows is so filthy rich that he can afford to flout a substantial source of income, as car radio service would seem to be; so I made it a point to quiz several of them as to just why they gave the cold shoulder to the horseless carriage trade. Their replies were so emphatic, so logical, and so similar that I feel sure they were expressing the attitude of the majority of the service fraternity toward this kind of service work.

### Large Shop Required

In the first place, they told me, auto radio work requires a much larger and more specially-arranged shop than does one intended for just home radio and television service. In all but a few small sections of the country the car must be driven inside a heated building to work on it during many months of the year, and this means that the service shop must have an entrance and a floor that will permit this to be done. During these days of high rental, any sideline business that requires extra floor space has to pay off very well to carry its own weight.

Then, too, car radio work requires the purchase of a lot of expensive equipment that is of use only in this single phase of the business. Half-inch electric drills and hole saws, special wrenches, battery testers, vibrator testers, low-voltage high-current power supplies—these are but a few of the items that must be bought when a serviceman takes an auto radio service. In addition, he must increase his inventory of parts substantially with such specialized parts as vibrators, vibrator transformers, suppressors, tire-static kits, car antennas, remote dial drive parts, etc., etc.

### Work Uncomfortable

Probably the most important consideration, though, is the fact that car radios are physically difficult to work on. Many of the new ones have to be removed from the car just to check the tubes, and removing them is likely to require first the removal of the glove compartment and then snaking the chassis out through this hole in the dash! Others make it necessary to disconnect and drop several of the control cables and levers of the car before the chassis can be pulled. What is still worse, the work must often be done on hot and dirty cars while in a most uncomfortable position. As one gray-haired serviceman put it: "Television has made me a roof-monkey, but I'll be cussed if car radio work is going to make a human pretzel out of me!"

Auto radios are subject to every ailment a house radio can suffer plus a few more exasperating ones all their own. Ignition noise, tire static, sticking vibrators, and search-tuning vagaries have driven many a good serviceman into hanging up a sign saying: "No Car Radio Service." Intermittents, the Number One Curse of electronic service, are very common in auto sets because of the vibration, extreme temperature range, and changes in power supply voltage to which these sets are subjected. Many—too many!—sets will play perfectly on the bench for days and then cut out within ten minutes after being laboriously re-installed in the car.

### Charges High

But the serviceman could and would take all these headaches in stride if the pay made it worth while, but for the past few years he has been encountering increasing resistance to the charges he must make if he is to be paid as well for working on car sets as he receives when working on house and television receivers.

A customer who will pay a twenty dollar bill for installing a fifty-cent part in an automatic transmission without a whimper will scream as if he were being stabbed when he is charged three dollars to install a two-dollar tube in a set that had to be removed from the car for the operation.

In spite of all these drawbacks to car radio service, however, this writer firmly believes that now—when many servicemen are turning down this kind of service—is an excellent time to get into it. Customers who are finding an increasing number of servicemen do not want their auto radio work are in a chastened mood; and if they can find a shop that is really well equipped to do a good job on car sets, they will be willing to pay what it is worth.

Many a fine business has been built in this country by performing a service for people that others could not be bothered with doing.

While thinking it over, consider these facts: There are 19 million automobile radios in use today. Car radio, unlike home radio, will not be affected by the progress of television. When a car radio goes dead, the owner cannot simply turn on another set, as he can do in his home; nor can he go down town and pick up a replacement for $19.95. That dead set is right there in front of him all the time he is in the car, a constant irritation and reminder that he should have it fixed.

### Things to Watch

However, if you do go into this phase of service, here are a few things to watch: use cheap labor for the installation and removal of sets. A boy can quickly learn to do this, and he will not find the awkward positions in which he has to work nearly as uncomfortable as you will.

You can inspect and supervise his work, but you should be able to make a lot more money at your bench than you can wrestling wrenches.

Secondly, do not allow a garage owner to fast-talk you into giving him a special cheap service price in return for a promise to "send you all our work." If you do good work, you can get all the auto radio service you can handle, and there is no point in doing it more cheaply for someone else. When you deal directly with the customer, you are building up your own reputation; but when you work for the garage owner, you are building up his name.

### Guarantee Bench Operation

If a garage wants to remove and reinstall sets and have you work on them only on the bench, well and good; but be sure the garageman understands that you guarantee only that they will work on the bench. See that each one is demonstrated to be in playing condition when it is picked up. If you fail to do this, you will be held responsible for the set's being fouled up by the installing garage mechanic or for an intermittent or noisy condition that occurs only in the car.

Finally, do not be afraid to charge for car radio work. Doing it requires hard physical effort; specialized radio service knowledge; equipment and data; and additional shop facilities. On top of that, you are doing work that most servicemen refuse to do.

Keep all of these things in mind when you set up your rates for doing auto radio service, and you may find it is the best-paying part of your business!

# Frequency Compensation In Video Amplifiers

Simple R-C circuits provide flatter passbands for critical demodulation and amplification stages

By BRUCE RICHARDS

THE TWO ends to the video passband both require compensation by virtue of inherent circuit characteristics.

The compensation required is simple and involves relatively few and inexpensive components, but the results in improved picture quality are worth the trouble to make certain that every receiver is properly designed with high and low frequency compensation networks.

## The Video Detector

An excellent illustration of a modern crystal type video detector is shown in Figure 1; the circuit components contained in the photograph are included in the dotted lines of the schematic.

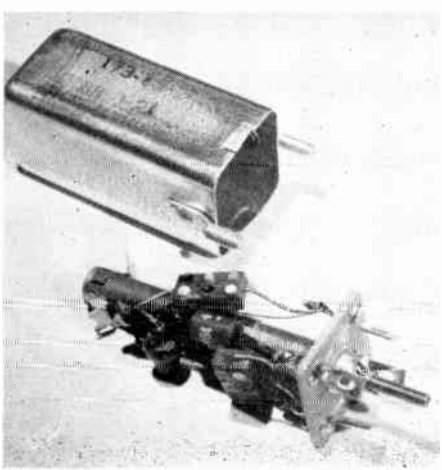
This is an economical and commonly used method of feeding a signal to the video amplifier. The crystal performs as well as a 6AL5 type diode would, and has the advantages of hum elimination, reduced number of components and no filament to heat.

## Video Amplifier

A video amplifier, following any type of detector, must be able to amplify uniformly a wide band of frequencies, extending from a few cycles per second to several megacycles.

While it is possible to construct a video amplifier that will provide a fairly constant response for a wide band, this is generally done only by reducing the amplification that can be obtained from each stage.

Excellent overall frequency response is obtained by the use of resistance-capacitance coupling. Actually the R-C coupled circuit used as a video ampli-



fier does not differ from an audio amplifier except in the values of the circuit elements.

In general, tubes with very low interelectrode capacitance must be used; care must be exercised in wiring the circuit to keep leads short and properly spaced in order to maintain distributed wiring capacitance effect to a minimum. But two basic problems must be solved when an R-C amplifier is employed in wide band amplification systems. These problems concern the very high and very low frequency responses.

### High Frequency Compensation

High frequency compensation is necessary because there is reduced gain at high frequencies as a result of the reduction in plate load impedance caused by the shunting effect of interelectrode and distributed wiring capacitances.

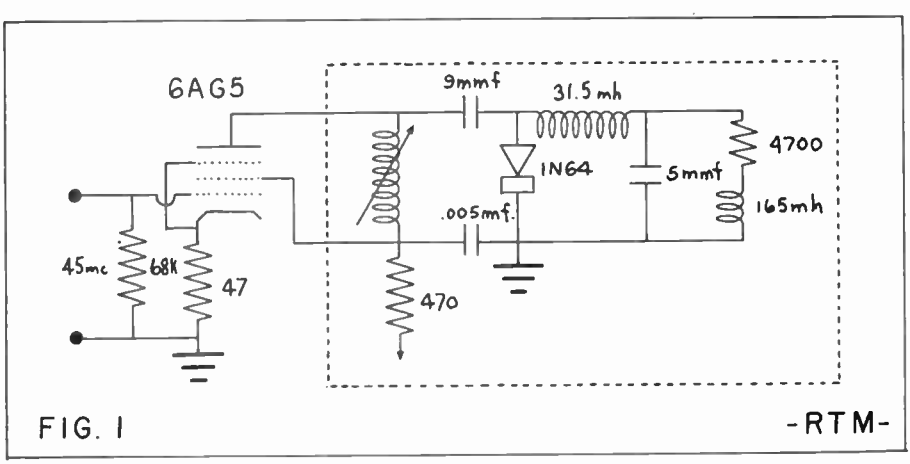
The use of a combined shunt-series compensation system gives the high frequency peaking effect of the shunt compensation circuit and provides increased gain—attributable to the resonance effect of the series compensation circuit. See Figure 2.

### Low Frequency Compensation

The low frequency response of a video amplifier is, to some extent, a function of the grid coupling circuit. By virtue of the increasing reactance of a coupling capacitor, as the frequency of operation decreases, the lower frequencies from about 200 cycles down are attenuated.

The value of the coupling capacitor has a practical limit of approximately 0.1 mfd, because the capacitor increases stray capacitance which may affect the high frequency response.

The loss of gain at a low frequency is generally remedied by the addition of a low frequency compensation filter in series with the load resistor; such a compensation circuit contains two elements—a capacitor and a resistor—forming a filter circuit. The filter increases the plate load impedance at low frequencies, and helps maintain the gain. See Figure 2.

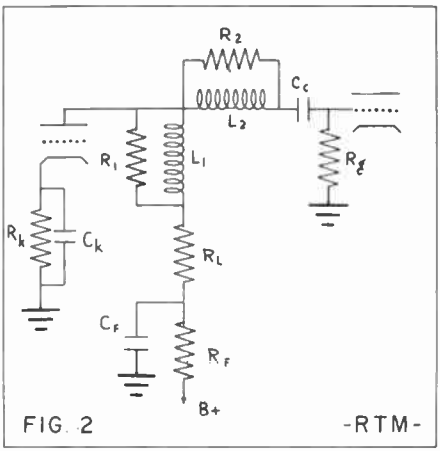


### Cathode Bias in Amplifier

In a video amplifier stage the necessary grid bias is usually obtained by utilizing the voltage drop across a resistor connected in series with the cathode. The total current through the tube passes through this resistor. Since the electron current through the tube changes with variations of the applied signal voltage, a varying voltage is developed across the cathode resistor $R_k$. To obtain a steady value of grid bias these signal variations must be bypassed around the bias resistor by means of the cathode bypass or filter capacitor $C_k$.

The reactance of this capacitance must be low enough to provide a low impedance path around the resistor for the alternating components of the signal.

For video frequency emplifiers which may pass low frequencies the capacitance of the cathode bypass capacitor $C_k$ must often be 100 microfarads or more. In general, the time constant $R_k$ — $C_k$ must be long compared to the period of the lowest frequency to be passed.




$R_L$ is the plate load resistor
L-1 is the shunt compensation coil for high frequency compensation
L-2 is the series compensation for high frequency compensation
L-1 and L-2 represent the combination shunt-series system for high frequency compensation
C-F and R-F represent the low frequency compensation filter
R-1 and R-2, shown in dotted lines are used to shunt the L-1 and L-2 coils for Q reduction to prevent overemphasis of the high frequency peaking

## Old Ladies Home for Tubes?

THE life expectancy of electron tubes has been compared with human beings with striking similarity. E. Finley Carter, Sylvania engineer, points out that both electron tubes and human beings suffer from a small but significant mortality in early life and that when they survive an early critical period, chances for a fairly long life are improved.

He likens tube failure because of defects in other components, contamination and old age to human mortality by accident, epidemic and ultimate old age. He also stresses that tubes, like humans, can be damaged beyond repair by overwork or overloading.

# The Meaning Of TIME CONSTANTS

In present-day high frequency work you can't neglect proper servicing of timing circuits

By DAVID A. LEONHARDT

ANY combination of a condenser and a resistor in series forms a timing device.

The time constant depends upon how fast a condenser will charge or discharge through a resistor. If the capacitor or the resistor is large the time for charge and for discharge will be large; if a capacitor is small the time for charge and for discharge will be fast.

Obviously, then, it is possible to select an R-C combination which will fix the length of time required for the capacitor to charge or to discharge at a desired length.

## Charging Time

A capacitor does not become fully charged instantaneously, nor does it become fully discharged instantaneously. Both these operations take time.

With a capacitor and a resistor in series with a source of power, the current begins to flow at a rapid rate into the capacitor, but the rate of flow begins to decrease immediately.

When a capacitor is fully discharged, the rate of flow of current into the capacitor is high; as the capacitor approaches full charge, the rate is very low.

Actually, it requires an infinite time for a capacitor to become fully charged; theoretically, it is debatable whether a capacitor ever becomes fully charged, even in an infinite number of time constant cycles.

It is like the story of the little chap on the "Quaker Oats" box. He is holding a box with a picture of a man who is holding a box with a picture of a man, and so on, ad infinitum.

Be this as is may, at the end of the fifth time constant cycle the charge on the capacitor will be 99 percent of the applied voltage.

A single cycle is the length of time it requires for the unit to assume a charge equal to about 63 percent of the applied voltage.

This means that if the time constant of a resistor and capacitor in series is one second, there will be a charge of approximately 63 volts on a capacitor with an applied voltage of 100 volts at the end of the first second.

At the end of the fifth second, there will be a charge on the capacitor of about 99 volts.

Time constants are indicated either in seconds or in microseconds. In or-

dinary AM broadcast radio, time constants were for the most part indicated in seconds, but in FM, TV, radar, and UHF, they must be given in microseconds.

Basically, as we have shown above, a time constant depends upon two things: the capacity of the capacitor and the resistance of the resistor. The larger the capacity of the capacitor the longer time will be required to charge the capacitor approximately to full charge; similarly, the greater the resistance the more the flow of current will be retarded.

Since both these affect the time delay, the time constant is the product of the resistance in the circuit and the capacity in series with the resistance.

### Calculations

When the resistance is in megohms and the capacity is in microfarads, the time constant will be in seconds, thus:

| *Resistance in megohms* | *Capacitance in Microfarads* | *Time Constant in Seconds* |
|---|---|---|
| 5.0 | 2.0 | 10.0 |
| 2.5 | 0.1 | 0.25 |
| 1.0 | 1.0 | 1.0 |
| 0.5 | 0.05 | 0.025 |
| 0.25 | 0.002 | 0.0005 |
| 0.1 | 0.01 | 0.001 |

### Inductor-Resistor Circuit

What is not too generally known is that an inductor-resistor circuit also has a time constant. The time constant for a circuit having an inductance L in henrys and a resistance R in ohms is L/R. This may be manipulated for microhenrys and megohms.

### Servicing

These considerations are important for the serviceman in the field as they were for the design engineer in the laboratory.

The selection of a given resistor and capacitor in a time constant circuit was made on the basis of good design factors. Any replacement in the field should be made with similar engineering design factors in mind.

Some harm has been done to the servicing profession by careless replacement of a resistor or capacitor in a time constant circuit. It may make little difference in the AM broadcast field, as the time constant change there is not great enough to be perceptible, but it is quite another matter in TV servicing. There, the concept is more important than has heretofore been believed.

## TV Without A Set

AN FM radio listener in Salt Lake City recently sat puzzled as he listened to a horse opera which apparently lacked something.

"It sounded odd—like I should be seeing something," the listener reported.

The mystery cleared up when the announcer, at the station break, identified the station with a channel number.

# Bypass Capacitors And Bypassing

The first of a series on a neglected branch of the technician's stock-in-trade

By RICHARD H. ANDERSON

## PART I

THERE is comparatively little in the general literature on bypass capacitors. Many engineers take bypassing for granted, or the type and value of bypass capacitors have been picked largely on the basis of cost and availability.

There should be more information provided to the design engineer and the serviceman on this important topic.

The great expansion of the electronics industries with the tremendous influx of new young engineers who never learned some of the fundamentals of bypassing the hard way in the '20's and the '30's necessitates some up-to-date information on this important topic.

In the course of this series of pieces on the general subject of bypassing, the following queries will be considered and answered according to the best information available.

### Fundamental Questions

1. What is the fundamental function a bypass capacitor is designed to perform?

2. Why and where are capacitors desirable for bypass applications:

   a. for heaters
   b. for cathodes
   c. for screens
   d. for plates
   e. for grid returns
   f. decoupling
   g. AGC

3. Which factors govern the capacitance value of a bypass capacitor in a given application?

   a. For which applications are low tolerance components specifically indicated?

   b. Within which ranges of capacity value will the capacitor perform effectively? Heater bypasses range in value from 500 to 5000 mmf. Will any value do a good bypassing job, or is there some special value which will give her most effective bypass?

   c. Why should the bypass capacitor for a plate and screen have different values? Some design-

ers use the same value; others use different capacitor values.

4. Under which circumstances may bypass capacitors be omitted from a circuit without noticeable circuit deficiency effects?

5. For which bypass applications will the different types of capacitor be most suitable?

6. How does the frequency at which a circuit is operating influence the choice of a bypass capacitor value?

7. Is there a significant relation between a component value being bypassed and the bypass capacitor value?

8. Are some types of capacitor superior components for a given application? Wherein does their superiority lie and what are the reasons underlying the recommendations?

9. What determines the impedance of a bypass capacitor?

10. Are there any unusual circuit details for any specific bypass applications?

This is by no means an exhaustive list, but it is indicative of the meat to be provided in this series of pieces on bypassing in general. In an attempt to justify the consideration of this material, if any were necessary, we present herewith a paragraph from a bulletin by a highly reputable manufacturer with a national distribution of electronic products:

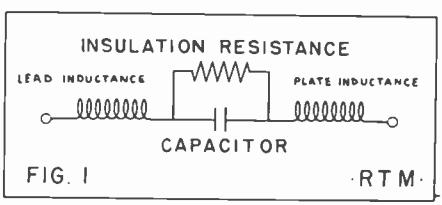
## Evolution of a Radio Receiver

"The development engineer was asked to produce a table model set that would outperform competitive models. The logical approach was to put in extra parts whenever in doubt. The resulting chassis worked beautifully but manufacturing costs were out of this world. The engineer was kept on the job. One by one he removed bypass capacitors and isolation resistors. By the time the engineer had half emptied the chassis the committee authorized launching of a new model. Still costs were too high. Soon the version stripped down almost to the bare chassis, will go into production."

This may meet your competition but what does it do to your quality? Of course, you can cut out bypass capacitors and the receiver will perform, but it is hardly likely that it will perform up to the advertsied quality. Is there any wonder why bypassing is so poor in many receivers?

On the other hand, we have a capacitor manufacturer suggesting that when a receiver comes in for servicing it will be first class preventive maintenance to remove all the old type outmoded oversize bypass and coupling capacitors and substitute the newer ceramic type.

This is good advice. If you can sell a customer such service he will really have a better receiver to take home than the one he brought in, provided that the new capacitors substituted for the old ones are really better and provided




**At high frequencies even a straight wire pigtail lead has inductance characteristics. Every substance offers some opposition to the flow of electrons; hence the insulating material, used to separate the plates of the capacitor and to encase it, has resistance characteristics. The plates of the condenser contribute some inductance effect; this is more pronounced at high frequencies than at low frequencies.**

that you add bypasses wherever they should be.

### Capacitor Functions

A capacitor may be called upon to perform a wide variety of functions in electronic circuits. These applications of a capacitor are based upon the ability of this component to differentiate between electrical currents operating at different frequency levels. Among the important uses of capacitors the following are significant:

1. D-C blocking
2. Ripple filtering
3. RF bypassing
4. IF bypassing
5. Audio bypassing
6. Frequency determination and differentiation
7. R-C timing
8. Energy storage

Each of these requirements sets up a different set of determining factors for fulfillment of the proper function of a capacitor.

It becomes important, therefore, for the circuit designer to be familiar with the principles underlying the selection of a capacitor for a given application.

### Equivalent Capacitor Circuit

The higher the frequency, the less difference there is between an inductance, a resistor, and a capacitor. In the UHF range, there is practically no difference between a typical inexpensive resistor, RF choke, and a common paper capacitor.

The inductance has both resistance and capacitance characteristics in addition to its designed inductance function; a resistor has both inductance and capacitance characteristics in addition to its resistance function.

Similarly, a capacitor has resistance and inductance characteristics. This is illustrated in Figure 1.

The insulation material has resistance effects, so that there is a finite resistance across the capacitor, in series with the pigtail leads of the capacitor. The pigtail leads are an inductance; further, the plates of the capacitor themselves have inductance characteristics.

These are important factors to bear in mind because they affect the choice of a capacitor for any given circuit requirement.

These are all undesired effects. The magnitudes of these unwanted characteristics vary through wide limits depending on the mechanical design and the impregnant used in manufacture.

But these characteristics must be considered as equally important with the others, such as capacitance value, voltage rating, current rating, temperature coefficient, stability, etc., in selecting any capacitor for a specific application.

## Wanna Swap?

If you have something around the shop that you'd like to trade for some equipment or parts of more value to you, use the SWAP BOX columns starting next month in RTM. For details see page 98.

# SECOND ANODE VOLTAGES FOR TV WITH SELENIUM RECTIFIERS

Doubler, Tripler and Quadrupler Circuits Permit Low-Cost Use of Selenium Cartridges for the High Voltages

IT IS possible to provide the high voltage for the second anode of 16- and 20-inch TV picture tubes with selenium rectifiers.

But it is most desirable to use doubler, tripler, or quadrupler voltage multiplier circuits. The reason for this is that wherever the conventional type bridge or center tap rectifier circuits are used the number of selenium units is considerably greater than the cost for comparable tube-and-transformer rectifier circuits.

With the voltage multiplier type circuits, however, the rectifier costs are comparable with very low cost supplies.

Individual selenium rectifier cartridges are available that will deliver 4000 to 6000 volts of DC output. Some suggested multiplier circuits are shown in Figure 1. Note that the doubler may be either a full wave circuit or a half wave circuit as shown in A and B.

The DC output voltage ratings of the half wave selenium rectifier cartridges are calculated on the basis of using a capacitor across the load circuit as illustrated in the diagram.

At low current drains, voltages from 8000 to 16,000 volts are available from these circuits with high voltage selenium cartridges.

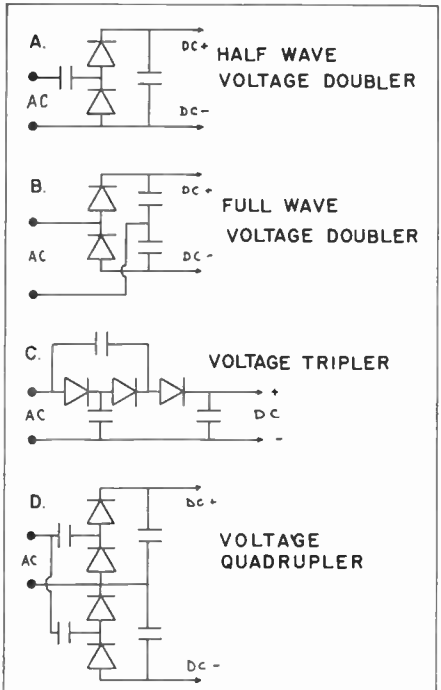



FIG. 1 -RTM-

—RICHARD H. ANDERSON.


## INPUT—OUTPUT NETWORKS

The Daven Company of Newark, N. J., is producing a new series of branching networks.

Units like this are used extensively in major broadcasting installations, motion picture sound studios and as laboratory standards of fixed attenuation.

The multiple input and output networks are used to equalize incoming sig-


nal levels—in multi-channel mixers and similar broadcast equipment, and to combine two or more incoming lines into a single outgoing line, or to divide one incoming line into two or more outgoing lines. They may be obtained in either balanced "H" or unbalanced "T" circuits. All units are designed for minimum loss.

The resistors are of the precision wire wound type with accuracy of plus or minus two per cent. The maximum level of these pads is +24 VU. A maximum number of 10 inputs or outputs is available.

Almost any standard impedance or loss is available upon request. The multiple networks frequency range is from zero to 50 Kc for most values. The range can be extended if necessary.

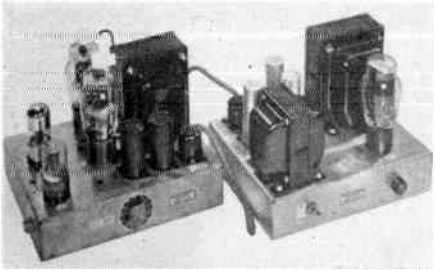
Further information concerning these Daven multiple networks will be supplied upon request. Write to The Daven Company, 191 Central Ave., Newark, New Jersey.

—RTM—

## 'WILLIAMSON' PARTS

Standard Transformer Corporation, Chicago, has announced "Stancor" components for the famous Williamson Amplifier, designed to make high fidelity audio available at low cost.

The new components include a high fidelity output transformer, a power transformer and a filter choke.



"The full potentialities of the famous Williamson Amplifier, which until now it had been assumed could be realized only through the use of costly imported transformers, can now be attained by these new Stancor components," Jerome J. Kahn, president of Standard Transformer said in announcing the units.

The components include Stancor high-fidelity output transformer, A-8054; power transformer PC8412 and filter choke C-1411.

Tests made on a unit built from standard stock parts show zero Db frequency response at the 8 watt level remaining unchanged at the low level of 0.5 watts.

Intermodulation distortion measures only 3% at 8 watts output. Total harmonic distortion at 1000 cycles may be considered non-existent below the 10 watt power level, the company claims.

The new components answer the problem of high fidelity enthusiasts who have hesitated to build the Williamson Amplifier because of the high cost of imported transformers, Kahn said.

Stancor Williamson Amplifier Bulletin No. 382 describes construction of the amplifier, with chassis drawing, schematic and complete parts list.

—RTM—

## PLASTIC SCREW ANCHORS

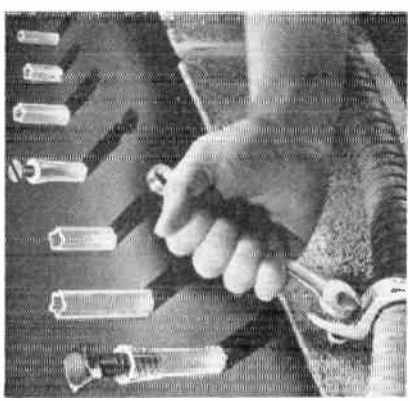
The new "Scru-Tite" screw anchors made of Tenite plastic, are light in weight, corrosion proof, and are excellent electric insulators.

Used in fastening all types of solid materials such as brick, wood, concrete, glass, metal, bakelite, or any solid, the new anchors do not discolor surrounding areas, and are available for all screw sizes.

To use the fastenings, drill a hole to size, drive the anchor into the hole with a hammer, fasten material by inserting the screw and screwing it in, in the normal way.

Screws up to four sizes larger than those matched to the anchors can be used safely, according to the manufacturer.

The units are sold by hardware, electrical, and industrial supply distributors.



Master Craft Products, of 95-01 150th Street, Jamaica 4, N.Y., is the manufacturer.

—RTM—

## TV BOOSTER

T. V. Development Corp. has developed a new all-channel booster, "The General (B-55)."

This booster, now available for immediate delivery, will help solve fringe

→ to page 52

# An Invitation to New Subscribers

THIS month, many thousands of sample copies of RADIO AND TELEVISION MAINTENANCE are being sent throughout the field to those not on our regular mailing list. A sample copy of RTM is our method of introducing the publication to those in the field who are not familiar with it.

*We could send expensive brochures to prospective subscribers, or buy a large amount of advertising, or sell subscriptions through agents . . . but we don't. Just as the most convincing sales tool is a good product or service, we believe a sample of RTM is the best spokesman for telling what the subscriber will receive.*

### Subscribers' Magazine

RADIO AND TELEVISION MAINTENANCE is truly a subscribers' magazine. Its format, its approach, its very personality is shaped by those who read it. From its technical pages to its fearless coverage of news items, every word is written not to please special groups or specific persons, but to inform the subscriber on the technical and business matters of importance to him.

RADIO AND TELEVISION MAINTENANCE is more than just a trade journal. It is a personality . . . a living entity in a field that is currently in the throes of labor pains—a new, fighting field that is struggling to attain a bright future though it is many times confused by the complications of strange economic forces. RTM, now more than ever before in its seven years of publication, is produced for the subscriber. It is his publication. It is written, edited and printed for the individuals in the radio trade.

And while RTM is written for the subscriber, it is the subscriber who makes this policy possible. That's why we're selective in inviting new subscribers. We want readers who want straight facts, honest reporting and competent technical handling. The man who gets a sample copy of RTM has been selected because he is currently earning his living in the radio

field, a man who needs a lively, accurate publication to keep him on his toes and provide the entertaining reading that a technician enjoys in his field.

RTM is growing. It is taking strides right along with the rest of the industry. It is expanding its circulation lists. With the regular increase in subscribers, a systematic expansion of editorial material will be noted in RTM. More and more features, a greater number of technical articles, increased coverage of new developments, all will be coming your way.

Those who have subscribed to RTM have watched our evolution and have noted the strides forward. Those who are seeing RTM for the first time with this issue, we trust will get the "feel" of the publication, will recognize the aims, will detect the quality of material offered to the technician.

### Join the Thousands

If you are not a regular subscriber, become one now. You can join the thousands of radio and television men all over the country (and in most parts of the world) who look to RTM for the latest facts and features on what's new and useful for the radio technician.

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# Products for the Trade

→ from page 49

area problems as well as indoor installations. It is claimed to be the only booster carrying an unconditional six-month guarantee and a uniform gain of five on all channels, utilizing the full bandwidth.

The unit uses silver-plated precision-wound coils, the Hi-Q components, and the shortest possible leads. It is not affected by hand capacity, and the metal cabinet fully shields against interference, the maker asserts.

In the OFF position, there is no-loss transmission. Tuning is by positive, gear drive.

All components are pre-tested, and all boosters are pre-peaked and aligned at the factory, where they are individually


adjusted for maximum performance for all channels on a battery of TV receivers.

Anyone in the trade can obtain full descriptive information, including circuit diagram, by writing to T. V. Development Corp., 2024 McDonald Ave., Brooklyn 23, N. Y.

## GE LISTS ELECTROSTATIC TUBES

The General Electric Co. has announced production of television picture tubes designed to operate without focus coils and save important quantities of copper, nickel, and cobalt, all strategic materials in short supply.

Elimination of the focus coil results from the development of an improved electron gun for zero-voltage electrostatic picture tubes by engineers of the company's Tube Department at Electronics Park in Syracuse, N. Y.

The new gun design will be incorporated in a series of 17 and 21-inch zero-voltage tubes scheduled for production in the company's Syracuse and Buffalo, N. Y., plants. First of the new tubes to go into production is the 17RP4, a glass rectangular.

In addition to conserving material vital to the defense effort, elimination of the focus coil will also mean a considerable cost saving for receiver manufacturers, according to E. F. Peterson, sales manager for the department.

Although high-voltage electrostatic tubes eliminate use of the focus coil, they also require the addition of a focus voltage rectifier and a potentiometer.

The zero-focus tube, however, not only eliminates the focus coil, but does not require addition of any new circuit components.

Zero-voltage picture tubes had previously been considered impractical, but incorporation of new ideas on the gun design has made the tube practical for use and manufacture, Peterson said.

New design features in the gun structure will insure against arcing within the tube. Internal arcing, according to Peterson, has always plagued electrostatic-focus picture tubes because of the

high voltage gradient required for focusing action. The new design by G-E tube engineers has virtually eliminated this source of trouble, he added.

Conventional magnetic focus television picture tubes require either a cobalt-nickel magnet, a copper coil, or a combination of the two to establish the magnetic field required for focusing.

The zero-voltage electrostatic line will include both glass and metal tubes. Face plates will be spherical as well as cylindrical. The latter type reduces light reflections from illuminating sources in the room.

—RTM—

## TV DISTRIBUTION AGC

Technical Appliance Corporation, Sherburne, N. Y., manufacturers of Taco antenna equipment and Tacoplex Antenna Distribution Systems, now


make available an AGC strip for use with the Tacoplex System.

The AGC strip is unit designed to enhance operation of the system in fringe area installations.

In such installations it has been noted that signal strength from the transmitter varies from day to day, throughout the day, resulting in fading or overloading.

This fact makes it imperative to have an operating engineer "ride the gain," to compensate for the changing signal strength.

The new AGC unit does this automatically by means of a detector and filter, which develop a bias voltage proportional to the signal output.

The bias voltage is fed to a four tube amplifier strip which is connected to the antenna.

The strips come tuned for any one of the 12 TV channels or to the FM band.

—RTM—

## TWO-SPEAKER PA SYSTEM

A new portable public address system, Newcomb Model H-1512, has two 12-inch heavy duty loudspeakers and a 17-watt amplifier.

Its plywood case is covered with washable fabricoid material and has metal fittings for added protection.

The amplifier provides inputs for two mikes and one phonograph, has frequency response of from 20 to 20,000 cycles.

Individual boost and attenuation type bass and treble controls offer control to meet a wide variety of acoustical conditions.

If desired for special purposes, a remote control unit can be added for mixing and fading of both mikes from any

distance up to 2,000 feet.

Overall size of the case is 11-1/8 by 20-1/2 by 21 inches. Total weight is 44-1/2 lbs.

A similar model is also available with a 25-watt amplifier, providing inputs for three mikes and one phonograph. Both are U/L approved.

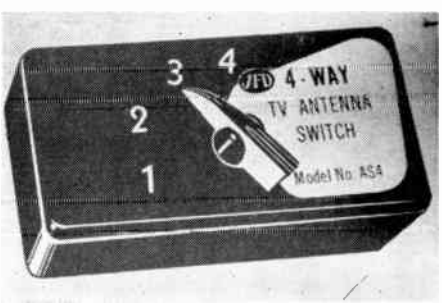
The unit is manufactured by Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, California.

—RTM—

## 4-WAY ANTENNA SWITCH

Following up the announcement of new television set couplers and single channel booster, the JFD Manufacturing Company, Inc., Brooklyn, New York, announced the development of a new TV 4-way antenna switch.

The switch will derive maximum performance of fringe area multiple Yagi




installations by permitting quick switching to desired antenna.

It supplies low-loss switching facilities in any TV installation, local or remote, where up to four antennas are used, the maker says.

A constant-impedance rotary switch with low-loss resistance silver-to-silver contacts provides maximum energy transfer.

The new JFD accessory is housed in bakelite case, constructed for unobtrusive installations.

Catalog sheets describing the switch are available from the manufacturer.

—RTM—

## 'PICK-UP STICK'

The new Hytron-CBS Pick-Up stick is said to solve two long-ignored, but irritating, problems.

Its special wax tip picks up screws,


nuts, etc., dropped into inaccessible spots in radio chassis.

It also holds head of screw in those impossible-to-reach spots while starting nut. A slight pressure of the wax tip does the trick. The stick is also a pencil.

The stick is offered to servicemen at five cents each in packages of 25.

Servicemen may get their pencils from jobbers.

—RTM—

## RHOMBIC ANTENNA

Davis Electronics has just introduced a new, aluminum alloy "Super Rhombic" antenna, designed to eliminate stacked arrays and overcome the problems of fringe and ghost area reception.

The antenna reportedly gives all-channel coverage with a gain of over 12 Db.

Lab and field tested, it is constructed with aluminum alloy elements which have proved superior to copper wire rhombics, the company claims.

To take advantage of horizontal wave length orientation, the Super Rhombic has a tilt of 15 degrees. This feature, coupled with directivity of 12 degrees, is supposed to make the Super Rhombic an effective antenna where maximum distance must be attained and ghosts eliminated.

Space-tapered element construction gives automatic match to all commonly used lead-ins without a matching transformer.

The unit is light in weight, is shipped preassembled, and may be installed in a few minutes.

The manufacturer is Davis Electronics, 3047 W. Olympic Blvd., Los Angeles 6, Calif.

—RTM—

## METAL WORK BENCH

A new "Scotty" work bench, currently offered through jobbers, is all-steel construction with a flexible top or with a heavy steel top.

Until recently, Natkin and Company, makers of the bench, limited production to benches, service merchandisers and other metal units designed especially for the automotive industry.

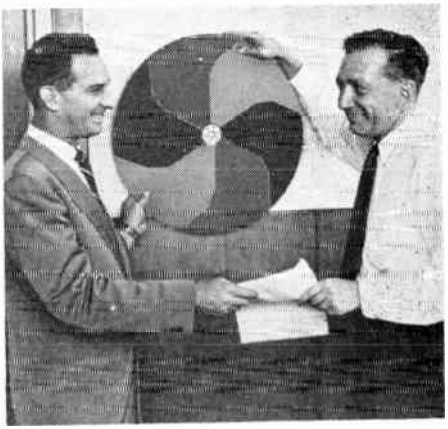
This is the first of a line of benches, tote-tables, and other units which the firm is developing for other industry.

Write to Natkin & Company, 1601 S. Hanley Road, St. Louis 17, Mo., for further details.

—RTM—

## CBS BUYING BIG QUANTITIES OF TV CONVERTER WHEELS

The Celomat Corporation, New York, has just received one of the largest single orders ever placed for TV color converter wheels from CBS—Columbia, Inc., Leopold M. Kay, vice president in charge of engineering, announced.



"We are particularly proud of this order," says Myron J. Greenwald, vice president of Celomat, "because it justifies the many long months of experimenting and laboratory work that have gone into the perfecting of the 'Vue-Scope' color wheel.

"From out past experience in television, we were able to single out the CBS system of color telecasting as the outstanding method. Even before the FCC officially ruled in favor of this sys-

tem, our belief in it was so great that we began our efforts in the development of the 'Vue-Scope' wheel."

Retailers and service organizations have notified Celomat that they, too, have booked substantial orders for the wheels, the company said.

Complete information on the wheels may be obtained by writing to Celomat Corporation, 521 West 23rd Street, New York.

—RTM—

## SELF-TUNED BOOSTER

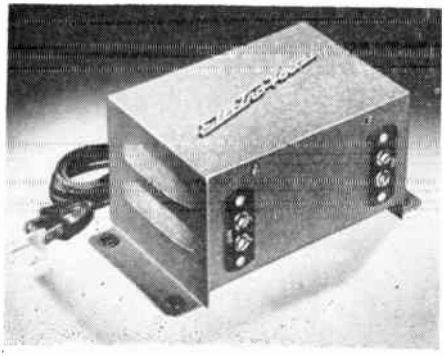
The new Model 3002 "Tune-O-Matic" two-stage broadband automatic self-tuning TV booster, for fringe and intermediate areas, is announced by Electro-Voice, Inc., Buchanan, Michigan.

This new booster utilizes two 6KB7 tubes (one on the high bands and one on the low) in low-noise circuit.

It provides uniformly high usable gain with very low internal noise, on all channels—minimizes "snow"—assures greater picture definition and clearer sound, the company boasts.

Tuning is automatic—no booster dials to turn—so that even a child can turn on the TV set and see his favorite program on any channel.

The booster is concealed in or behind the TV set or in any inconspicuous place. It plugs in between the TV receiver and AC electric outlet, and is turned on or off by the TV receiver switch.



Unit is finished in baked lacquer copper tone.

It is 6-7/8 by 3-1/8 by 3-5/8 inches and weighs only 1 lb., 13 ozs. It has rubber grommet feet to protect polished surfaces.

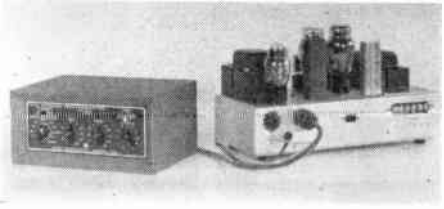
For complete data, write to Electro-Voice, Inc., Buchanan, Michigan.

—RTM—

## REMOTE-CONTROL AMPLIFIER

An entirely new H. H. Scott remote-control amplifier has control and compensating features which simplify operation and installation.

The control box can be placed up to 25 ft. from the power amplifier. An eight-position record-compensator ad-



justs for any recording characteristic.

Selector switch changes from phono, tuner, TV, or other high-level inputs.

An automatic loudness control boosts treble and bass at decreasing volume to compensate for human ear's insensitivity to high and low frequencies at low volumes.

The amplifier's individual three-channel continuously-variable tone controls each have control range from 6 Db per octave boost, through flat response, to 6 Db per octave attenuation.

Input-level adjustment is provided for matching to almost any pickup. Frequency response is flat from 18-22,000 cps, the company claims. Output is 20 watts. Hum is 84 Db below full

output, while harmonic distortion less than 0.5 percent at full output is claimed.

There is also provision for adding a separate Scott "Dynaural" noise suppressor to the unit.

Tubes: 12AX7, 2-12AU7, 5VAG, 6SN7, 6J5, 2-6L6.

The set is furnished with six-ft. remote control cable. A bulletin is available in request to Hermon Hosmer Scott, Inc., 385 Putnam Avenue, Cambridge 39, Mass.

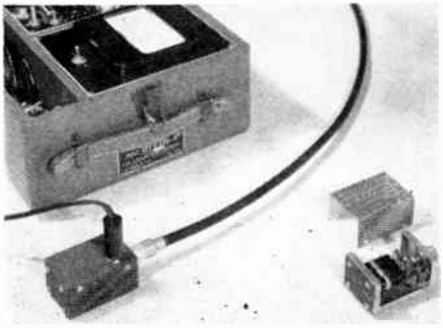
—RTM—

## RF WATTMETER

Motorola, Inc., of Chicago, is producing two small resistive-load RF wattmeters for use with Motorola test sets or any 0-50 microammeter.

The meter measures RF power output from 0-60 watts and is used for testing base stations and mobile unit transmitters. It measures transmitter power output from 0-2 watts and is recommended for portable unit testing. such as the "handie-talkie" portable radiophone.

The output of the transmitter being tested is fed into the wattmeter load, and the indicating device is connected to the jack provided.



The calibration chart supplied is used to correlate the power dissipated in the load unit and the meter readings.

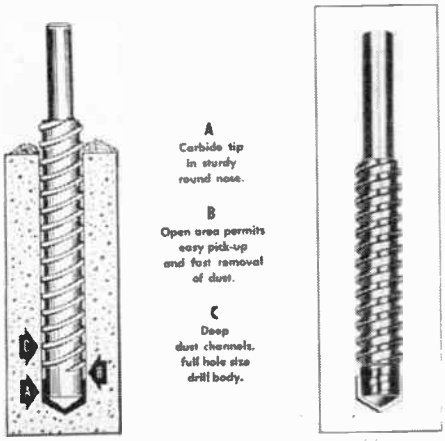
A hermetically sealed crystal diode and a one percent metalized multiplier resistor are incorporated in the unit.

—RTM—

## MASONRY DRILL

"Speed Spiral" is the name given an interesting new carbide tipped masonry drill marketed by the Super Tool Company, 21650 Hoover Road, Detroit 13, Michigan.

This drill is machined from the solid




with a round nose supporting the carbide tip.

The design provides ample dust clearance without necessitating gashing ahead of the carbide tip or otherwise weakening the end that does the work.

Double lead fast spiral dust grooves are made extra deep for long life. They pick up the dust from immediately behind the carbide tip.

It is reported that "Speed Spiral" design offers exceptional performance—that holes up to 12" deep can be drilled without stopping or removing the tool

from the hole. The drill body is the same as the nominal size of the drill.

Literature available from the company lists available sizes, prices, and other information.

—RTM—

## RCA UHF ADAPTER

RCA has come up with an adapter to give UHF television reception on a standard VHF receiver.

The converter, designed for use in any area which will be covered when the UHF channels are opened up, gives coverage of the entire UHF band.

The unit is 7⅜ by 8½ by 10⅞ inches. It can be installed on any present-day VHF set.

The right-hand knob is for tuning; the left hand knob has three positions—off, VHF, and UHF.

—RTM—

### Tel-O-Tube Announces Warranty

Tel-O-Tube Corporation of America, cathode-ray tube manufacturer, has announced its new policy of guaranteeing its replacement picture tubes for six months after the date of installation.

The new policy, which will go into effect immediately, is directed toward the protection of the jobber and distributor by allowing them unlimited shelf time for all tubes purchased from the company. Warranty now becomes effective as of the date of installation, the company pointed out.

Prior to the new program, policies were effective as of the date of manufacture, with the result that many distributors were often faced with an inventory of out-of-warranty tubes which were either unsalable, or salable only at a greatly reduced price.

Tel-O-Tube picture tubes are currently available in a complete range of sizes, from ten to twenty inches. Electrostatic tubes are also available.

—RTM—

## TV IF BOOSTER

A new TV-IF signal booster is specifically designed for use in near-fringe as well as metropolitan or suburban areas where a moderate increase in signal will produce satisfactory results on weak stations.

By increasing video and audio signals

approximately 25 percent, the booster can often change unsatisfactory pictures into pleasing TV reception at nominal cost.

Designated the Model TSB-1, the new Grayburne booster is a complete IF stage ready for insertion in the receiver circuit.

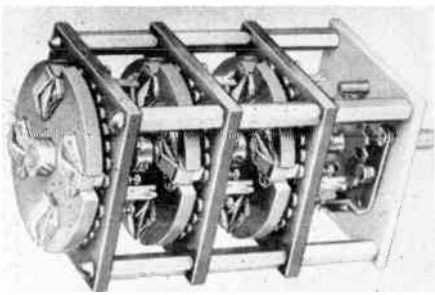
No external cabinet to house the unit is needed, and no on-off or channel switches are required.

For further information on the unit write Grayburne Corporation, 103 Lafayette Street, New York 13, N. Y.

—RTM—

## DAVEN MAKING MILITARY SWITCHES

The Daven Company of Newark, New Jersey, has announced that all its switches are now constructed in accord-



ance with applicable JAN and MIL specifications.

They feature silver alloy contacts and slip rings; positive roller-type detent action which does not add to the depth of the unit; and switch stops which are independent of rotors.

Due to new facilities, delivery is much improved on all models of standard switches. With these switches, a large number of positions and poles may be obtained in a very small physical space.

All Daven switches are constructed to withstand continuous use over long periods of time under extreme climatic conditions, the company says.

Special switches are now available for high-speed work for such applications as telemetering, plus work, and other military applications, with various ratios of on-off time and angular spacing of live contacts.

Due to the design of the switch panels and rotary members, a large selection of positions and poles is available.

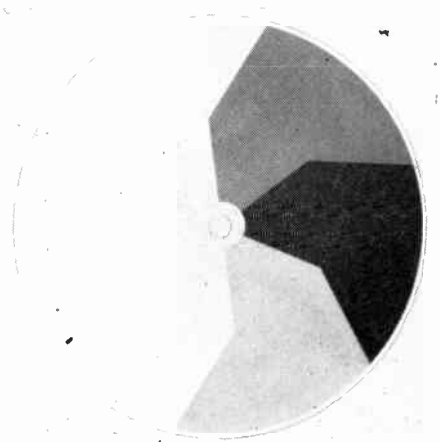
Further information regarding Daven switches for particular applications will be supplied on request. Write to The Daven Company, 191 Central Avenue, Newark 4, New Jersey.

—RTM—

## DUAL COLOR TV WHEEL

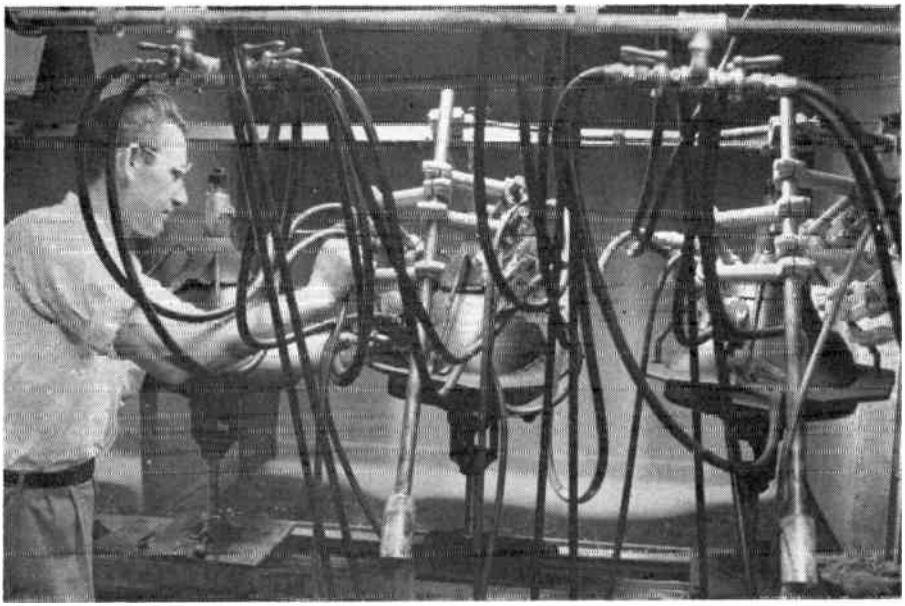
The Celomat Corporation, New York City, is now in production on its new dual color wheel—a development that permits color and black-and-white viewing without change-overs.

"The dual color wheel," Myron J.



Greenwald, vice president of the company, said, "is a real innovation for set owners who want to receive color and

→ to page 75



No, it s not a milking machine—but a paint spraying machine for television picture tubes. Here the metal and glass tubes are sprayed first with a conductive paint and then with a coat of lacquer before going through a drying process. The water spray in the background removes the paint odor from the air. The automatic paint spraying process is capable of painting several hundred picture tubes daily. The tubes move along an endless belt while they are being painted.

# AN INSIDE LOOK AT GENERAL ELECTRIC'S PICTURE TUBE PLANT

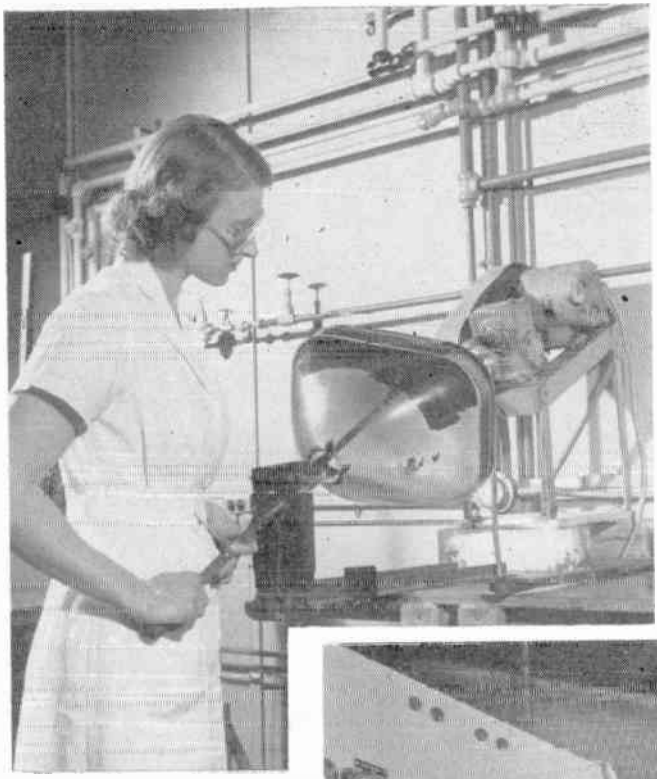
TELEVISION picture tubes—millions of them—continue to roll off the production lines of American manufacturing plants as the industrial giant called "The Electronics Industry" girds itself for mobilization and the possibility that TV will come to a sudden halt.

In these pictures, you can see a sampling of some of the hundreds of different operations that must be performed before a completed picture tube can be readied for shipment, or placed into a receiving set.

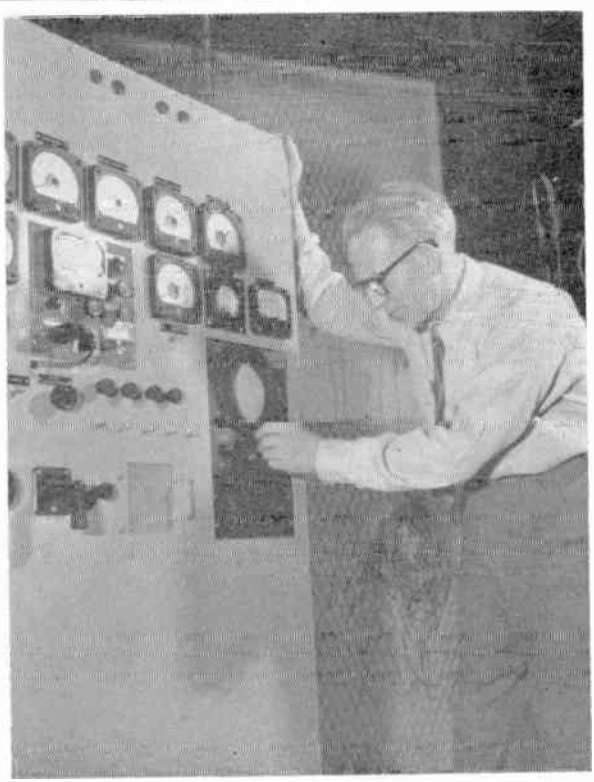
In addition to these processes, however, there are such operations as electron-gun assembly, exhaust, settling of the phosphorescent material on the inside face of the tube, aging, and a good many others.

The tubes are assembled under such critical standards that no allowance can be made on the grounds that "it won't make any difference." In work on kinescopes, every tiny variable must be accounted for before the tube leaves the plant. There can be no compromise when the television picture itself reveals the slightest defect.

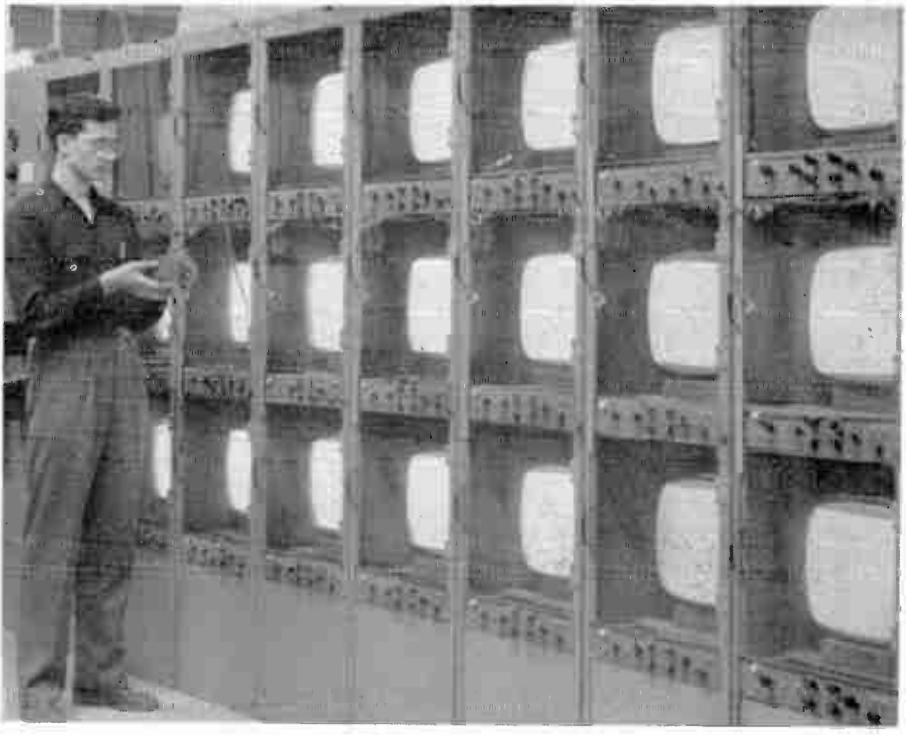
Even with the greatest care, bad tubes do slip through occasionally. It is with the idea in mind of eliminating such a possibility that the various "quality control" programs in the factories are being more and more widely developed.



All sizes and shapes of television picture tubes are painted at General Electric's picture tube laboratory at Electronics Park, Syracuse. Left, a lab technician paints the inside of a 20-inch glass TV picture tube. The tube will be used for developmental testing work at the lab.

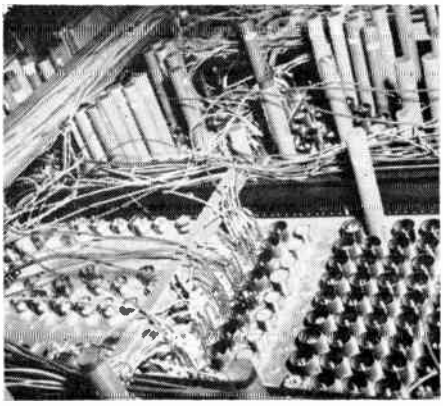


Here's General Electric's universal "pushbutton" test set which replaces four other test units in testing lighthouse tubes used widely for radar and communication applications. Merely by pushing individual buttons, the operator can test a tube for filament current; plate current; heater-cathode leakage; gas; mutual conductance; and pulse emission. Prior to this new operation, the tubes had to run the gamut of four separate test units. In contrast to this new method, whereby the tubes are pre-heated only once, the former method of testing necessitated pre-heating the tubes prior to each test. The "pushbutton" test set is located in General Electric's Industrial and Transmitting Tube Division building at Schenectady. The set was developed by H. L. Woodcock, shown at right.



Life tests, above, are given on 17-inch zero-voltages electrostatic focus picture tubes at GE's plant at Electronics Park, Syracuse. Tubes, below, are being put through final electrical tests before shipment from the warehouse.

# Stability Of Germanium Diodes



Some of the 16,000 germanium diodes used in the National Bureau of Standards Eastern Automatic Computer, are mounted in plug-in bases singly or in clusters to facilitate insertion and removal. This view of a group of base-mounted diodes and associated cabling gives an idea of the computer's complexity.

Automatic computer using 16,000 germanium units provides information on behavior

UNITED STATES production of germanium diodes for radio and electronic applications has expanded to something like 4 million a year. Yet because they are relatively new, germanium diodes have not received extensive service study, and few significant data on their characteristics in extended use have become available.

Because it uses some 16,000 germanium diodes for computing and switching functions, with the requirement of very high reliability, the National Bureau of Standards Eastern Automatic Computer (SEAC) is a natural proving ground for diodes.

A recent study of germanium diodes in the SEAC program is based on data compiled during the electronic computer's first six months of operation.

## Reliability Essential

Reliability is the outstanding requirement of diodes in computer use. Even momentary failure of a *single one* of SEAC's diodes will cause computer misfunction.

In view of this severe requirement, germanium diode experience in the SEAC program has been gratifying. After some 2500 hours under voltage, only about 5.4 percent of the diodes initially in service had had to be replaced, most of the replacements being because of back current drift, or "creep."

The great majority of these replacements were made in the course of routine maintenance checks before the questionable diodes could cause computer misfunction. The rejection rate for the several thousand diodes purchased in the last six months of 1950, furthermore, was less than 2 percent. Diode quality has undoubtedly improved since SEAC's first diode purchases were made, and continued improvements seems likely.

## All Diodes Alike

SEAC circuitry was designed to use diodes of a single specification, the 50 volts (back) 50 milliamperes (forward) type. A design value of –40 volts was selected as being the absolute limit of back voltage that would be encountered, and 20 ma was chosen arbitrarily as the peak forward current.

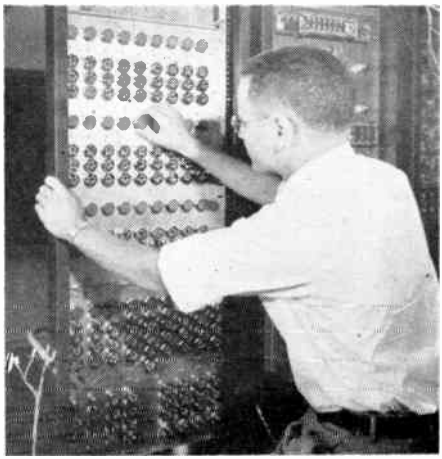
Each diode must be individually tested before use in SEAC; spot checking is inadequate, since all weak links must be excluded.

Tests are made twice before a diode goes into service, once before soldering into position and once after. Equally important to reliable computer function are the preventive maintenance checks made at regular intervals on diodes already in service.

SEAC diodes are tested for back current at –40 volts and for forward voltage drop at 20 ma forward current, the design maxima. For a "normal" diode, that is, one that does not "creep" appreciably, permissible back current at –40 volts is specified as 250 $\mu$a before soldering, 300 $\mu$a after soldering; and 500 $\mu$a for units in service. For a "good creeper," corresponding rejection limits are 120, 200, and 300 $\mu$a. (A "good creeper" is defined as one that drifts less than 50 $\mu$a and stabilizes markedly in the ½ minute observation period.)

Rapid "wigglers" (rapidly-fluctuating creepers, with periods of less than a second) must not exceed plus or minus 10 $\mu$a fluctuations. Maximum permissible forward voltage at 20 ma is 2.0 volts before or after soldering and 2.3 volts for units in service.

Fixed forward current was specified rather than fixed voltage, partly because SEAC's gate circuits are current operated, and partly because the fixed-current test circuit is short-circuit proof.



**A SEAC subassembly with a large number of germanium diode units in place. The plug-in mountings facilitate the NBS technician's work of checking and replacement.**

## Characteristic Deterioration

Deterioration of back characteristics has been the chief reason for SEAC diode replacements; and excessive creep has been a much more frequent reason for replacement than excessive back current.

Excessive creepers are replaced because of their unpredictability, although creep of itself will not necessarily cause computer misfunction. Creep in back current was observed in a substantial percentage of the commercially available diodes tested for SEAC, including both the wax-imbedded types and the hermetically-sealed types without the wax embedding.

The incidence of creep varied between makes, however, as well as from batch to batch. Forward characteristics, unlike back characteristics, deteriorated very little; and the number of complete failures such as shorts and opens was negligible.

Creep in diodes has not been fully described or theoretically explained in the literature. The SEAC study pro-

vides a substantial amount of data concerning this troublesome phenomenon. This information in turn affords some basis for speculation as to the mechanism of creep, although theory was not the primary concern of the study.

Creepers vary widely in their behavior. Initial creep may be in the direction of either increased or decreased current, while the long-term trend may bear no relation to the initial trend. Initial downdrifters are at present considered as undesirable as updrifters, since either seems likely to rise to excessive currents in the course of time. Creep may be gradual and steady, perhaps ultimately leveling off. Or, as more often happens, it may be more or less periodic, the period varying widely from less than a second ("wigglers") to a number of minutes or even hours.

## Causes of Faults

It now seems clear that diode creep is not caused to any appreciable extent by imperfect mechanical contact. Although moisture is suspected of playing some role, it appears unlikely that some of the observed creep phenomena could be caused by moisture alone.

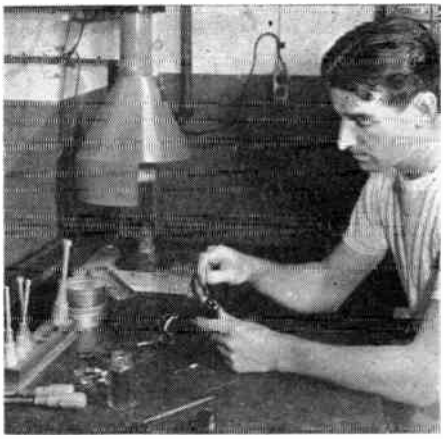
Peculiarities in the germanium structure in the neighborhood of the contact, with sensitivity to small temperatures or to electric fields, would seem to be another possibility.

Further work on the heat treatment of the germanium ingots, and on the forming of the diodes, may help to explain and solve the creep problem.

In addition to the observations on diodes in regular service, a few experiments were made. To study the effect of operating temperature on creep, 29 creepers were tested at 25° and 75° C. Although individual units differed, these experiments indicate that drift is not notably aggravated by increase in temperature within the usual operating range.

Another group of 18 creepers was studied for 210 hours at room temperature in an effort to determine whether an observation of one minute or less is sufficient to exclude long term creepers. These limited data indicate that one-minute or ½-minute observations, holding to a 300 $\mu$a limit, satisfactorily exclude those units which would later drift beyond 500 $\mu$a.

Pursuing the theory that creep might be related to moisture contamination, some experiments were run in which several makes of diodes were subjected to water soaking at room temperature. The chief effect of soaking (on non-hermetically sealed units) was to raise the back current and produce "jumping"; the back current at –40 volts would rise to at least 1,000 $\mu$a and frequently to 2500 $\mu$a, and would swing in an erratic fashion back and forth over a range of several hundred microamperes, the swing taking from one to five seconds.



**An NBS technician assembles a cluster of germanium diodes in a plug-in base for use in SEAC.**

## Salvage Attempts

Experimental attempts were made to salvage some of the water-soaked diodes, either by baking or with heavy forming currents similar to those used in the original manufacture. Both treatments were distinctly beneficial.

When the heavy current salvage treatment was tried on creepers rejected for SEAC use, great improvement was noted in about one-third of the number treated, while the other two-thirds deteriorated.

Limited though these soaking and salvage data are, they point to the possibilities of, first, salvage of rejected diodes, and second, manufacture of more stable diodes by increased pulse forming treatment and perhaps by baking.

The SEAC diode experience study indicates a definite need for more life data and better specifications for germanium diodes for computer applications. NBS investigators have outlined data-compilation and specification projects which they hope will be undertaken cooperatively by computer groups and other interested diode users.


"I DIDN'T HEAR THE GAME YESTERDAY. MY RADIO WAS ON THE BLINK."

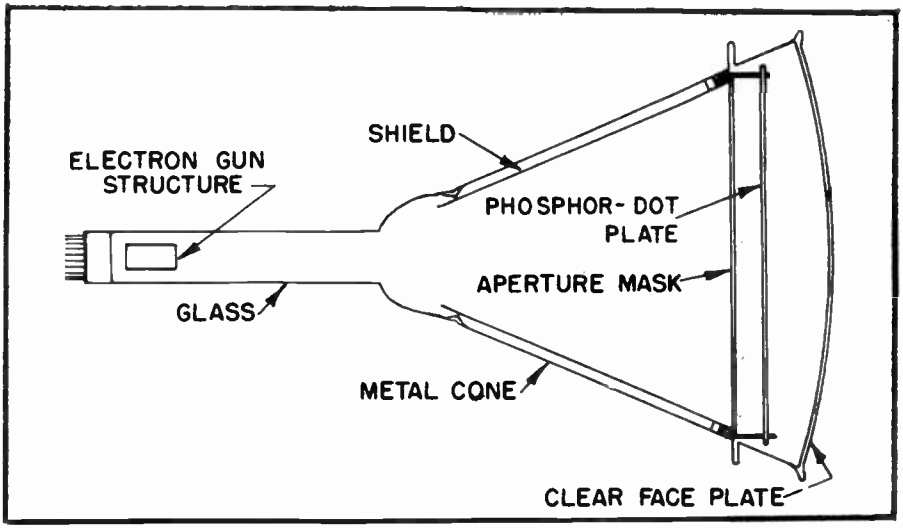



**Fig. 1. Cross-sectional diagram of tri-color kinescope showing major parts and their relative positions.**

# DEVELOPMENT OF THE TRI-COLOR TELEVISION TUBE

## RCA Device May Still Be Accepted for General Use in Color TV

THE first working model of the tri-color tube was demonstrated early in 1950. It was designed for RCA's all-electronic system of color television, which had emerged from RCA Laboratories after years of research and development.

The tri-color tube is an important part of RCA's all-electronic color television system. Color images are "painted" on the face of the tube by thin pencil-like beams of electrons, bringing to life fluorescent materials which glow in the three primary colors—red, green, and blue.

This tube reproduces color pictures when color signals are broadcast—or it will reproduce black-and-white pictures when the signal is in standard black-and-white.

Dr. E. W. Engstrom, vice president in charge of research for RCA Laboratories, has described the tube as "what can be accomplished in the complex and ever-widening science of electronics in which no one man could possibly find all the answers to one problem."

### Purpose of Tube

RCA has been working on a color television system for more than 10 years. As early as 1940, RCA held laboratory demonstrations of a color system using a whirling disk to produce the color.

With the advent of standards for black-and-white television, however, it

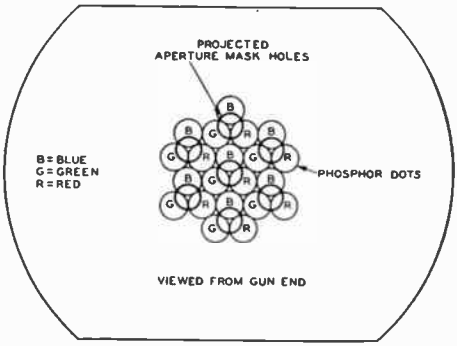



**Fig. 2. Orientotion of mask holes with phosphor color dots.**

became apparent that if color television was to be introduced, it must be integrated with existing black-and-white standards; that is, color television broadcasts should be received on existing sets in black-and-white without the addition of any extra equipment.

RCA thus began concentrating its research efforts on a compatible system.

## Tube Operation

In outward appearance, the tri-color kinescope is similar to the ordinary black-and-white tube. It consists of a funnel-like metal shell with a glass faceplate, on which the televised picture image appears.

In March, 1951, RCA turned over to its licensees a fourteen-page bulletin describing the engineering details of the 16-inch development tri-color kinescope.

In this booklet the techniques used in producing the engineering models of the tube were described.

In a general description of this method of producing color, the booklet explained that the screen assembly, or face of the tube, consists of an aperture mask, spacer frame and tri-color phosphor dot plate, which acts as the direct-view color screen (Fig. 1).

The dot plate is flat glass, on which small closely spaced phosphor dots are arranged in triangular groups. Each triangular group is comprised of three color-emitting dots—green, red and blue. Each dot is .014 inch in diameter, about the diameter of the wire in a paper clip.

## Internal Mask

The aperture mask, which is between the electron gun structure and the phosphor dot plate, is made of metal and contains an array of 195,000 holes. For each trio of phosphor dots on the plate, there is one opening in the aperture mask.

The aperture mask is kept the correct distance from the glass phosphor-dot plate by means of the spacer frame, which, like an automobile engine, must be made and aligned within close tolerances. The mask must be kept at the right distance in order that an electron beam aimed at a blue dot will not hit a red one (Fig. 3).

The phosphor dots are applied to the glass plate by means of a process similar to silk-screen printing.

## Demonstrations and Litigation

The RCA tri-color tube was first shown publicly in Washington, D. C., in March, 1950. In that demonstration before the Federal Communications Commission, two different types of developmental tubes were shown. One employed a single electron gun to activate the phosphors; the other used three electron guns—one for each of the three dot groups. Since that time, research and development has been concentrated on a tube using three electron guns.

October 11, 1950, the Federal Communications Commission, by a vote of

5 to 2, issued an order adopting standards for the Columbia Broadcasting System color arrangement, rejecting the RCA system.

Shortly after its decision, FCC asked RCA to turn its tube over to CBS for experimentation. To this, Frank M. Folsom, president of RCA, replied that the request was like the Phillies asking the Yankees for Joe DiMaggio in the 1950 World Series. He also pointed out to the FCC that just as soon as working models were completed, they would be turned over to the entire industry.

On November 14, 1950, RCA asked the Federal District Court in Chicago to issue a temporary restraining order against the FCC decision. RCA charged that FCC had acted contrary to the public interest in outlawing RCA's compatible, all electronic color system.

An incompatible system, RCA pointed out in brief, would require present set owners to spend millions of dollars to purchase adapters so that color broadcasts could be received in black-and-white.

In December, 1950, following further research, RCA held a new series of demonstrations of its system and the tri-color tube in Washington for representatives of the press and industry.

The number of phosphor dots on the tube face had been increased from 351,000 to nearly 600,000—giving finer definition in the picture quality. Reaction to the superior quality of the color shown at these tests was extremely favorable, RCA spokesmen said.

In January, 1951, the legal case which RCA initiated in Chicago was taken to the Supreme Court of the United States. On May 28, the court handed down a decision, while "granting the desirability of a compatible color television system," upheld the authority of the FCC to issue its order.

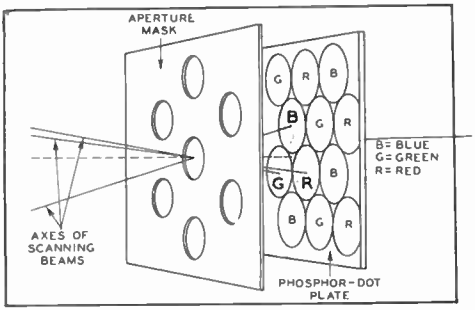



**Fig. 3. Diagram illustrating principle of operation of tri-color kinescope.**

In the meantime, since its December demonstration in Washington, RCA has continued the refinement of its color television system and embarked on field tests to prove the practicality of the system under broadcast conditions.

Great significance has been attached to the field tests because in turning down the RCA system, the FCC indicated that

the RCA system had *not* undergone sufficient field testing.

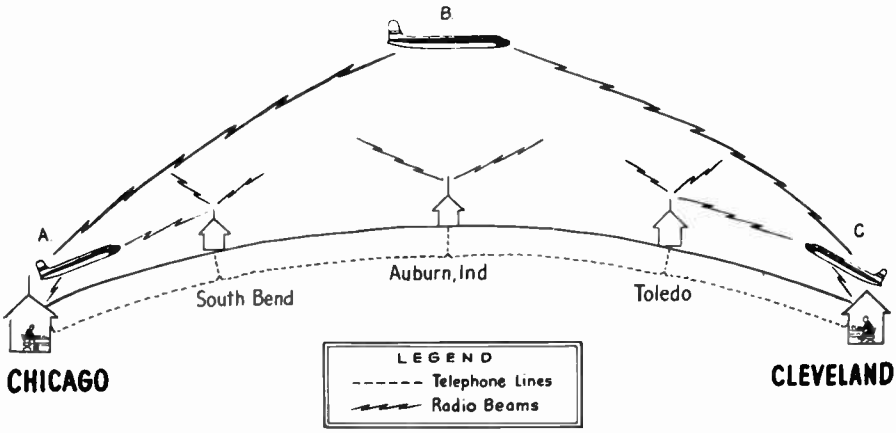
### Black-and-White

"When historians at the close of the 20th century evaluate the most important scientific developments," Brig. General David Sarnoff, chairman of RCA, declared, "I will predict that this tricolor tube will be among the great inventions of the second half of the 20th century."

Meanwhile, black-and-white telecasts will remain the backbone of television for many years, according to Sarnoff.

"The public has a big investment in television sets," he said. "By the end of 1951, there will be at least fifteen million sets in use. It certainly is unfair to the public to urge an incompatible system that would force present set owners to spend a lot of money to adapt their sets in order to get any picture at all from color television."


**". . . Because it makes lousy coffee, that's how come I returned it!"**




**Sketch shows how United Air Lines' new VHF radio network and telephone circuits link planes and ground stations for "party-line" communication. The pilot of Plane "B" is within VHF range of Planes "A" and "C" and consequently can talk directly to their pilots. Plane "A" at Chicago and Plane "C" at Cleveland are beyond VHF range, but their pilots can exchange messages by talking through network stations, linked by telephone lines. Operators at Chicago and Cleveland can talk via the network to all United planes in the area and can hear conversations between planes or between a plane and an operator.**

# Country's First VHF (CQ) Radio Network

COMPLETION of this country's first VHF radio network has been announced by United Air Lines, which is using a new five-station web as a "party line" for daily flight operations on the Chicago-Cleveland segment of its coast-to-coast route.

Stations at Chicago, South Bend (Ind.), Auburn (Ind.), Toledo and Cleveland form the network. United operators are on duty at Chicago and Cleveland. The other stations have automatic sending and receiving equipment. Each station has a 50-watt transmitter, operating at 127.5 megacycles. The stations are also interconnected by private telephone lines.

All stations and all United planes flying the Chicago-Cleveland route simultaneously receive transmissions from any point aloft or on the ground. Reception is generally bell-clear even during static conditions.

As an example of the operation, suppose the pilot of a "Mainliner" flying over Toledo wishes to report weather conditions. His message over an 8-watt transmitter is picked up by the Toledo VHF station, automatically relayed to Auburn, South Bend, Chicago and Cleveland for instantaneous rebroadcast at each point. In this way information is immediately pooled for the benefit of all pilots on the route.

United developed the new network in cooperation with American Telephone & Telegraph Company. A. T. & T. at present is supplying telephone and control lines while United provides radio equipment. In the next six months, A. T. & T. will install its own equipment and assume maintenance of the network.

# What's your problem?

**This department of RADIO AND TELEVISION MAINTENANCE is devoted to helping to solve the difficult service problems of our readers. Tough ones of general interest will be printed, and readers will send in answers. The best solutions will be printed in later issues. If only one answer to a problem appears here, its originator will receive $5.00 in cash. If two or more different ways of beating the poser are of nearly equal merit in the opinion of RTM editors, the second best will be worth $3.00 to the man who submits it, and the third best will bring home $2.00. Send your question or solution to: Problem Editor, RADIO AND TELEVISION MAINTENANCE, P. O. Box 867, Atlaotic City, N. J.**

## ANTENNA DIFFICULTY

*A couple of months back, Eugene L. Dimeo, of Ellwood City, Pa., wrote to this department and asked whether it would pay him to line up folded dipoles for four separate channels Yagi-fashion, with an overall reflector at the rear.*

*Here's what Reader Neil Blanc has to say on Mr. Dimeo's problem:*

GENTLEMEN:

Mr. Dimeo's idea of mounting four dipoles and a reflector on a horizontal plane would not provide the results he desires.

To realize maximum gain from a dipole-reflector antenna, the reflector must be of proper length and correctly spaced from the dipole for the channel it's designed for. Any compromise, such as the one Mr. Dimeo suggests, would result in a lower gain system than he presently employs.

All channel antennas are of necessity lower in gain than a single-channel antenna, and do not provide the answer in many fringe areas.

To obtain a noticeable improvement Yagi antennas should be used. It is possible to stack Yagi antennas of channels 13, 9, 5, and 3 in a relatively small space.

Starting at the top of the mast, mount a channel 13 Yagi spaced 2 feet, 8 inches from a channel 9 Yagi, then 6 feet, 4 inches to a channel 5 Yagi, and then 8 feet to a channel 3 Yagi.

This arrangement would occupy 17 feet of space vertically and should be guyed between the channel 9 and channel 5 antennas, preferably with sections of nylon rope at the tops of the guys to prevent interference of the guys with nearby antenna elements.

—NEIL E. BLANC
Berlin, Wisconsin

## FM AND AUTO SETS

*In last month's RTM, James Harrison asked advice on an FM tuner that*

*continued to hum, although he tried bonding, shielding of various kinds, and other measures.*

*The department's $5 prize for the best answer goes to Gerald Shirley, who also has a few points to make in connection with an auto radio problem in last month's issue:*

GENTLEMEN:

James Harrison's problem with hum in an FM tuner, recalls a similar problem I had with a Meissner several years ago. The manufacturer's service department suggested a number of approaches to the problem, none of which helped.

As a last resort—and for no logical reason that I could think of—I tried supplying the filaments of the tubes in the front end with a separate six-volt power transformer.

That cured the trouble, and it may cure Mr. Harrison's set. It is even possible that if he tries shielding the filament leads, it may eliminate the hum; on the other hand, if the hum is a symptom that has gradually crept into the set, then it is more likely that something more drastic is required—such as adding a separate filament transformer.

As to Mr. Webster's problem with his auto radio, I'm no auto radio expert, but I can think of several things to try which he didn't mention.

In the very first place, he did not say whether the noise with the car running was also present when the car was coasting, and with the motor shut off.

If yes, then anti-static springs mounted in the wheel hub caps might reduce or eliminate the noise.

As to the generator, did he try attaching a condenser at its output? All he says is "Should I have it cleaned and new brushes put in?"

And another thing: with the car running, and motor going, is the noise still present when the antenna is discon-


**"This is our two-screen model, designed for hunting lodges, bachelor dens and fraternity houses."**

nected? If yes, then the noise is getting into the set through the hot six-volt lead. Bypass it where it goes into the set.

If the foregoing approaches prove unfruitful, try some bonding techniques—hood to the frame, etc.

Other auto men will undoubtedly be able to suggest still other possible cures for Mr. Webster's problem child.

—GERALD SHIRLEY
New York, N. Y.

## DU MONT ANTENNA

GENTLEMEN:

My problem is this. Is a Du Mont TV set made to use only a lazy-X antenna, or may I use any type?

A Du Mont requires a 72-ohm coaxial cable. But in one installation, I used a Cinco antenna with a 300-ohm twinlead, and a matching transformer for the 72-ohm input. I also used a booster for a tryout, and the reception was pretty good.

Now, I was forced to take down the antenna because the Du Mont salesman told the customer that the booster and antenna would burn up the set.

I would like to know the real facts about a Du Mont installation and whether I may use any type of antenna. Thanks.

—BILL MITLO
New Castle, Pa.

## IN THE FLOOD'S WAKE

**The aftermath of nature's fury is shown in this scene during clean-up operations after the recent flood in the Kansas City region. In this picture, two technicians of the RCA Service Co. are moving a damaged TV receiver from a wrecked home in Kansas City, Kansas, to the company's nearby branch office. There, the set will have to be gone over carefully to see whether it can be repaired. The inspection service is furnished free of charge to victims of the inundation, but it doesn't always do much good. In many cases, receivers brought into the shop are double their normal weight because of collected mud and debris inside the cabinet, and are often a total loss.**

# Products for the Trade

→ from page 59

also black and white in the most satisfactory manner possible.

"The dual color wheel is actually two clear plastic discs with color segments that are balanced and matched in pairs of the same density.

"These color segments in rotation unite to form a perfect color wheel. For black and white viewing, the wheels are kept stationary; the colored segment sections of the wheels fall below the screen, and the black and white picture is transmitted through the clear plastic upper half of the discs."

—RTM—

## 30-INCH 'TELETRON'

The Du Mont 30-inch "Teletron," world's largest TV picture tube, is now being offered to both receiver manufacturers and to the trade through Du Mont distributors for the first time, according to B. C. Scales, Sales Manager of the Cathode-ray Tube Division, Allen B. Du Mont Laboratories, Inc., Clifton, N. J.

The giant 30BP4 presents a usable picture area of approximately 536 square inches, twice the area of a 20-inch rectangular.

In addition to its size, the 30-inch tube incorporates several features not found in other tubes, the company says.

The outstanding feature is the short overall length achieved through the use of a 90-degree deflection angle. The overall length is 23-9/16 inches, approximately two inches longer than the 20-inch tube.

For maximum contrast as well as rejection of ambient light, the 30BP4 employs a Du Mont gray-filter face plate. The second anode is designed to operate at 20,000 volts. A single-magnet ion trap is used in the tube.

—RTM—

## CABINET RACK ASSEMBLIES

To assist engineers in assembling sound units for the varied applications of industry, schools, churches, stadiums, and other users, Newcomb Audio Products offers the basic elements for custom, cabinet-type rack systems.

Designed for flexibility, these assemblies enable the engineer to install PA equipment to meet individual requirements.

All standard Newcomb amplifiers are available mounted on panels, as well as a record changer, radio, intercom amplifier and other special equipment.

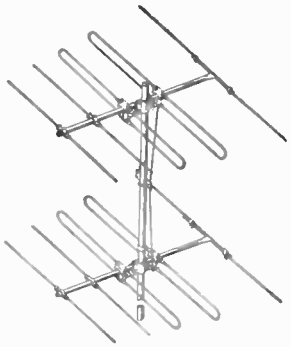
Model 595-19, a typical Newcomb cabinet, provides panel space of 56 inches. Mounting holes are RMA standard 1¼ and 1½-inch spacings. Panel mounting holes are tapped in ⅛-inch stock. A fully ventilated rear door provides easy accessibility.

Entire cabinet is a welded assembly with dark grey hammertone finish, has

provision in rear for nine half-inch conduits. A removable terminal strip mounting plate is included near conduit inlets. Dimensions are 59½ by 23 by 16 inches. Manufactured by Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, California.

—RTM—

## 5-ELEMENT YAGI



A new antenna designed for the extreme fringe areas is being produced by Technical Appliance Corporation, Sherburne, N. Y., manufacturers of "Taco" antennas.

The new antenna is a 5-element twin-driven Yagi design.

Tuned for any one of the low-band channels, the antenna features a gain greater than the company's old 4-element twin driven design.

The antenna consists of three parasitic elements, two directors, one reflector, and two driven elements. The driven elements are folded-dipoles connected in parallel with a terminal impedance matching 300 ohm twin-lead.

A sharp degree of directivity is said to eliminate most noise and reflected signal pickup providing clearer, stronger pictures. High front-to-back ratio is helpful in areas affected by co-channel interference.

The antenna comes factory assembled in the "Jiffy-Rig" style and is readied for installation in a matter of a few minutes. Depending upon the installation requirements, the 5-element twin-driven Yagi is available as a single bay, or as a stacked array.

—RTM—

## NEW TV RECEIVING TUBE

The General Electric Company's Tube Departments have announced development of a low-cost miniature television receiver tube designed to reduce snow in fringe area reception.

The new tube, the 6BK7, which has already gone into production at the company's receiver tube plant in Owensboro,Ky., has a noise factor of only seven decibles as a cascode amplifier at 216 megacycles.

Intended primarily for cascode service in VHF reception, the 6KB7 may also be used as a low-noise first-intermediate-frequency amplifier in UHF.

Design features of the 6BK7 include a shield between the triode sections and high transconductance to improve gain and reduce the noise level.

Typical operating conditions of the 6BK7 include:

Plate supply voltage, 150 v; cathode bias resistor, 56 ohms; amplification factor, 40; plate resistance, 4,700 ohms; transconductance, 8,500 microhms; plate current, 18 ma.

Further information on the 6BK7 may be obtained by writing the General Electric Company, Tube Departments, Electronics Division, Schenectady 5, N. Y.

—RTM—

## TV MASK-LENS ASSEMBLY

Deitz Miracle Lens Company, manufacturer of television masks and lenses, is promoting two recent developments—a one-piece lens and mask assembly for

use with color television reception, and a new 21-inch mask for standard black and white reception.

The new mask and lens assembly, currently being used by Colortone Television, is a one-piece combination escutcheon and magnifying lens which will both frame and enlarge the picture.

Suited for use with small screen color reception, the new unit is available for seven- and ten-inch sets.

The other new product is a 21-inch rectangular mask made especially for use in conjunction with the new flat-face picture tubes.

Both products are being offered to jobbers and distributors on an immediate delivery basis. Inquiries may be made to the Deitz Miracle Lens Co., 141 President St., Passaic, New Jersey.

—RTM—

## SINGLE CHANNEL BOOSTER

The new JFD factory pre-tuned booster does not require any tuning and employs an automatic on-off switch which works through the operation of the set.

So-called "wafer-thin" construction 1½ inches deep, facilitates installation on back of a TV cabinet.

The "Tuck-Away" unit delivers over 20 Db gain of full 6 Mc. band width, the maker claims.


A temperature-compensated thermo-relay power switch provides automatic on-off operation.

The booster is housed in a gold "Hammertone" finish metal case.

Dimensions of case are 4½ by 4¾ by 1¾ inches.

—RTM—

## TRANSPORTATION—PA SYSTEM

In response to demand for a small, compact, low-priced PA system unit combined with a transcription player, the Audio-Master Corp., 341 Madison Avenue, New York, introduced a new model, the 52-PA, which consolidates both features.

The unit has a five-tube push-pull high gain amplifier with approximately five-watt output. It is equipped with an 8-inch detachable loudspeaker and 10-foot extension cord, and a three-speed motor with indicator for 33-1/3, 45 and 78 rpm. It plays records and transcriptions up to 17-1/2 inches.

Other important component features are the transcription arm with twist crystal cartridge fitted with two permanent needles for standard and micro-groove records, volume and tone controls and pilot light jewel.

The carrying case is made of Dupont "Fabricoid," bound in genuine leather.

The unit is slightly under 15 pounds in weight.

—RTM—

## SIGNAL FLASHER

A lightweight, portable electronic signal flasher—without moving parts or filaments to burn out—has been announced by the Haledy Electronics Company, 57 William Street, New York.

This new, low cost flasher of cold cathode tube design emits a sharp flash of light visible for approximately a mile.

Unaffected by vibration, humidity or temperature in a compact splash and rainproof aluminum case measuring 6 by 6½ by 10 inches, it weighs only 8½ lbs. It can be carried by handle for use wherever signaling is required—on land, sea or air.

The flasher utilizes a set of three standard 90 volt batteries in series. Battery current is not used to make filaments glow, operate relay contacts, heat thermal elements or run motors.

An off-on switch as well as an outside knob to control the number of flashes pe minute, is provided. A clear or colored precision Fresnel lens protects the cold cathode tube.

Complete with batteries, the flasher is available for immediate delivery.

## COMMERCIAL 'ANTENSIFIER'

Blonder-Tongue Laboratories, 38 N. Second Ave., Mt. Vernon, N. Y., has just announced a new type commercial TV amplifier.

The new unit, called the "Commercial Antensifier," is a 4-tube, 4-stage TV signal amplifier that will supply gain of 30 times on all channels simultaneously.

Operation is automatic, without tuning or adjustment.

This unit can be used with the Blonder-Tongue, or any other master antenna distribution system, to overcome line losses at any point in the system.

In weak signal areas, it can be used as a pre-amplifier for the distribution system. It will now be possible to supply up to 2000 TV sets, in a master antenna installation, by the use of B-T Commercial Antensifiers, the firm stated.

Built-in transformers provide line match for both 75 and 300 ohm trans-

# Editor's Page continued

→ from cover 2

How long can we expect them to remain and still take advantage of technical advances?

The only ray of hope for the technicians asking for standardization is in the shortages-of-parts situation which is about to develop. Because of scarcity of materials, manufacturers may be forced to standardize to make the most economical use of available supplies. However, this is a temporary condition. As soon as shortages disappear, new circuits and components are sure to knock the former standardization right out the window.

While it is tough on the service company trying to keep a stock of parts on hand, it would be unwise to attempt a straightjacket on new developments at this time.

In this period of rapid evolution, we have to live with this parts problem and make the best of it. It makes it difficult for both the technician and the public, but it is the price we must pay for swift progress in electronics.

As a graphic example of what early standardization can do, note the trouble that the industry is having and is about to have with the current color standards. Do you think being hasty with standardization is the wisest road to take?

mission lines, at input and output terminals.

Four dual-triode tubes (2 6J6 and 2 6BQ7) yield the most gain and low noise factor, it is claimed.

It is placed in a ventilated metal cabinet, finished in gray "hammertone," and is equipped with ON-OFF switch and signal light.

—RTM—

## WEBSTER-CHICAGO SHOWS COLOR UNIT

Webster-Chicago Corporation is demonstrating this month an auxiliary color television unit, for attachment to standard black-and-white receivers.

First deliveries of the unit are already being made to distributors, it was announced by C. P. Cushway, executive vice-president.

The company is also making color wheel assemblies for sale to set manufacturers for inclusion in their auxiliary units or combination color and black-and-white sets, Cushway said.

At a demonstration for the company's distributors and the press, a closed-channel program was picked up at the Edgewater Beach Hotel in Chicago from the company's factory on the western edge of the city.

Webster-Chicago, which made the first color converters used by CBS in demonstrating its system before the FCC, expects to have moderate production of the units by October 1, Cushway reported.

Final price ranges on the units are still being worked out, he said, because final costs are not yet determined on a number of new components going into the units.

The auxiliary unit provides a 12½-inch picture. It has a 16-tube chassis, a picture tube and the color wheel assembly. There are three controls—contrast, brightness and color phasing.

—RTM—

## TUBE RECOVERY CO. GOES NATIONAL

H & A TV Picture Tube Company, whose recovery process is claimed to provide as high as 65 percent salvage of "dead" tubes, announces expansion of its service to a nation-wide coverage.

The process is described as an electrical repair which guarantees tube life will meet Radio and Television Manufacturer's Association specifications.

Limited originally to serving Chicago service depots, growth indicated wide interest in the process as an aid to reducing costs on maintenance contracts, the company says.

Cost of H & A recovery is $4.25 for a 10-inch tube, with prices scaled upward according to tube size.

The company is located at 3547 West Montrose Avenue, Chicago 18.

—RTM—

## MINIATURE RECTIFIERS

The "Minisel" line, a new line of subminiature selenium rectifiers, has been developed by the Precision Rectifier Division of Electronic Devices, Inc.

It consists of tiny selenium rectifiers in ratings up to 20 ma DC ouptut and 25,000 V AC input per single stack and features a variety of constructions for military and commercial applications. Special constructions allow for hermetic sealing and fungus proofing.

These rectifiers are constructed of matched ¼-inch diameter round selenium rectifier cells encased in bakelite, glass or metal housings. The cells are manufactured by a unique process under extremely strict quality control.

Because of this, there is very little

variance in characteristics within the individual unit and from unit to unit. This uniform distribution of internal losses makes for extremely long life. In fact, Minisel rectifiers carry a two-year guarantee in many applications.

These rectifiers can be built in all common and in an infinite variety of special electrical configurations, including a complete line of standard instrument and spark suppressor rectifiers.

—RTM—

## RCA PRODUCING NEW LINE OF METAL DETECTION EQUIPMENT

New metal detection equipment featuring four types of small-aperture inspection heads for more efficient and speedier location of metallic particles contaminating non-metallic products was announced today by the RCA Engineering Products Department.

Product lines in which the equipment will have application include meat, bakery products, candy, plastics, paper, rubber, tobacco, textiles, and explosives.

The new metal detectors, which RCA has designated the "Guardsman Series," will indicate the presence of even minute particles of metals or alloys, whether magnetic or non-magnetic, and regardless of their depth in the material, as products pass through an inspection aperture on an endless conveyor belt or by means of a chute at rates of 10 feet to 1,000 fet per minute.

They can be used to light a warning lamp, ring a bell, stop a continuous process, mark the contaminated object, or deflect it into a special channel or receptacle for rejects.

The new equipment is the company's latest industrial tool for quality control. It is also useful as a means of preventing machinery damage, eliminating fires and explosions resulting from tramp metal and reducing lost production time in industrial processing.

The detectors consist of two units. The control unit, which is the same for all models and applications, has an overall measurement of 8-1/4 inches high, 6-3/4 inches wide, and 10 inches deep. It weighs 20 pounds.

The second unit, the inspection head, is provided in four different styles to meet specialized installation requirements. Two of the box-type heads have rectangular apertures—one measuring 2-1/2 by 7-1/2 inches and one 4 by 5 inches—and are designed for detecting metal in candy, chewing gum, pharmaceutical products, and other items that can be carried on a small conveyor belt during processing.

The others have smaller box-shaped heads with round apertures—one measuring 1-1/8 inches in diameter; the other measuring 2 inches in diameter—and are suitable for ground meat, liquids carried in glass tubes, cigarettes, and similar items that can pass through the small head in a non-metallic tube or trough.

Materials passing through the inspection aperture are screened by a high-frequency electromagnetic field, generated by coils embedded in a waterproof material.

High-frequency power is fed to the coils from an oscillator, and the reaction caused when metal is present in the material being screened operates a relay which triggers either a signaling device (lamp or bell) or an automatic marking or ejecting mechanism, or a combination of these, whichever is desired.

The equipment is practically immune from building and conveyor vibration,

while electronic voltage regulation assures freedom from effects of line voltage fluctuations. The equipment is not affected by normal humidity and temperature changes.

Sealed against dirt, lint, and dust, the unit is also waterproof, permitting scrubbing and hosing where required by purity standards.

All models of the Guardsman Series have a power requirement of 115-volt, 50/60 cycle, 70 watts AC.

—RTM—

## AUTO ANTENNA

A new auto radio antenna, called the "Solo-Mount" because it can be installed by one man working only on the outside of the car, was just announced by the Insuline Corporation of America, 36-02 35th Avenue, Long Island City 1, N. Y.

The base of the antenna contains a special captive cup washer, which, after it is dropped through the hole in the cowl or the fender, adjusts itself to the shape of the fender to form an anchor for the assembly.

The antenna proper consists of three telescoping sections of chrome-plated brass, extending to 59 inches. A shielded lead-in cable, 46 inches long and fitted with a presoldered plug at the receiver end, is included.

—RTM—

## NEW VOLTOHMYST MODEL

An all-electronic vacuum-tube "Junior Volt-Ohmyst" meter designed to meet service technicians' demands for a low-priced voltohmmeter capable of measuring AC volts, DC volts, and resistance in five different ranges was announced by the RCA Tube Department.

The new test-bench unit will be available through RCA test equipment distributors.

The AC-operated meter (WV-77A) employs a high-impedance diode tube as a signal rectifier—an unusual feature in volt-ohmmeters in this price range.

In addition, it features an electronic bridge circuit similar to the one used in the Senior VoltOhmyst, a 200-microampere movement, and carbon-film multiplier resistors.

Designed to streamline the serviceman's test operations, the lastest addition to RCA's "Blue Ribbon" test equipment line utilizes a single three-purpose shielded-input probe cable for all measurements.

A novel switching arrangement and a slip-on probe eliminate the separate cables and probes heretofore required for various test purposes. With the Junior VoltOhmyst meter, measurement of resistance and AC voltages is accomplished with the direct probe. DC voltages can be measured by slipping the isolating probe onto the direct probe. The DC probe, direct probe and cable, ground lead, and an alligator clip are included with the instrument.

The meter will measure DC from 0.05 volt to 1200 volts in five ranges. It will measure AC from 0.1 volt to 1200 volts rms in five ranges. It also measures resistance in five ranges, from 0.2 ohm to one billion ohms.

Other engineering and convenience features include high input resistance on all ranges, electronic protection against meter burn-out on all functions, a DC polarity-reversing switch to eliminate reversing of test leads, zero-centering facilities for discriminator alignment, metal shielding for stability in RF fields, and an ohm probe to facilitate testing of electrolytic capacitors.

The instrument is calibrated against laboratory standards and is backed by a 12-month warranty. It measures 8 inches high 5⅜ inches wide, and 4½ inches deep, weighs four pounds, and comes complete with a carrying strap.

# Line Carrier Simplex System

A NEW automatic simplex type switching development for power line carrier installations has been designed and is in production.

The electronic transfer unit, designed for Motorola Research Line Carrier equipment, is so precise in its operation that a circuit can hardly be distinguished from a well-balanced duplex circuit, although it operates only on one frequency.

All switching is accomplished in response to speech itself. A fraction of a second's hesitation allows for line clearance and either party may begin to talk. Once speech is started, the line is open only the one way until the moment speech again stops.

This form of switching was developed for a variety of reasons. Among them are:

1. It allows party-line communications between several points, which full duplex operation cannot accomplish.
2. It operates on a single frequency, eliminating the complexities of full duplex type operation.
3. It does not require a press-to-talk button and circuit and, as a result, allows incorporation of automatic simplex operated circuits into standard telephone systems.

Three major features incorporated in the design provide the advanced switching operation:

1. Extremely high speed of operation.
2. Complete freedom from inserting "click" into the circuit.
3. The inclusion of asymmetrical time constant circuits whose operation in the direction of closing has different time constants than when opening.

## No Relays

The electronic transfer unit uses no relays because relay operation is considered to be too slow. Because the blocking and actuating of both the transmitter and the receiver were required to be

accomplished electronically, the unit was designed first and transmitters and receivers were later designed to work in conjunction with it.

In two milliseconds after speech is started, the unit automatically begins operation by first blocking the incoming receiver. Two-fifths of a millisecond later, the transmitter is started.

The signal, when received at the distant end, first locks out the transmitter. This requires 2/5 millisecond. Then 2/5 millisecond later the receiver squelch is opened and the audio signal applied to the receiver output terminals. Thus, 3 milliseconds after speech is started at one end of the circuit, it emerges on the receiver output terminals at the other end of the circuit. (Line propagation time is neglected in this computation.)

At the cessation of speech, an arbitrary delay is inserted before switching action can begin. This may be manually adjusted from 30 to 500 milliseconds. At the end of the delay, the local transmitter is cut off.

Two-fifths of a millisecond later the remote receiver squelch closes. Five milliseconds after this the block is removed from the remote transmitter, and then five milliseconds later the local receiver is unblocked so it can receive the reply from the remote end of the circuit.

Again, due to the ending of a transmission, no click is put into the speech signal due to switching.

**"Our set's out for repairs."**

# trade LITERATURE

## VOCATIONAL GUIDE

John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y., has announced a forthcoming publication, "TV and Electronics as a Career."

The book will be available at the organization's distributors next month.

Roughly speaking, the electronics industry is composed of seven branches of activity: engineering, broadcasting, manufacturing, servicing, parts and receiver distributing, sales representation, and retailing.

Each of these special fields is discussed in the text by an acknowledged authority currently active in the field.

The men who have collaborated to make this book a valuable guide to the individual seeking employment in the electronics industry are: J. R. Poppele, vice-president, WOR-TV; R. W. Peterson, assistant manager, Electronics Div., Admiral Corp.; W. H. Bolke, manager, custom service operation section, RCA Corp.; Ira Kamen, director of TV development, Brach Mfg. Corp., and R. H. Dorf, television consultant.

The book is claimed to be the only text that gives all the whys and wherefores of the electronics industry for the newcomer embarking on a career, or for the electronics "oldtimer" desiring to switch to another field of specialization within the industry.

In addition to the eight chapters covering the various phases of activity in the electronics industry, appendices include typical salaries for operating personnel in small and large radio stations, curriculum of electrical engineering courses at Illinois Institute of Technology, those at other public and private schools teaching radio and TV courses.

"TV and Electronics as a Career" is written in an informal style, and contains 130 pictorial representations of the industry at work. The text has approximately 325 pages in a 5-5/8 by 8-5/8-inch cloth binding. It costs $4.95.

—RTM—

## ANTENNA SYSTEM

Industrial Television, Inc., has announced publication of "Multivision Antenna System," which describes a new multiple antenna system which is practical for fringe area installations as well as strong signal locations.

The Multivision System is suitable for large or small installations, including community antenna systems.

The building blocks of the flexible Multivision Antenna system are ITI's "Autobooster" and "Multibooster" units, which are broad band amplifiers and do not require manual tuning to cover all twelve TV channels.

Signal losses due to passive decoupling, a common source of trouble in TV antenna systems, is reportedly overcome by the use of the Autobooster at each receiver as a decoupler.

The Multibooster is used as the main amplifier with separate high and low

band gain controls to allow balancing of signal levels.

Provision is made for separate high- and low-band antennas. Both the Multibooster and the Autobooster may be peaked in the field for maximum gain on specific channels.

This technical bulletin may be obtained directly from the manufacturer, Industrial Television, Inc., 359 Lexington Avenue, Clifton, New Jersey.

—RTM—

## OXIDE CORE BULLETIN

A new 12-page engineering bulletin profusely illustrated with graphs demonstrating the behavior characteristics of each of its three grades of metallic oxide Ceramag cores under varying conditions of permeability, flux density, temperature, and other magnetic properties is now available from the Stackpole Carbon Company.

These non-metallic cores have found widespread use in TV flyback transformers, deflection yokes, image-width controls and other applications where high permeability for relatively low flux densities and medium frequencies is required.

Particularly valuable for the design engineer, the new Ceramag engineering bulletin will suggest many new ways of lowering the cost and raising the efficiency of modern electronic equipment.

A copy is obtainable on request to the Stackpole Carbon Company, St. Marys, Pennsylvania.

—RTM—

## WIRE CO. BROCHURE

Columbia Wire and Supply Company, Chicago, has just released a new brochure describing the facilities and products of the firm.

The brochure illustrates the planning and layout facilities, rubber capping, attaching of terminals, automatic braiding and shielding, multi cutting, automatic cutting and stripping, coiling and winding, multi conductor twisting, heavy cable stripping, press assemblies, and other operations.

As a self-contained plant with complete mechanical facilities, Columbia produces or supplies all types of electrical insulated wire, cords, cable, wire kits, harnesses, and leads with terminals.

—RTM—

## 'DAG' COATING EFFECTS

Secondary emission, back emission and photoelectric effects in thermionic tubes employed for receiving and transmitting can be minimized by the use of an aqueous dispersion of Acheson "dag" colloidalized electric-furnace graphite.

So says a recent bulletin from the Acheson Colloids Corp., manufacturer of the coating.

Being resistant to electron bombardment, a graphite coating on a grid protects this metallic member from the impact of primary particles, thus greatly reducing, if not wholly eliminating, the emission of secondary electrons.

The excellent thermal radiation properties of graphite are also utilized in connection with grids to keep them sufficiently cool to prevent undesired primary emission. The graphite may be applied directly to the tube member with or without such preliminary treatments as acid etching, sand blasting or oxidation.

However, a surface which is rough as well as black radiates more effectively.

Representative tube types carrying graphite-coated grids or plates to increase radiation or reduce secondary emission are: (for receiving) power amplifier triode, triple grid power amplifier, beam power amplifier, pentagrid

converter, pentagrid mixer amplifier and rectifier-doublers; (for transmitting) power amplifier pentode, RF power amplifier pentode, beam power amplifier and screen grid RF power amplifier.

Because of its low photoelectric properties, colloidal graphite, when applied to tube parts, renders them practically free from the effects of such electromagnetic radiations as light, X-rays, etc.

The versatility of "dag" colloidal graphite in the electronic industry is explained thoroughly in Bulletin No. 433 of Acheson Colloids Corporation, Port Huron, Michigan. Copies are available free on request.

—RTM—

## INDUSTRIAL TUBES

A 28-page booklet devoted to industrial electronic and special purpose tubes has just been published by Milo Radio and Electronics Corp., 200 Greenwich Street, New York 7, N. Y., wholesale distributors of radio-electronics, TV, sound and broadcast equipment.

Designed for industrial use, this booklet furnishes complete technical specifications and information on hundreds of special purpose electronic tubes used in various industrial applications: control, processing, production, research, testing, counting, sorting, weighing, measuring, detecting, broadcast and micro-wave communications, avionics, radar, and other uses.

Featured are such brands as General Electric, Westinghouse, Sylvania, Tung-Sol, Eimac, Dumont and others, with listings of such special purpose types as kenotrons, phanotrons, ignitrons, thyratrons, pliotrons, photo cells, voltage regulators, germanium diodes, silicon crystal diodes, strobotrons, TR, ATR and trigger tubes, cathode ray tubes, pilot lamps, panel lamps and signal indicators.

Milo stocks all of these types in quantity and can offer "same-day" shipments with direct-factory prices.

Interested readers may secure a free copy of the booklet by writing directly to the company.

—RTM—

## PHONO REPLACEMENTS

Two new phonograph cartridge replacement guides are now being furnished by The Astatic Corporation, Conneaut, Ohio, one designed to aid the serviceman and dealer in quickly finding the proper astatic cartridge replacements for Columbia phonographs and record changers, the other giving similar guidance on Philco models.

The manner in which the information is presented affords easiest, fastest possible reference. The recommended Astatic cartridges, and the Astatic needle types employed in each, are illustrated, each illustration with a numerical designation.

All Columbia and Philco phonographs and record changers for which there are Astatic replacements are listed by model number.

Opposite these model numbers are the model designations of the proper Astatic cartridge replacement and needle type, together with the illustration numbers which picture the particular cartridge and needle referred to.

In requesting copies of the guides, ask for Philco Form No. 52 and Columbia Form No. 53.

—RTM—

## UHF MANUAL

The latest booklet in the RCA electronic training series, titled "Ultra High Frequency Fundamentals," has just been published and is now available, it was disclosed this week by the Government

Service Division of the RCA Service Company.

A revision and expansion of an earlier booklet, "Practical Analysis of Ultra High Frequencies," the new manual has been prepared as a technical aid for UHF training and the installation, operation, and maintenance of UHF electronic equipment.

It serves also as a source of introductory information and references for use in the study of radio and radar principles applicable to the service and repair of UHF military equipment.

The book is illustrated, and its content is organized for reference to such subjects as transmission lines, resonant sections, standing wave measurements, cavity resonators, wave guides, and wave guide application.

The new manual will prove especially useful to military personnel and to manufacturers holding contracts to provide UHF equipment for the military, the company stated. The price is 75 cents per copy. Orders may be placed with the Government Service Division, RCA Service Company, Gloucester, N. J.

**RIDER AM-FM VOL. 22**

Volume 22 of the "Perpetual Trouble Shooter's Series" is now in production at John F. Rider, and will be available in October.

Sixty-two manufacturers contributed their factory-authorized servicing data on AM-FM receivers, auto radios, record changers, disc and tape recorders.

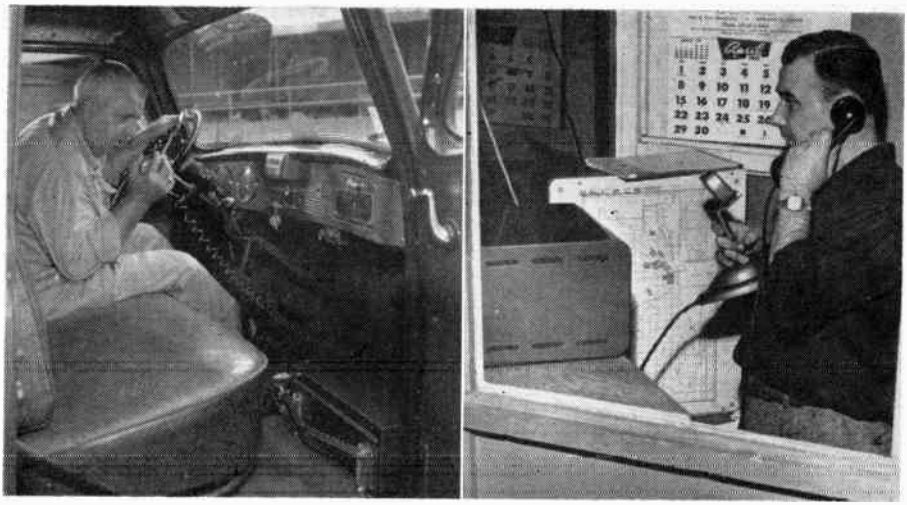
The volume covers production for the period November 1950 through August 1951. It contains 1,520 pages, all filed in place, ready for service bench use. The accompanying cumulative index for Volumes 16 through 22 facilitates the location of any model.

Volume 22 contains schematics, alignment procedures, chassis views, tube layouts, operating voltages, parts lists and parts values, voltage ratings of condensers, wattage ratings of resistors, coil resistance data, gain data, dial drives, and a "Changes" section for manufacturers' modifications.

Bound in a blue waterproof loose-leaf binder, it is priced at $18.00.

## Milk-Bottle Competition

MANUFACTURERS of selenium, the rare element used in rectifiers, have asked the National Production Authority to divert some selenium from going to the glass industry for such things as red glass. The supply of selenium, according to the manufacturers, has fallen to a three-day supply, and some DO (defense order) rated orders may not be filled. The Government is trying to develop new sources of selenium.



**Driver George Wysinski checks with the dispatcher over his FM 2-way radio to get his next job location and assignment. Steve Neitzer, the dispatcher, right, controls the movements of Motorola trucks between the company's four Chicago plants.**

# TWO-WAY FM FOR DELIVERY TRUCKS

AN OLD saw has it that cobblers' children have no shoes.

Such an adage fails to apply to Motorola, Inc., in Chicago, manufacturer of FM two-way radio equipment.

As close-to-home evidence of the value of mobile radio systems, the company has installed two-way radios in 18 of the trucks it uses for moving equipment between its four Chicago plants, and has placed all truck control under one dispatcher.

Leo Gray, head of Motorola cartage, estimates that such a system has resulted in a 30 percent decrease in cartage costs since its installation during the first few weeks of this year.

The principal cut in costs resulted from elimination of duplicate trips and coordinated cartage activities at the four plants, he explained.

## Eyes Right

A TECHNICIAN'S eyes are important in radio and television work. As much as 75 per cent of the defective units passing through the inspection department of Motorola were eliminated through a system of employee vision tests. In that most work is done at a distance of 13 inches, a premium is put on good vision.

# What they're saying . . .

## . . . about replacements

**Bill C. Scales, gen. sales mgr., cathode-ray tube div., Allen B. Du Mont Laboratories**

*In the period from 1946-1949, 2,030,000 sets with 10" tubes or smaller, and 2,404,000 larger sets were sold to the public. Each of these set owners represents a potential customer for either picture tube replacement or conversion.*

*"Through increased promotion and exploitation by sales representatives, jobbers, service personnel and tube manufacturers on the replacement and conversion theme, we can make this replacement and conversion market an important factor in the overall television industry picture.*

*"It is important that we make replacement and conversion as easy as possible for service personnel. Simplification of picture tube types is a step in the right direction."*

## . . . about defense production

**Glen McDaniel, president, Radio-Television Manufacturers Association**

*"With the enormous amount of military contracts outstanding, the average citizen would think that every plant in the country capable of producing or assembling electronic equipment would be humming with production.*

*"Yet, information submitted recently by RTMA member-companies in response to a questionnaire indicate that, on an average, set and parts manufacturers in June, 1951, were utilizing only half of their plant capacities in both defense and non-defense production. This was broken down roughly as 11 percent in defense work and 39 percent in non-defense manufacturing. An earlier RTMA survey showed losses of employment of 50,000 workers among Association members alone in an industry that normally employs about 200,000. The great IBEW Local 13 in Chicago, whose membership is largely confined to radio and television plants, recently reported that over one-half of its 26,000 members were unemployed.*

*"Perhaps this situation would not be so alarming if it merely involved survival of the fittest in normal commercial competition. However, much more than that is at stake: the ability of the electronics industry to meet its responsibility when and if a third world war comes.*

*"To those not familiar with our industry this situation would seem incred-*

*ible. Certainly it is anomalous. To those in the industry, however, it is no cause for alarm. People who have been living through the meteoric rise of electronics know that the process of rapid industrial growth is not without its pitfalls, and is often accompanied by dislocations in industry patterns and practices. We are now going through one of those periods of dislocation or relocation, but I am confident that our industry, noted as it is for resourcefulness, will emerge stronger than ever before.*

*"We realize that civilian business went into a slump and military business failed to take up the slack. Here is what happened:*

*"First, the fear of wartime shortages developed into a wave of buying that drove television receiver sales to record heights during the latter half of 1950. People bought in 1950 many of the television sets that would normally have been purchased in 1951.*

*"Second, consumer credit controls, higher taxes, higher living costs, and other economic factors resulting from our partial mobilization program along with normal seasonal influences, slowed down consumer buying with the result that TV set production in 1951 dropped to a quarter of its 1950 peak.*

*"Third, despite large appropriations for military procurement of electronics products, most radio-television manufacturers have been unable to obtain enough defense contracts to offset their losses in civilian business.*

*"All of you will have your own ideas as to why military production has not taken up the slack in civilian production. I will mention some of the factors bearing on the point:*

*"Electronic developments have been so great since World War II that the whole character of manufacturing requirements has changed.*

*"Citing the highly complex electronic fire control and radar equipment developed since World War II, Mr. Edwin T. Gibson said recently that the radar equipment used in World War II was more easily adapted to mass production methods common to the radio-television industry. The number of radar units needed by our armed services today is numerically only a small fraction of the number of TV sets which our industry is equipped to build, but it requires much more time, more engineering, and more labor.*

*"Officials estimate that not more than 20 percent of military electronics contract commitments will be spent for items which can be manufactured in normal mass-production fashion. Included, for example, are radar equipments costing $400,000 which use less than 350 separate components. Obviously, such equipment cannot be assembled on a production line basis. Assembly might be done by a total of 60 people, of whom half must be engineers.*

*"The manufacturer of mass production radios and TV sets is likely to find that the biggest order he can get for a military item is 50,000 or 60,000 units. He could handle the job in 10 or 15 days of production, but it takes him 18 months to prepare for the production run."*

# . . . about engineers

**E. Finley Carter, vice-president in charge of engineering, Sylvania Electric Products, Inc.**

*"In the commercial radio and television field, tube manufacturers operate with a delicate balance between the cost of manufacture and the cost of field service. The war brought problems of a new order of magnitude. The enemy plane that is missed because of a tube failure may be carrying a bomb which will bring great destruction to one of our cities. An important mission may be aborted because of a seemingly minor failure. The lives of our men and vast sums invested in military equipment are being bet on the dependability of vital electronic gear, but the vital dependence on electronics is not limited to military equipment.*

*"People cannot fly across mountains and oceans nor can planes be stacked over a busy airport without reliance on properly functioning equipment for which electronic engineers are responsible. Engineers must discard some of the habits and practices which have been acceptable in the competitive economy which surrounds the radio and television industry when products for entertainment are the prime consideration.*

*"These practices are dangerous if carried over into the design of military, navigational or other vital equipments.*

*"Often, too, they {electronic tubes} are considered as just components. It is not fully realized that the tube, itself, is really a complex system. While practically all of the known physical sciences contribute to its production, nevertheless much reliance must be placed on the art of manufacture and processing. This is because the variables are so great that statistical analysis, similar to that used by the life insurance actuary, is required to evaluate production and application probabilities."*

# . . . about price-cutting

**Edward Hink, sales manager, electronics parts department, Allen B. Du Mont Laboratories, Inc.**

*"Distributors need not draw any hasty conclusions from the few price-cutting examples encountered occasionally in the jobbing trade today. Such practices are no indication of special price concessions by Du Mont or other leading component manufacturers. Rather, price cuts are usually in connection with components dumped by TV set manufacturers who (a) may have over-bought, (b) who may have changed their circuitry or picture tube, or (c) who may be desperate to convert a parts inventory into ready cash. In*

*some instances the components may be of somewhat ancient vintage and therefore not to be compared with present TV components supplied to and through the jobbing trade. Price cutting, even for the purpose of raising quick cash or making a quick 'buck,' is doing the participating distributor little good because (1) it chops down his profit, and (2) it creates a questionable price structure he may have to live with in the future when business is really good.*

*"Furthermore, despite the fact that the present market is slow, there are ample indications that the fall and winter trade will be normal. For one thing, television is entering the era of replacements and conversions. Sets now in use for several years need replacements to keep going and even to restore initial performance. Small-sized screens are being replaced by larger tubes. Those jobbers now price-cutting will be sorry!"*

## . . . about shortages

**W. H. Sahloff, general manager, receiver department, General Electric Company**

*"The plain fact remains that total industry television production for the balance of the year will be drastically curtailed as a result of material shortages and controls, and there is every indication that costs are increasing in every area of production. We believe that the demand for our product is greater than our present ability to produce, and we fully expect that we will experience an actual shortage of General Electric Black Daylite television receivers before the year end."*

## . . . about the future

**Walter L. Stickel, national sales manager of receiver sales, Allen B. Du Mont Laboratories, Inc.**

*"We are still in a peace economy. True, it is a dual type economy, dictated by our national defensive effort, but we are still producing consumer goods and are not yet on an all-out war production basis.*

*"The potential market for television today is perhaps even greater than it was in 1946, the industry's first post-war year. There are still virgin markets in 50 percent of the nation, and as soon as the 'freeze' is lifted, set sales will shatter all previous records. In addition to the purely virgin markets, there are the lucrative replacement and second set markets to which all levels of television selling can apply themselves.*

*"However, aside from the vast market for the present type receivers,*

*there is still in the offing the completely untapped potential in UHF and color receivers, when they are perfected.*

*"No other industry in America's history has ever had the potential in innovations and developments, exemplified by UHF and color, that faces television today.*

*"As far as receivers are concerned, within the near future the public can expect greater probability in their TV sets, bigger picture tubes, which will be smaller in length than present types, making for shallower, more compact cabinets and increased use of printed circuits in receiver chassis."*

**Glen McDaniel, president, Radio-Television Manufacturers Association**

*"Recent upswings in sales of television receivers at the retail level have followed the relaxation of consumer credit controls which Congress effected at the behest of our industry. All indications are that this improvement will continue and that inventories will gradually get back to normal. In fact, in the light of tightening materials controls, TV receivers may again be in short supply before Christmas.*

*"From a long range point of view, we have every reason to be optimistic. Many new TV areas will be opened up within the next few years, and better service will be offered in numerous areas now having only one or two TV stations. Higher power for TV transmitters, now being allowed by the Federal Communications Commission already is expanding present markets.*

*"New export markets are opening up in other countries, especially in Latin America, are turning to television as they did formerly to American movies. American manufacturers, with a head start on most foreign radio-television producers, should be able to supply these new world markets as well as the expanding home markets."*

**STATEMENT OF THE OWNERSHIP, MANAGEMENT, AND CIRCULATION REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) of**

RADIO AND TELEVISION MAINTENANCE, published monthly at Somerville, New Jersey, for September, 1951.

1. The names and addresses of the publisher, editor and managing editor are: publisher, Paul Roberts, Gramercy Court Apts., Atlantic City, N. J.; editor, Maurice de Angeli, Toms River, N. J.; managing editor, Robert Letwin, 305-A N. Wilson Ave., Margate City, N. J.

2. The owner is International Publishing Corporation. Stockholders owning or holding one percent or more of total amount of stock in that corporation are: Paul Roberts, Gramercy Court Apts., Atlantic City, N. J.; Nancy Roberts, Gramercy Court Apts., Atlantic City, N. J.; Mary Lamaine, 429 N. New Hampshire Ave., Atlantic City, N. J.

3. The known bondholders, mortgagees, and other security holders owning or holding one percent or more of total amount of bonds, mortgages, or other securities are: none.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

PAUL ROBERTS
(Signature of publisher)

Sworn to and subscribed before me this 14th day of September, 1951.

(Seal) JENNIE M. CLEFFEY
Notary Public of New Jersey

(My commission expires Aug. 9, 1956.)

## RADIOACTIVE MATERIALS AND FM REPORT MOUNTAIN TOP SNOW DEPTHS

→ from page 16

In the radio units, individual sections such as oscillators, frequency dividers, transmitter and receiver stages, and time switches, are individually removable for easy servicing in the field. This is the same principle of design as in "handie-talkie" portable radiophones.

From the data gathered and transmitted by this equipment, preparations can be made to store a portion of the water as it comes down from the mountains. Commitments to both hydro-electric power and irrigation water supplies can thus be made with full knowledge of what the supply will be.

—RTM—

## EDITOR'S MAILBAG

→ from page 7

rate of 2 years for $3.00 to old subscribers up to Aug. 31; yesterday Aug. 31st, and as I got home late last night, I didn't read over the copy until today (Sept. 1st).

Howinhell can I take advantage of an offer like that if I get the dope too late to take advantage of it?

I sure would like to subscribe at that nice attractive rate of $3.00 for 2 years. Wonder if you would still accept my application under those terms? Considering how late you sent the July issue containing the offer, I wish you would strain a point for one day and admit me for 2 years at $3.00.

If you agree, I enclose a check for $3.00 for those 2 years. If you don't, just send me the check back and no hard feelings.

I am enclosing 3 cent stamp for postage in reply.

Sure hope you will stretch a point to include me. I had twin boys in May and a bit short in cash, but could not pass up this offer.

Warren C. Lathe, Sr.
Springfield, Va.

(Ed. Note: *Sorry the issue was late. The change in format caused delays in printing production and mailing. We're trying to catch up the lost time and extended the deadline for the old rate to give*

*you and the rest of the readers an opportunity to take advantage of the bargain. Congratulations on the twins!)*

—RTM—

### Keep the Changes

Dear Editor:

Beginning to like the magazine. Keep the changes you've started and don't forget us newly started technicians who can profit by articles on every-day servicing.

P. S. Hang on to Frye. He's good.

T. F. Nolan
Clinton, Indiana

(Ed. Note: *Thanks. We try to remember the needs of each subscriber and are always open to suggestions from readers on what they like best. We think Frye's good, too!)*

—RTM—

### Congratulations

Dear Editor:

We would like to take this opportunity to congratulate you on the new format as well as your future plans for betterment.

D. G. Stanley
Television, Inc.
Sarasota, Florida

—RTM—

### Won't Cut Cover

Dear Editor:

I do not like to cut the coupon from the back of your magazine. So kindly use this to extend our subscription for 2 more years. I don't know when our present subscription runs out.

The new smaller size seems to be a very good idea.

Donald G. Roberts
Syracuse, N. Y.

*Ed. Note: We could have filled this entire issue with nothing but letters from subscribers telling us how they liked the new format. We regret that we had to limit the number of letters reproduced in order to provide the necessary space for the large number of features we planned.*

Dear Editor:

I want to extend my subscription for 2 (two) more years. Didn't want to ruin the magazine (July issue) by cutting coupon off the back. Enclosed you will find $3.00 cash.

Robert C. Jones
Anderson, Indiana

—RTM—

### Old Reader Likes Change

Dear Editor:

We like the new type of RTM, both in size and information over the old book. We have been on the mailing list since RADIO MAINTENANCE first started.

Clive W. Keemer
Asheville, N. C.

—RTM—

### More Bouquets

I am in favor of new smaller size.

A. V. Rouse
Tonawanda, N. Y.

I want to congratulate you on this size of periodical—exceptionally neat and handy style and compact, too.

Joseph A. Lee
San Francisco, Calif.

Just received your new July issue; very, very nice improvement, easy to carry, too.

William McEwen
Los Angeles, Calif.

—RTM—

### Soaked on Way to India

Dear Editor:

A complaint I have to make is about the way you post the magazine. I received the Jan. '51 copy in an envelope

and in good order. Rest of issues are sent open, so I receive them in very rotten and second-hand condition. Not only do I receive them torn, but sometimes also soaked with rain. I prize this magazine greatly and you will realize how disappointed I am when I receive the issues in a hopeless condition.

Can't you do anything to help me in this matter?

R. M. Jhavery
Jamnagar, India

(Ed. Note: *Since July, RTM is being wrapped for mailing. Thank you for letting us know how to better serve you. We trust the postmen between here and India get umbrellas or at least keep RTM in the middle of the mail sack where it will keep dry.)*

—RTM—

### Hasn't Found Us Wrong

Dear Editor:

Just received the new issue of RTM for July and sure do like it. I am enclosing 3 one-dollar bills for my extension.

I enjoy reading your publication more than all the rest, and I get more help from them. I keep all of your copies and refer back to them a lot and have never found you wrong.

Thank you in advance for your 100 pages. Will be looking for it.

James H. Cooley
Washington, D. C.

(Ed. Note: *Thank you for your kind words. We certainly try to be right.)*

—RTM—

### Bats and Bouquets

Dear Editor:

Enclosed please find my check and application for a year's subscription.

I like your magazine very much as it is just the type that I enjoy especially in the new smaller size.

Please, what can be done about having them delivered more promptly? That's the only thing that I don't like about your magazine.

Aside from this keep up the good work. John Nelson

W. New Brighton, L. I., N. Y.

(Ed. Note: *We don't like the late mailing either. Bear with us during the transition. The printer is doing his best.)*

—RTM—

### Likes Paper, Too

Dear Editor:

I like the new size RTM very much and am proud to state that I have received every issue of RTM since it began

seven years ago. It was sent to me in India, during the war, from my home in Cuyahoga Falls, Ohio.

I like the quality of paper you are using in the smaller RTM.

RICHARD F. BROCK,
Akron, Ohio.

—RTM—

## WHAT YOU CAN EXPECT AFTER THE FREEZE

→ from page 20

tual level of the entire country. Propagandists see TV as the most effective instrument ever devised for influencing the lives and opinions of the masses.

Television may be many things to many people in addition to being the most dazzling development of present day electronic science. But when some historian of science, a few centuries from now, weighs the various developments in the light of their contributions to the advancement of human society, television may have had the greatest impact, but industrial electronics may far outshadow TV in its effect upon standard of living and way of life.

I would like to read you two brief quotations. The first is from an article by Harold G. Moulton, president of the Brookings Institute. He said, "without continuing and progressive increases in productive efficiency we cannot hope to realize our basic national objectives—military security, relatively stable prices, greater social security and higher standards of living."

The second quotation is from an article on Economic Affairs written by Lawrence Fertig for the "New York World Telegram and Sun." "First of all," he says, "it is important to note what is the cause of mounting production for each man-hour of work. Basically, of course, it is more high-speed tools of production—the man with the bulldozer produces more than the man with the shovel. During the past 50 years investment in tools per worker increased from about $2,000 to approximately $12,000, and as a result, real wages have increased more than threefold. But more machines and increased horsepower are only part of the story. Important also are new technical developments, greater skill in management and more efficient plant operation. Then, too, there is the great increase in working capital which permits corporations to carry the large inventories necessary for efficient production and the free flow of material in finished goods."

### Increase Productive Efficiency

What have these quotations to do with television? Little perhaps with television but a great deal with electronics. I fully believe that if we are to advance not only our standard of living, but the general level of our civilization, we must maintain continuing and progressive increases in productive efficiency.

This is not a one-man job, nor is success dependent upon any one factor. Certainly many things can be done to increase our national productivity, and neither more efficient management, nor better labor management relations are at the bottom of the list. But the most important is the continual strengthening of the arm of the worker by creating machines that place more and more horsepower at his command, that perform the repetitive tasks of manufacturing assembling and inspection. This electronics can do through the magic of its ability to perform amazingly coordi-

nated feats of control, analysis and memory.

There is no freeze on human ability, even though there does seem, at times and in certain circles, a freeze on our willingness to apply that ability intelligently. Frozen human resources can be thawed by applying the warmth of understanding, and of intelligence to the problems we face in our daily lives.

It is not my intention to end a talk on television with a sermon on human behavior. But I will say that unless we can match the advances we are making in electronics with an equal advance in the human sciences, we are not making real progress. Contributions to better living, health and comfort can be stolen away through human greed, moral laxity and intolerance. Against these thieves of the fruits of human endeavor, we must wage an unceasing battle whether it be at home, in business, in government or in the international affairs.

# SWAP BOX

DO YOU have some equipment or parts around your shop you would like to trade for something more useful to you? Do you need something special that some other technician might want to trade or sell?

RTM is planning a new column entitled "Swap Box." Any subscriber may submit an item to this section without charge. Items will be accepted under these three categories: WANTED, FOR SALE, SWAP.

The rules to follow in submitting an item are these:

1. Type or print your item in 35 words or less, including your name and address.

2. Only bona fide subscribers may make use of this free service.

The Editors reserve the right to reject any item which they feel is intended as a free advertisement for selling equipment or parts in quantity. The Editors further reserve the right to edit all items to conform to established standards.

No liability nor responsibility is assumed by the Editors for any sale or barter made through the Swap Box columns. All transactions must be made directly between interested parties and in no case will Editors become a party to any transaction except to publish the initial item.

All items for Swap Box will be published in the order received and as space permits.

Send your WANTED, FOR SALE or SWAP item to: **Swap Box, Radio and Television Maintenance, Box 867, Atlantic City, N. J.**

# You're Really Different

FROM a strictly publishing point-of-view, radio technicians could be considered an unusual group. Of course, to the publisher of RTM they are certainly not; we've been serving them for many years now. But, to an outside publisher, servicemen are definitely different.

Statistically, an outside publisher would marvel at the data we have on how technicians renew their subscriptions. Did you know that nine out of ten of you technicians ask for two-year renewals upon the expiration of your subscriptions? That's slightly short of amazing in the publishing field.

### Long-Distance Calls

How many publishers receive long-distance phone calls telling the circulation department to renew subscriptions or advise of a new address to make sure there is no extra delay in receiving the magazine? We don't know the answer to that, but we do know we receive such calls from places more than 100 miles from our office.

How do we interpret the actions of our subscribers? Very simply. The radio and television technician must keep abreast of new developments, he must know the latest techniques in order to do a good job. Therefore, it is quite obvious that he should be enthusiastic about receiving a publication that satisfies his needs.

### Enjoyable Reading

One reaction we seem to get from subscribers is that they not only get worthwhile information for their business operation from RTM, but that they really enjoy reading the magazine. We're as pleased as punch about this fact. Technical material can get mighty dry and when we can present this material in a form that is thoroughly enjoyed, we feel a warm glow of satisfaction.

The outside publishers might think the technician a strange kind of subscriber, but we think he's tops. No other subscribers in the world respond to honest effort like the technician.

# Can You Read 24 Hours a Day-7 Days a Week?

RADIO AND TELEVISION MAINTENANCE is published once a month; however, before each issue goes to press, millions of words have been scanned by our writers and editors.

**It would be impossible for you to read all the material that comes across the desks of our writers and editors even if you continually read 24 hours a day, every day in the week. Yet, out of the mass of technical papers, reports, manuscripts, photos, charts and drawings, they select the subjects and items they consider the most pertinent to you and your business.**

When you read RTM you are getting carefully selected articles, features and news items that are written by technical experts and edited by a staff of trained editors. You are reading the facts of most importance to YOU in the field of radio, video and audio each month.

Be sure you get RTM every month. Be sure you are up on all that is new in the industry. If you are not a regular subscriber, **write today!** Mail the form below to start RTM on its way to you each month. Remember, even if you read 24 hours a day, 7 days a week, you still couldn't match the reading of the staff that covers the field for **you** in RTM.

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