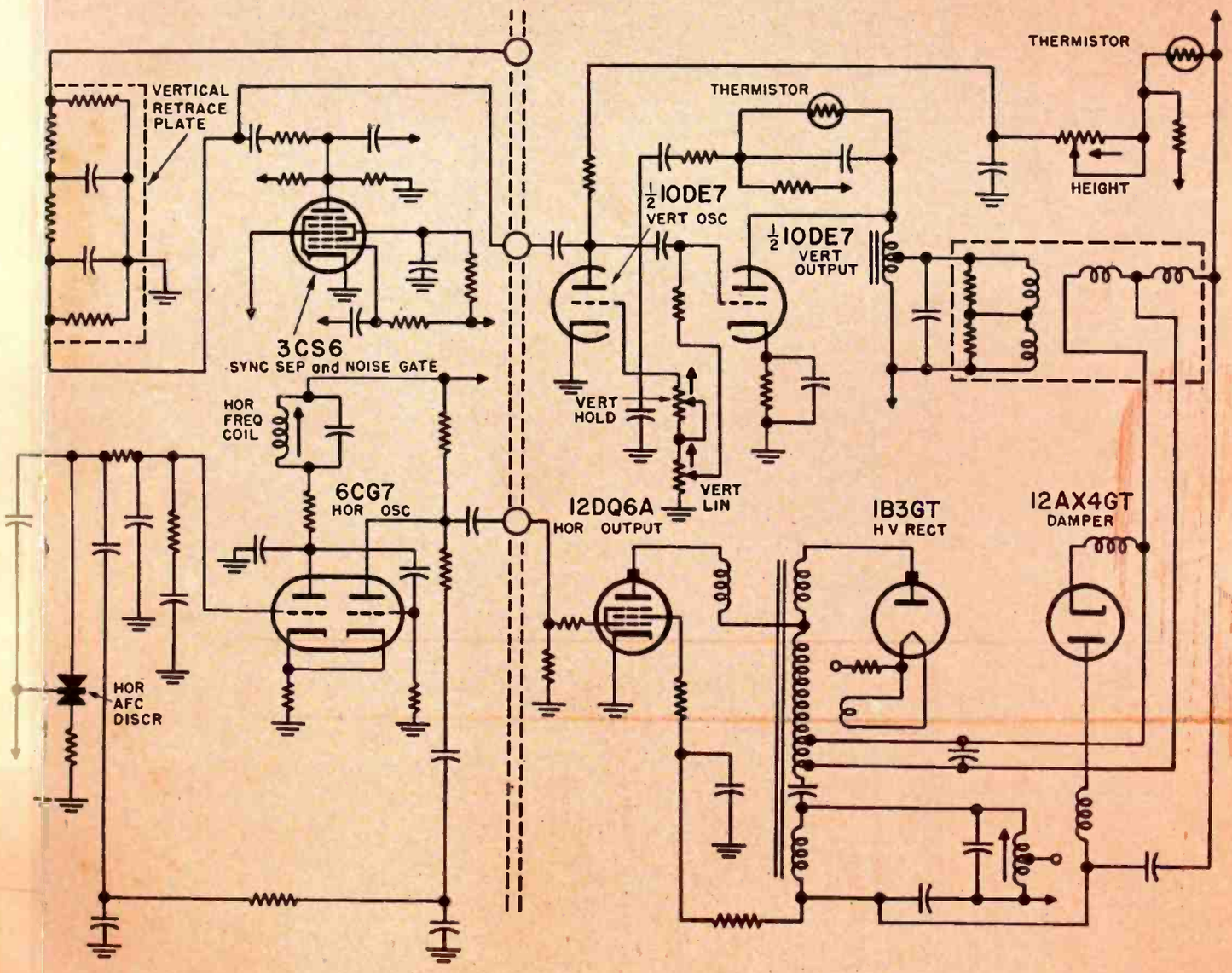
JULY, 1957

RADIO
TELEVISION
ELECTRONIC

SERVICE

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE



Cathode-coupled horizontal multivibrator and dul-triode vertical-deflection circuitry of 21inch TV chassis using 110° picture tube.

See circuit analysis, this issue

Men who know

depend on

RADIART VIBRATORS

...the COMPLETE replacement line

Radiart vibrators are the Standard of Comparison for quality, performance and dependability in the industry! Men who know . . . management, jobbers . . . . and servicemen . . . ALL agree that experience over the years has dictated that RADIART vibrators are the ones to buy and use.

AND . . . the complete line of COMMUNICATION vibrators offers the correct replacement for 6 volt and 12 volt applications.

Be sure you have the new vibrator replacement guide... write for your FREE copy...

THE **RADIART** CORP.
CLEVELAND 13, OHIO
A Subsidiary of Cornell-Dubilier

Vol. 26 No. 7 JULY, 1957

26th YEAR OF CONTINUOUS PUBLICATION

SERVICE

THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE
Including RADIO MERCHANDISING and TELEVISION MERCHANDISING
Registered U. S. Patent Office

COVER CIRCUIT

FEATURES

CIRCUIT DIAGRAMS

DEPARTMENTS

Second-Class mail privileges authorized at New York, N. Y.; additional entry at the Post Office, Norwalk, Conn. . . . Subscription price: $2.00 per year ($5.00 for 3 years) in the U.S.A. and Canada; 25 cents per copy. $3.00 per year in foreign countries; 35 cents per copy.

EDITOR and PUBLICATION DIRECTOR

Lewis Winner

Associate Editor: **David E. Pearsall II**

Assistant Editor: **Robert D. Wengenroth**

Editorial Assistant: **Arnold Gewirtz**

Editorial Assistant: **Howard Jennings**

Art Director: **Anthony R. Aliffi**

Supervisor, Circuit Diagrams: **Michael D. Bellezza**

Editorial Production: **Astrid Kelly**

CIRCULATION DEPARTMENT

Circulation Manager: **A. Goebel**

Ass't Circulation Mgr.: **A. Kiernan**

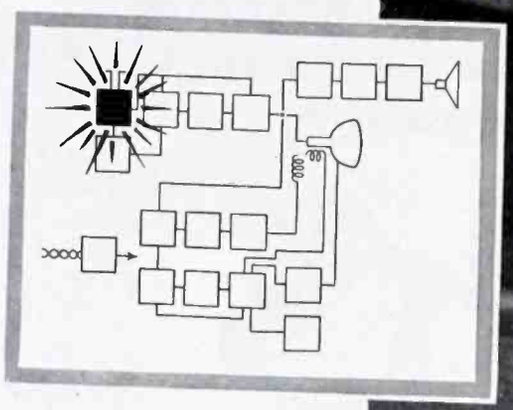
ADVERTISING DEPARTMENT

Advertising Mgr.: **Aaron L. Lafer**

Pacific Coast: **Leo Sands**, Dist. Mgr.
535 Ramona St.
Palo Alto, Calif.:
Tel.: DAvenport 5-3716

Published Monthly by
Bryan Davis Publishing Company, Inc.
52 Vanderbilt Ave., New York 17, N. Y.
Tel.: MUrray Hill 4-0170

B. S. Davis, Pres. Lewis Winner, Vice-Pres.



Using a special v-h-f tuner, a General Electric applications engineer double-checks a G-E r-f-amplifier tube for low noise level . . . meaning sharp, virtually snow-free TV pictures, even in weak signal areas. ▶

Extremely low noise level accents quality performance of General Electric r-f-amplifier tubes!

ALL G-E r-f-amplifier tubes have a low noise figure—well below normal—bringing better TV to your service customers. Even in fringe areas where the signal is weak, General Electric tubes pull in clean, sharp pictures, with seldom any trace of snow.

Improved design . . . advanced processing techniques . . . extensive tests . . . all contribute to maintaining low noise level. Also, sturdy General Electric tube construction plus precision manufacture keep down microphonics, with tests under severe operating conditions added to make sure that performance holds to the highest possible standards.

Customer satisfaction is further increased by long r-f-amplifier tube life. To this end, tests of 6BN4's, 6BQ7-A's, 6BS8's, and other G-E types are performed at max plate dissipation in circuits most conducive to grid emission, in order to establish that grid emission and gas current are negligible. Also, heater-cathode shorts have been sharply reduced throughout the r-f-amplifier group, further prolonging tube life.

For pleased service customers, and the greater business this can bring, always install General Electric high-quality tubes! Your G-E tube distributor can fill every need, gives prompt delivery. Phone him today! *Distributor Sales, Electronic Components Division, General Electric Company, Schenectady 5, New York.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

161-1A7

Mr. Independent Service Dealer...

IF YOU'RE FEELING THE SQUEEZE *of*

Rising Costs • National Service Company Competition • Lack of Manpower

Better look into the RAYTHEON

BONDED ELECTRONIC TECHNICIAN PROGRAM

Today, more than ever before, qualifying as a Raytheon Bonded Electronic Technician will help you in many ways:

First, your service work is backed by a Bond issued through one of America's largest insurance companies. This bond means you can charge and get a proper price for your work because the bond creates customer confidence in your shop.

Second, you get the services of Western Union "Operator 25," who, in answer to requests, is sending customers to Raytheon Bonded Dealers from coast to coast.

Third, you get the backing of national advertising which sells your *bonded* service as the customers' best buy!

Fourth, you become a member of a national group of service dealers who can feature the national symbol of superior TV-radio service . . . the Raytheon Bonded Decal. *Yet you retain your own independence.*

Fifth, you'll find technicians prefer to work for Raytheon Bonded Dealer organizations because these companies have earned the respect of their customers.

Your Raytheon Sponsoring Bonded Tube Distributor will be glad to explain the program to you.

TV-Radio service is *your* business . . . serving *you* is ours

RAYTHEON MANUFACTURING COMPANY

Receiving and Cathode Ray Tube Operations

Newton, Mass. • Chicago, Ill. • Atlanta, Ga. • Las Angeles, Calif.

Raytheon makes all these { Receiving and Picture Tubes, Reliable Subminiature and Miniature Tubes, Semiconductor Diodes and Transistors, Nucleonic Tubes, Microwave Tubes

RAYTHEON ®

Excellence in Electronics

THIS MONTH IN SERVICE

NATIONWIDE TV-RECEPTION STUDY UNDER WAY--TV set owners across the country are now participating in one of the most unusual reception investigations ever undertaken, to determine veryhigh- and ultrahigh-signal conditions in all types of areas. The project, under the direction of members of the field test panel of the Television Allocation Study Organization (TASO), and manned by transmitting and receiving experts from television broadcasting stations and consulting-engineering firms, involves visits to homes to inspect antennas, observe receiver operation and make inquiries regarding set performance and service requirements. . . . Study specialists are detailing the information on questionnaires which will be carefully analyzed and subsequently reviewed in a special report for the FCC. Questions reveal the date and time of visit and the prevailing weather; exact location of household (identified on a field map of area); type of site (urban, rolling country, hill top, etc.); type and height of antenna system (uhf or vhf) and transmission lines used; age of the antenna system; direction of the antenna; mounts used for antenna and method used for rotation (if any); type and size of receiver; type of tuner and converter (if any) used; age of receiver and converter; date of last servicing job, and relative picture quality. . . . To maintain complete impartiality in the tests, only the set owners are being asked to turn on their receivers and tune in each of the local stations, while technical observers make notes. These observers do not touch the receiver nor any part of the television installation. . . . All observers are carrying TASO identification cards. . . . This special study of television performance, which will last several months, has for its object the ultimate establishment of more TV broadcasting stations and the improvement of reception throughout the country. Through the cooperation of TV broadcasters, equipment manufacturers, Service Men, distributors and the public, TASO expects to achieve this objective.

ALL-SEMICONDUCTOR (TRANSISTOR-DIODE) TV CHASSIS NOW BEING DEVELOPED--Completely transistorized TV receivers, which will include from 17 to 28 transistors and from 8 to 15 diodes, are now being engineered. Specifications released by the research and development section of one manufacturer indicate that from 2 to 4 transistors might be required for the amplifier and local oscillator of the tuner and 1 diode for the mixer; 4 to 5 transistors for the video if amplifier and 1 diode for the detector stage; 1 to 2 transistors for the sound if amplifier and 2 diodes for the detector; 2 to 3 transistors for the audio amplifier; 1 to 3 transistors for the video amplifier and 1 diode for dc restoration; 2 to 4 transistors for sync and agc, and 2 diodes in the clamping circuits; 2 to 3 transistors for vertical deflection and 1 diode as a pulse clipper; 3 to 4 transistors in the horizontal deflection and high-voltage stages, and 4 or 5 diodes for the phase control, damper, clamping and high-voltage rectifier circuits; and 1 or 2 diodes as rectifiers.

FM ACTIVITY INCREASING--There are more FM stations on the air today than a year ago, and during the next six months the total number of stations is expected to rise to 600, the highest in several years. . . . In Los Angeles and New York, according to the FCC records, there are more applicants for FM channels than there are channels available. Five have asked for three channels in Los Angeles and five have also asked for two in New York. At present, New York has 18 FM stations allocated, and 16 are taken, while Los Angeles has 20 channels, with 17 on the air. There are only five vacancies in Chicago, which has 18 channels and 13 operating stations.

COLORCASTS PLANNED FOR WORLD SERIES GAMES THIS FALL--Improved color cameras, the development of higher gain and better signal-to-noise ratio amplifiers for lenses, plus new pickup techniques, have prompted NBC to announce that this fall they plan to transmit in color, at least two world-series games from an American League ball park, using the facilities of a special mobile colorcasting unit. And if the National League ball park is close enough to the American League park, so that the color van can be set up quickly and efficiently, additional series games may be telecast in color.

Fixed-Frequency Low-Band

Circuitry Report On A 30-50 Mc Model Designed

MOBILE PAGING by way of FM receivers is an important factor in 2-way operation. Today, paging networks are used extensively in conjunction with two-way mobile services in the 30 to 50-mc band, such as police, ambulance, fire, utilities, petroleum, trucking, towing and forestry.

For this purpose crystal-controlled, fixed-frequency receivers which operate on either 6 or 12 *v* are available. One model,[1] recently developed, can be operated directly from the regular auto radio antenna without affecting the operation of the auto radio. A squelch circuit, adjustable from the front panel, is included for quieting of the receiver between calls.

The *if* transformers are high-Q types designed to give optimum selectivity without sacrificing image rejection.

Standby Switch Operation

A standby switch not only turns off the vibrator supply by disconnecting the 6 or 12 *v* going to the vibrator transformer, but it also serves to disconnect the antenna from the input of the receiver and connects it back to the extra socket on the rear apron of the receiver. By connecting an external coax jumper cable from this extra socket (nearest the side of the receiver on the rear apron) to the antenna input socket on the auto radio and connecting the auto radio antenna to the inside socket on the rear apron of the *car-call* receiver, both receivers can be operated from the auto-radio antenna.

When the *car-call* receiver standby switch is *on*, the auto radio will be dead and the *car-call* receiver will operate. When the switch is on *standby*, the *car-call* receiver is dead and the auto radio plays normally.

A reversible vibrator is used so that the receiver can be operated on either 6 or 12 *v*. The filaments are changed from 6 to 12-*v* operation by throwing a switch on the chassis (behind the speaker) to the proper position. The vibrator supply is connected for the proper voltage by reversing the vibrator in its socket, so that the arrow on the power transformer points to the correct voltage on the top of the vibrator.

A printed circuit[2] is employed in the audio portion. A 220-mmfd capacitor in this printed circuit, which is normally used as an *rf* bypass between the detector transformer and ground, is used instead from the grid of a 6AQ5 to ground to provide additional high-frequency cutoff. If this printed circuit is replaced it must be reconnected in the same manner. If the 220-mmfd capacitor is used as originally intended to bypass *rf* at the detector, the stray internal capacity of the printed circuit will be found to tend to impair the proper action of the noise-limiter circuit.

The ratio-detector circuit is somewhat unorthodox in that the output of the 6AL5 is not directly grounded, but is returned to a variable positive potential obtained from a potentiometer in the cathode circuit of the 12AX7 audio tube. This potentiometer varies the *dc* voltage appearing on the grid (pin 2) of the 12AX7 squelch tube. The incoming signal normally developes negative *dc* voltage across the 2-mfd capacitor connected across the 6AL5 diodes. This voltage, when applied to the grid (pin 2) of the 12AX7, biases the tube to cutoff and allows the audio half of the 12AX7 to operate normally. When the squelch control is moved away from the ground end (counter-clockwise), the positive voltage derived reduces the negative voltage on the grid (pin 2) of the 12AX7, causing it to conduct. A 4.7-megohm grid resistor on the audio half of the 12AX7 then acts as a plate resistor for the other half of the tube. The resultant voltage drop across this resistor biases the audio section to cutoff and quiets the receiver. The cathode and grid return of the audio section of this tube are operated at a fixed positive voltage of 70, obtained through a 220,000-ohm resistor to B+. The cathode of the squelch section obtains its 5 *v* of fixed positive bias from the cathode of the 6AQ5 through a pair of 15,000-ohm dropping resistors. This provides a very simple one-tube squelch circuit which it has been found will operate with an incoming signal as weak as .5 microvolt, if desired.

The *car-call* receiver can be used with a standard auto-radio antenna (extended as far as possible) without appreciably affecting the operation of the automobile radio. However, for maximum sensitivity and best operation at a distance from the transmitter, a quarter-wave antenna should be installed on the vehicle. The length of this whip antenna, figured from tip to metal mounting bracket, can be obtained from the following formula: Length (inches) = 2775/frequency (mc). To illustrate: 2775/35.58 mc= 78". The antenna should be insulated from the car body. A 53-ohm coax cable, such as RG-58/U, should be used to connect the antenna to the receiver.

For maximum sensitivity, the squelch control should be turned just far enough counter-clockwise to quiet the receiver when no signal is present. Turning the control too far counter-clockwise will not permit the squelch to open on weak signals.

Tuning Adjustments

A quality signal generator should be connected to the receiver's antenna socket (which is near the center of the receiver) and adjusted to zero beat with the transmitter frequency. The output of the signal generator should be set to approximately 10 microvolts without modulation. The squelch control should be open all the way (clockwise).

The *dc* probe of a *vtvm* should then be connected to pin 7 of the

---

[1] *Seeley Electronics FM Car-Call model F receiver.*

[2] *Centralab PC150.*

Mobile FM Receiver

For Radio Paging

by WARREN M. SEELEY

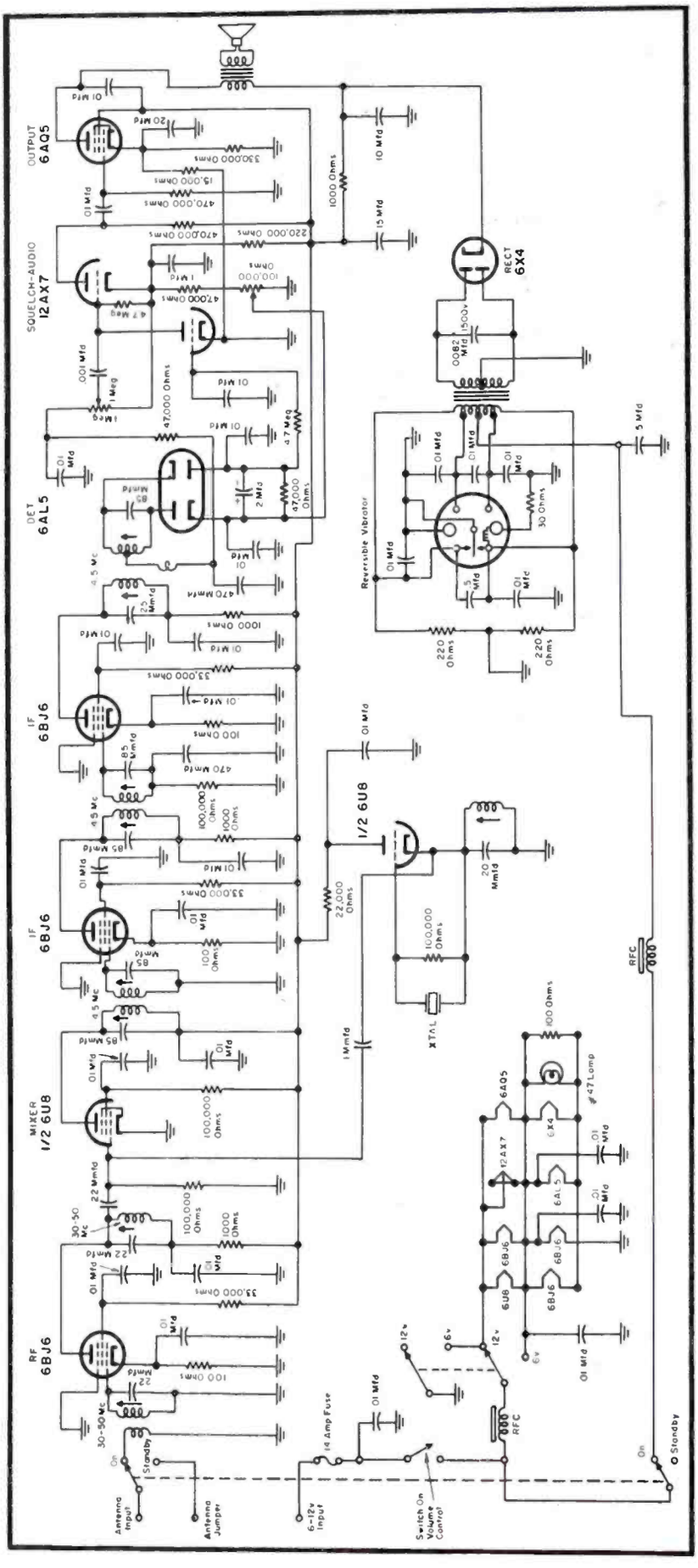
6AL5 tube socket and the top and bottom screws on each of the two 4.5-mc *if* transformer cans nearest the power transformer adjusted for maximum negative voltage on the meter. The bottom screw on the 4.5-mc ratio detector transformer can (nearest the 12AX7) should then be adjusted for maximum voltage. To align the secondary of the ratio detector, a carefully matched pair of 100,000-ohm resistors should be conected in series and across pins 5 and 7 of the 6AL5 socket (across the 47,000-ohm resistor). The *vtvm* should be connected from the center of these two resistors to the tie point nearest the ratio-detector transformer. The top screw on the ratio-detector transformer should then be adjusted for zero voltage on the meter, with the signal input increased to about 10,000 microvolts.

In the absence of a signal generator, the tuning adjustments may be made during installation of the receiver in the vehicle. One should choose a location where the signal from the transmitter is as weak as possible. The location should be well away from traffic, since moving vehicles tend to reflect radio waves, causing the signal strength to vary. With the receiver turned on and the antenna connected to the socket nearer the center of the receiver, a *vtvm* should be connected to pin 7 of the 6AL5 socket. (A 20,000-ohm-per-volt meter may be used in place of the vacuum-tube voltmeter, if desired.)

Ignition Noise

Ignition noise and other electrical interference (caused by the auto generator, voltage regulator, etc.) will be particularly noticeable at frequencies between 30 and 50 mc. Ordinarily this noise will be suppressed to such an extent that it can hardly be noticed; however, occasionally a stub-

(*Continued on page* 32)



COMPLETE CIRCUIT of the Seeley Electronics FM 30-50 mc mobile receiver, designed for radio paging, which can operate on 6 or 12 v. In the ratio-detector, the 6AL5 is not directly grounded, but returned to a variable positive potential obtained from a potentiometer in the cathode circuit of the 12AX7 audio tube.

21-Inch TV Chassis Using

Complete Analysis of Horizontal and

by DON WINTERS

Service Engineer, Radio and TV Division
Sylvania Electric Products, Inc.

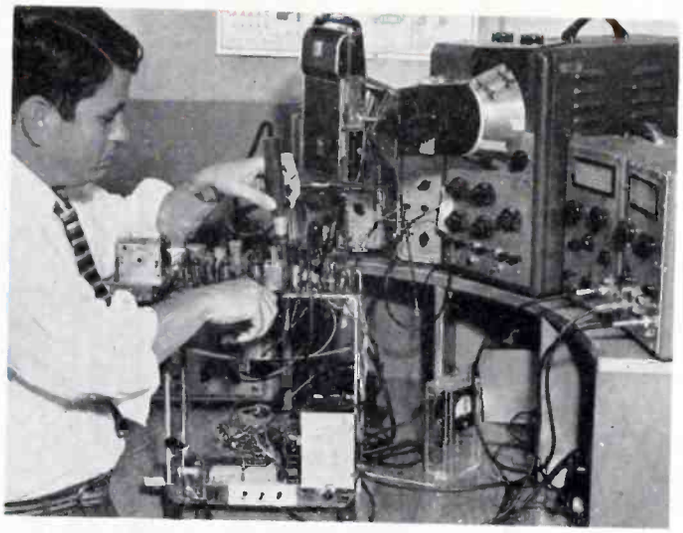


FIG. 1: DON WINTERS setting up 110° chassis for waveform photos. A shelfless console is used to house the new model; the chassis is mounted on a metal rail that extends across back of receiver.

IN VERY EARLY DAYS of TV there were three, five and seven-inch receivers, all of which were static-deflection units. The pictures were small, although sometimes quite good, but the intensity, focus, quality and general definition were not comparable to what is available in current chassis. The small static-deflection tubes employed were acceptable when used with accelerating potentials of less than 10,000 volts. To increase the size of the picture it was found necessary to increase the high voltage to get good brilliance. However, as mathematical computation will show, as the high voltage on any type picture tube is increased, scanning becomes a much more difficult problem. The largest static-deflection picture tube that was put to any practical use was a nine-inch size introduced over ten years ago. To develop brilliance in this tube, a rather high second-anode voltage was necessary. This meant using push-pull output stages to generate sufficient power for scanning the tube, both horizontally and vertically. These high-potential problems also caused many of the coupling capacitors to break down in the deflection system. In other words, circuit design of the early static-deflection tubes was good as long as the size of the tube did not get much above seven inches.

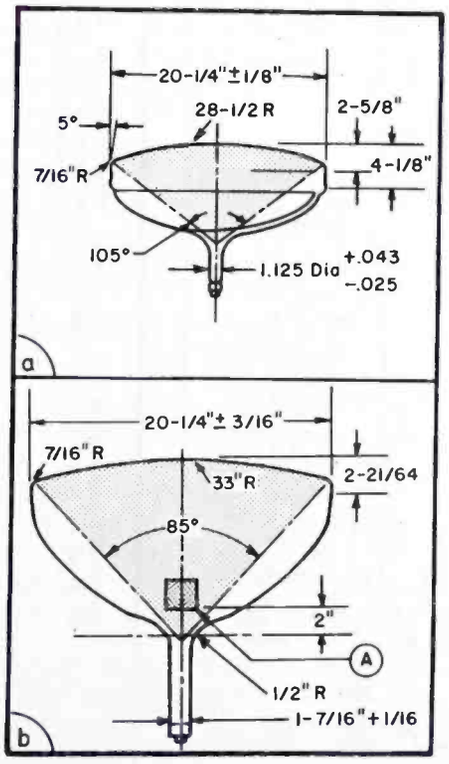


FIG. 2: COMPARISON of 21ATP4 (90°) picture tube and the new 21CQP4 (110°) model.

Public demand required a larger tube to be developed. With the advent of larger tubes, circuit requirements became so difficult that a different method of deflection was required. Magnetic deflection was the only answer and the early ten and twelve-inch tubes were developed. The horizontal-deflection angle of these early tubes was approximately 50°. Even then, due to poor circuit design, the non-availability of good deflection transformers, and the poor sensitivity of deflection yokes, terrific power requirements were necessary to give ample deflection. In addition, the high voltage was developed separately, not in the conventional circuit as we know it today.

As time went by, circuit refinements were developed, resulting in improvements in scan transformer and yoke efficiencies. Eventually the early 50° deflection tubes were being scanned quite efficiently with a single 6BG6. The new design of the flyback circuit enabled the development of high voltage from the same scanning tube. As more and more time was spent in the development of new circuits and new scanning techniques, the deflection angle was changed to 65°. This proved to be an advantage to the dealers, as well as the manufacturers, the shorter deflection angle allowing the receiver to be built in a more compact cabinet. It was found, as far as circuit design was concerned, that changing the deflection angle from 50° to 65° made no appreciable difference in the amount of drive necessary to give proper scanning.

About this time, with the development of the 21 and 24-inch receivers, it was evident that a receiver using 65° deflection in a 24-inch tube would be too deep. This meant that the receivers had again become too large physically, necessitating an increase in the scanning angle, to make a more compact unit. It was decided to settle around the 90° horizontal deflection angle, but this large angle began to develop additional problems.

Something had to be done to enable the receiver to give a better focus picture across the entire face. At this time, it was thought that a correcting focus voltage might even be used to correct the focus as the beam was scanned. However, engineers were not satisfied with this method, and instead, turned toward

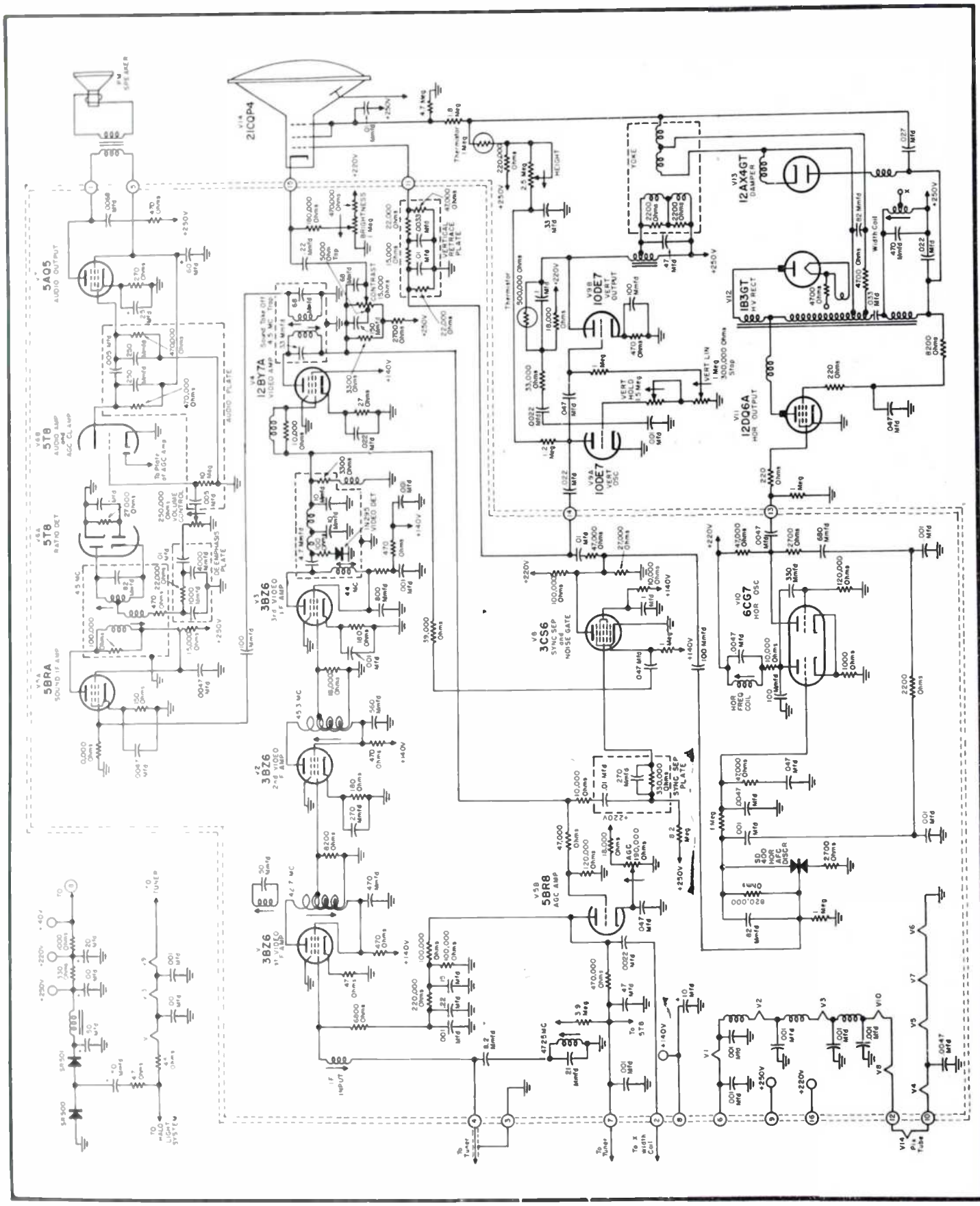
(*Continued on page 12*)

RIGHT: Circuit of Sylvania S110 chassis with 110° picture tube.

110° Picture Tube

[See Front Cover]

Vertical Deflection Circuits Used In Latest Wide-Angle TV Model



21-Inch Wide-Angle TV Chassis

(*Continued from page* 10)

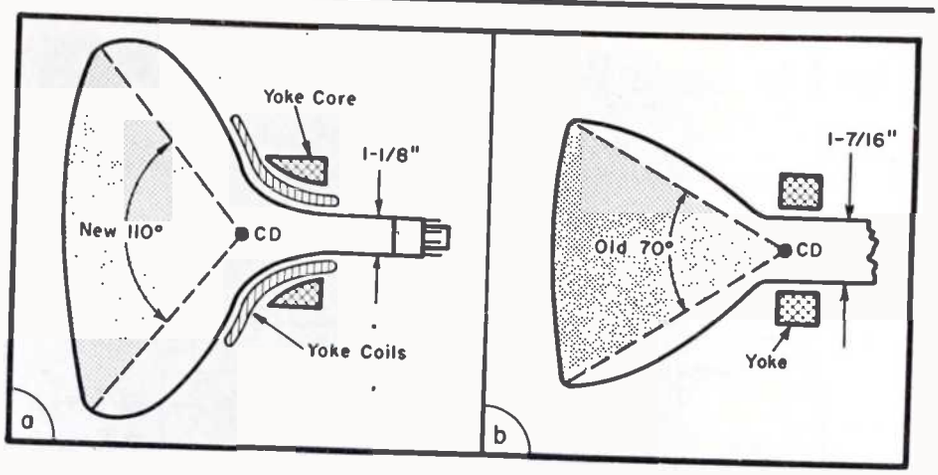
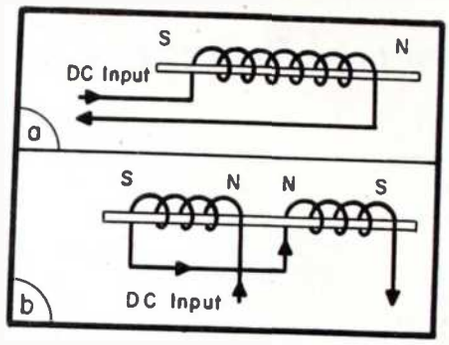


FIG. 3 (left, below): CROSS-SECTIONAL drawings of 110° and 70° tubes and their yokes. Note how 110° deflection yoke fits up on bell moving the center of deflection forward into the tube.



(Above)

FIG. 4: FLUX-CANCELLATION principle is illustrated in this schematic.

a new type of scanning yoke called *cosine*. Even today most engineers are not exactly sure what is happening in this yoke to give the perfect focus in the standard 90° picture tubes. Suffice to say that it develops a deflection field in such a manner that the beam, both horizontally and vertically, will stay in focus and the beam spot size will stay the same across the entire face of the picture tube. With the development of the *cosine* yoke the focus problem was minimized. However, it was found that the 90° tube required additional drive to give proper scanning. Many of the early 24-inch receivers had to use 6CD6's or 6BQ6's in parallel, to get proper scan. Later, as the art advanced, it was again found that, by improving efficiencies in the horizontal-scanning system, a single driver tube could be used.

Several years ago, when the portable TV market began to develop, it was felt that the time had come to make an even more compact receiver. Work was started on a 17-inch 110° picture tube. In conjunction with this, experimental work was also started on a 21-inch 110° picture tube. It was found that these new scanning angles could again cause trouble with focus and scan. New circuits had to be found to overcome these obstacles.

This new tube was very compact; in fact, so compact that due to the possibility of smaller cabinet dimensions there was little room left to mount a chassis. With this in mind a new chassis had to be developed; one composed of two decks.[1] The lower deck across the bottom was designed to contain the tuner, low and high-voltage power supplies and vertical and horizontal scanning. The deck across the top was arranged to contain all other circuits; *if*'s, sound, etc.

A comparison of the standard 21ATP4 picture tube and the 21CQP4 110° picture tube appears in Fig. 2 (p. 10). It will be noted that the diagonal measurement on the face of the picture tube is exactly the same. This shows that there has been no decrease in the amount of square inches on the face of the new 110° picture tube, but the shorter depth of the new picture tube is quite evident from the dimensions shown. The tube itself is aluminized, and is of the non ion-trap type. Therefore, the only component on the neck of the picture tube is the deflection yoke. A centering device is incorporated on the rear of the deflection yoke for simplicity, as far as service is concerned.

A photograph of the rear of a 110° chassis is shown in Fig. 1 on page 10. In previous TV models employing either a vertical or a horizontal chassis, it was common practice to mount the chassis on a shelf located m'd-way between

(*Continued on page* 33)

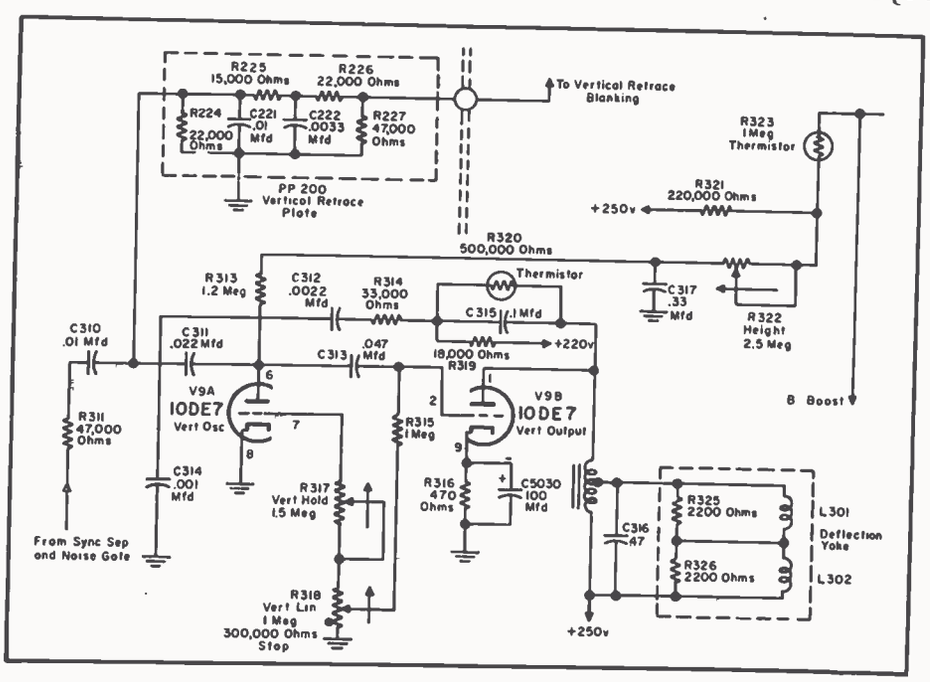


FIG. 6: PARTIAL SCHEMATIC of vertical-scan circuit in 110° chassis.

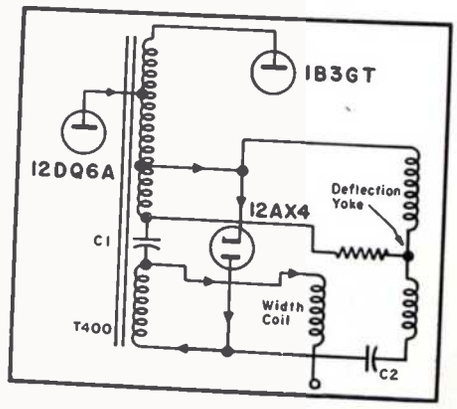


FIG. 5: SIMPLIFIED HORIZONTAL output circuit showing direction of current flow.

(Left)

[1]*Sylvania S110.*

BURTON BROWNE ADVERTISING

Everyone Looks First to LITTELFUSE

Whenever there is a new fuse need for service...

It is *always* Littelfuse that gives you the complete package for your requirements.

Now—the LC fuse caddy for your tube caddy—an assortment of 15 LC fuse types to cover over 94% of all service requirements for this new fuse which is rapidly becoming *the* TV fuse

Part No. 094041

NEW LC FUSE CADDY

Servicing Transistor Radios‡: Signal Tracing . . . Voltage, Resistance and Current Measurements

SIGNAL TRACING or similar methods of signal injection are well adapted to the servicing of transistor radios.

Because of the extremely low signal voltages present at the base input of transistors a high-gain 'scope (with .03-volt-inch vertical deflection) or equivalent should be used for gain measurements. And because of frequent distortion problems which have been encountered, a 'scope is also desirable to observe waveforms.

When using signal tracing in a transistor radio, it should be remembered that all transformers, from the antenna coil to the output transformer, are step-down type and a great reduction in signal voltage can be expected between the collector of one transistor and the base of the following transistor.

Measurement of *dc* terminal voltages is just as important and just as applicable to the servicing of transistor radios as to the servicing of vacuum tube radios. The most important difference is in the magnitude of the voltages to be measured. The maximum terminal voltage which will be encountered in RCA transistor radios is 9 *v*. Bias (*base-emitter*) voltages are in the order of .05 to .2 *v*. The operation of a transistor with .1-*v* bias will be unsatisfactory if .2 *v* is specified. Just as with vacuum-tube radios, meter sensitivity is also quite important. Voltmeters used in servicing transistor radios should have a sensitivity of 20,000-ohms-per-volt or better and a low-range scale which will enable reading of bias voltages to an accuracy of ±.03 *v*.

One very important voltage condition which should be noted is in connection with bias voltages. The term *forward bias* is used in connection with transistor operation. With no potential difference between emitter and base, there will be no current flow in the collector circuit. As the bias is increased, the current increases.

In normal operation there will be a *forward bias* of between .1 and .2 *v* between the base and emitter.

In most circuits both base and collector voltages are negative when referred to a common positive emitter. With some transistors these voltages are positive in reference to a common negative emitter.

In some transistor circuits, the terminal voltages on one transistor may be so dependent on the currents of another transistor that the first transistor will be inoperative if the second were removed.

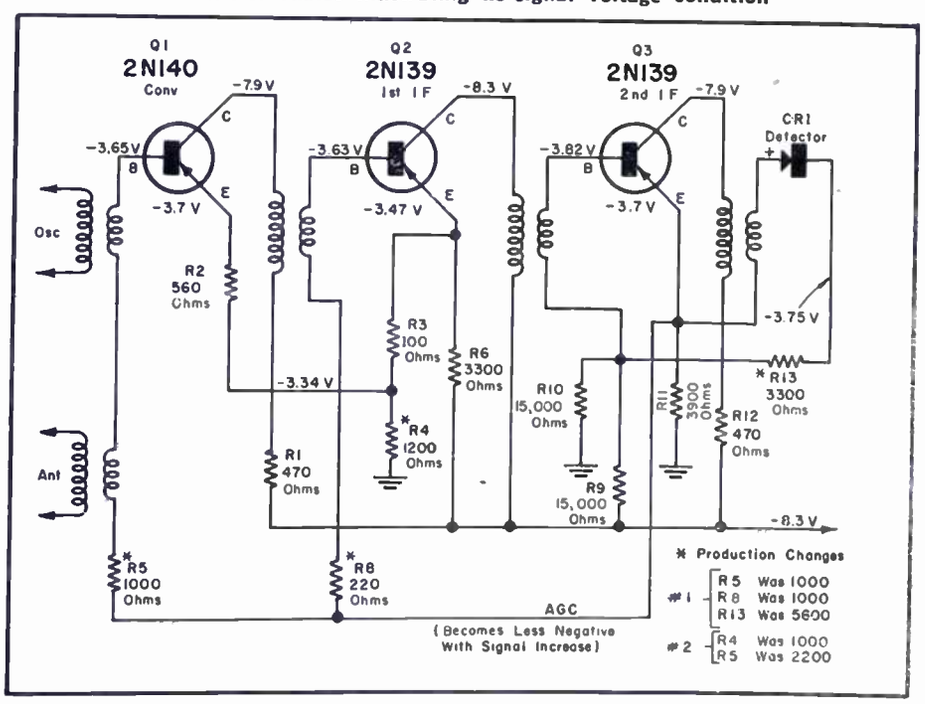
A simplified diagram of the converter-*if* amplifier-detector section of RCA models 8-BT-9 and 9-BT-9 shown in Fig. 1 illustrates the emitter voltage problem. It will be noted that if Q_2 were removed, the Q_1 emitter voltage will be less negative, because of less current through R_4, the 1200-ohm resistor. An emitter voltage which is less negative reduces the bias and reduces collector current; in this circuit it will be reduced to cut-off. In the opposite direction, if Q_1 were removed, the emitter of Q_2 would become less negative and the collector current of Q_2 would increase.

Although servicing by resistance measurement is one of the most common testing methods used with vacuum-tube radios, this method has severe limitations when applied to the testing of circuits which contain transistors.

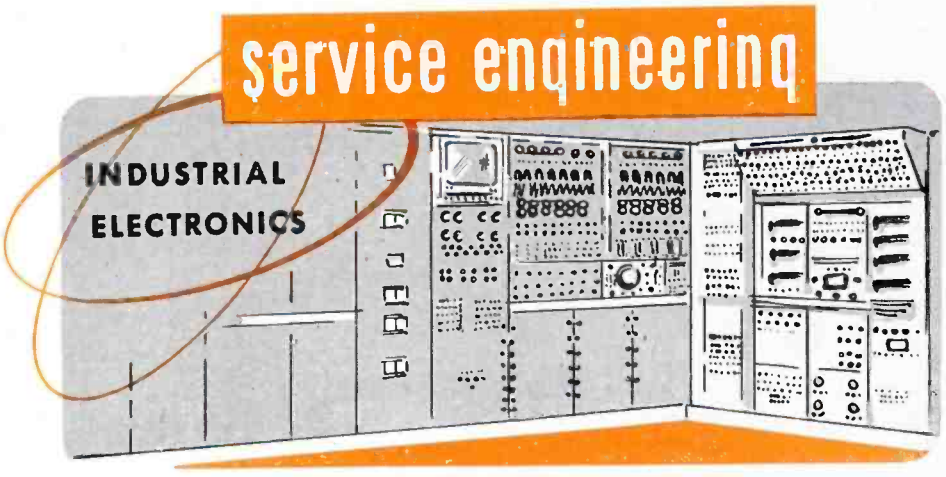
Transistors will conduct on electric current when the terminal voltage is supplied from an ohmmeter, just as readily as when the voltage is supplied from the battery used for normal operation. Because of this transistor conductivity, the resistance

(*Continued on page* 32)

FIG. 1: CONVERTER-IF-DETECTOR STAGE circuitry of RCA 8-BT-9 and 9-BT-9 transistor radios illustrating no-signal voltage condition



‡*Based on information prepared by the commercial service department of RCA Service Co.*



Marine-Mobile Radio Installation-Servicing In San Pedro, California

By locating in San Pedro, the port city of the growing Los Angeles area, which is not only a major industrial center, but a center for year-round pleasure boating, and concentrating on sales and servicing of both marine and mobile radio equipment, Marine Radio Service has developed into one of the largest independent operations of its kind on the Pacific Coast.

The shop and salesroom of Marine Radio Service is on the San Pedro waterfront adjacent to the berthing spaces for the area's multitude of pleasure craft.

The company was formed in May, 1950, by William R. Rocker. Sales and service are under the direction of Jack E. Sanders, who has been with the company for two years.

In addition to hundreds of yachtsmen, the company services electronic gear for the major steamship lines, the U. S. Navy, commercial fishing boats, oil companies, the U. S. Department of Justice and the State of California Fish and Game Commission. Activities include installation and maintenance of electronic equipment on off-shore drilling rigs and for industrial plants in the Los Angeles metropolitan area.

The shop's staff consists of ten, of whom six are full-time Service Men, plus one who works on a part-time basis. Besides servicing, the company sells and installs marine radar, depth finders, and marine and mobile radiotelephones.

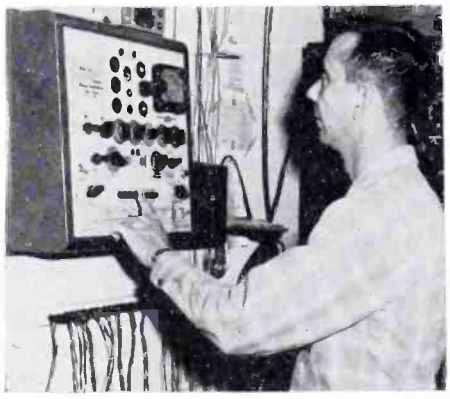
The shop is provided with a complete assortment of test instruments, plus specialized apparatus for accurate checking of transmitter frequencies and spurious transmissions. These special devices are extremely important to meet rigid FCC performance requirements.

Most service calls are charged for on a per-call basis.

In spite of a healthy amount of marine business, mobile two-way radio has accounted for a number of new installations. By selling and installing two-way gear, Marine Radio has developed a continuing service business. And selling two-way requires more than just knowing how to select the right equipment for specific jobs. The prospects must know what radio will do for them, in terms of dollars and cents and performance.

A few years ago, typical boat owners bought simple marine radiotelephones so that they could keep in touch with land. But today, many boats are equipped with better radiotelephones, depth finders, portable electronic megaphones and even radar sets. One boat which Marine Radio Service recently outfitted has over

(*Continued on page 39*)

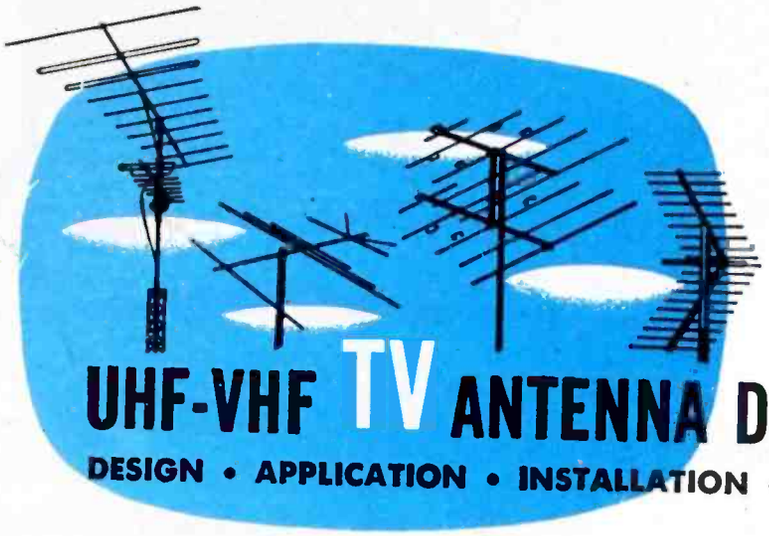


CHECKING TUBES for electrical merit and shorts on a master tester and for grid emission with a grid circuit checker.

ONE OF THE FIELD TRUCKS used by Marine Radio Service for marine and mobile repair and installation.

OPERATING one of the fixed two-way installations recently completed by Marine Radio Service.

Exclusive Report On Results of Field Investigation Of Performance Improvements Available When Old TV Antennas Are Replaced



DURING THE PAST FEW years Service Men have been alerted to the fact that there are millions of ancient rooftop TV antennas which should be replaced. Many Service Men have taken heed and installed new antennas, but a number have questioned the degree of improvement which would be noted if a new outdoor installation were made.

To prove that a new antenna installation can provide solid improvement in all-round performance, one manufacturer[1] recently conducted a fact-finding investigation.

Engineering was told to locate an installation which, on the basis of appearance, had outlived its usefulness, but to the set owner was apparently still satisfactory.

Furthermore, the installation was to employ antennas which could be duplicated with antennas which are still in production. This was particularly important to permit a controlled test of the installation.

Such an installation was found; employed were two cut-for-channel 8 antennas[2] and one[3] cut-to-channel 3.

To provide the *control* test ingredient, a new antenna[4] was installed and beamed at the Syracuse stations, fifty air miles away from the pickup point. Direct readings were taken on all of the stations and by instantaneous switching from the control antenna to the existing antenna, comparative readings were recorded. At the same time photographs were taken of the pictures received on the existing antenna. Photos of received pictures, accepted as satisfactory by the set owner, were taken. Unretouched prints of these photos are shown below.

Mobile Lab Tests

In addition to the comparative readings referred to, another series of readings were taken by a control signal force. A mobile laboratory was set up in the backyard (in order to line up with the antennas to be checked) and a series of readings were taken from a controlled signal to provide a final check. When the engineers had satisfied themselves that they had as many readings as would be necessary to provide this control, the complete antenna assembly was replaced with not only new antennas of the same models, but new transmission line, standoffs and other required components.

Upon completion of this new installation, another series of identical tests were conducted, with respect to the control antenna and the new antenna using signals from the TV station, and the control signal from the mobile laboratory. Also pictures of the TV picture received with the new antenna system were taken, as shown in accompanying illustrations; the pictures were brighter, with increased detail, in view of a substantial boost in signal strength. Comparative readings under all conditions mentioned appear in table 1; p. 38.

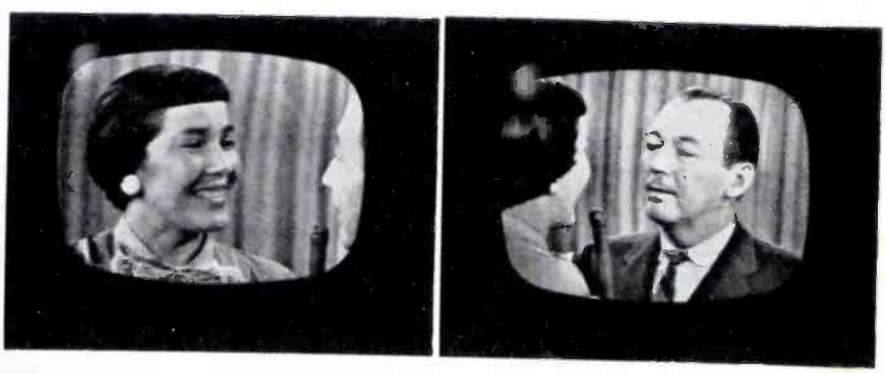
Some may ask why were these tests made under both actual operating conditions and also from the mobile laboratory. The double set of readings were taken because of the propagation variables which exist in hilly country and to double check the results. These checks emphasized the fact that installations deteriorate through the years; the rate of deterioration is often slow so that set owners do not notice any perceptible difference in the picture results.

Service Men can conduct similar tests using a field strength meter. In such a study one should select some installation which has been *up in the air* for years, where the transmission line is in bad condition and where

(*Continued on page* 38)

[1]*Taco*. [2]*Taco* 1850. [3]*Taco* 1325. [4]*Taco Trapper*.

SNOWY-PICTURE results on channel 3 on original antenna installation; caused by low signal-to-noise ratio. (This is an unretouched photo.)



ABOVE: LEFT—RIGHT . . . IMPROVED PERFORMANCE obtained on channel 3 after installation of new antenna which provided a higher signal-to-noise ratio and cleaned up picture. (These are unretouched photos.)

You can save time and trouble by standardizing on BUSS fuses.

The BUSS fuse line is most complete

You'll find the right fuse every time, when you turn to BUSS. There are BUSS fuses of all types and sizes for the protection of television, radio, instruments, controls, avionics and other electronic and electrical equipment. A companion line of fuse blocks, clips and holders is most complete.

Buying fuses from one source saves you time, trouble and simplifies your stock handling records.

Safeguard your reputation for quality and service

BUSS fuses are tested in a sensitive electronic device that automatically rejects any faulty fuse. As a result, there are never any 'kicks' or complaints from your customers about BUSS fuses failing to protect or faulty fuses causing needless shutdowns.

Why settle for anything less than BUSS quality in fuses? Standardize on BUSS fuses and be sure of dependable electrical protection.

Capitalize on the BUSS Trademark

The universal acceptance of BUSS fuses is based on the millions upon millions of BUSS fuses used in homes, on farms and in industry over the past 42 years. Handling quality products, like BUSS fuses, helps you maintain your reputation for quality and service.

For more information on BUSS and FUSETRON Small Dimension fuses and fuseholders . . . Write for bulletin SFB. Bussmann Mfg. Division (McGraw-Edison Co.) University at Jefferson, St. Louis 7, Mo.

BUSS fuses are made to protect—not to blow, needlessly

S-757

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

Makers of a complete line of fuses for home, farm, commercial, electronic, automotive and industrial use.

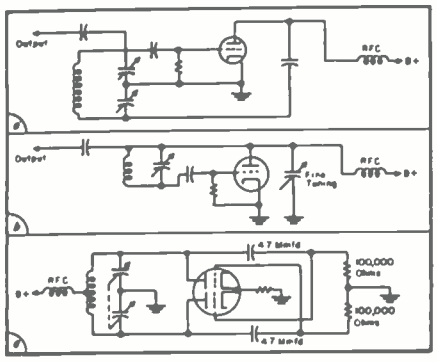


FIG. 1: THE BASIC Colpitts (a) and ultraudion (b) oscillators are illustrated in these circuits. In (c) is a push-pull oscillator circuit.

B-W/COLOR-TV VHF Tuner Mixers-Oscillators

by WAYNE S. RIAL, Application Engineer
Electronic Tube Division, Westinghouse Electric Corp.

Circuitry-Tubes Used in Old and New Systems

THE LOCAL OSCILLATOR stage of present *vhf* tuners is required to produce a constant output voltage of about 3 r peak, and a variable frequency over the ranges of 101 to 139 and 221 to 257 mc for a 44-mc *if*. Also, it is desirable that the frequency stability be less than 500-kc variation under normal operating conditions. This means that the local oscillator stability is very critical for black-and-white receivers and is exceptionally critical for color receivers.

The local oscillator circuit used most frequently in *vhf* tuners today is the *ultraudion* circuit which is a modification of the Colpitts oscillator. In the Colpitts oscillator, actual physical capacitors are used to provide the proper voltage distribution across the oscillator tank circuit as in the circuit in Fig. 1*a*.

In the ultraudion oscillator (Fig. 1*b*), *rf* voltage distribution across the oscillator tank circuit is accomplished through the grid-to-cathode and plate-to-cathode capacities of the tube. Feedback capacity necessary to sustain oscillations is obtained by the tube's grid-to-plate capacity.

Sometimes additional external capacitors are placed between grid and plate in this circuit to insure oscillator stability.

Another circuit which has been successfully used in the past is the push-pull oscillator using two triodes with a common cathode (the 6J6).

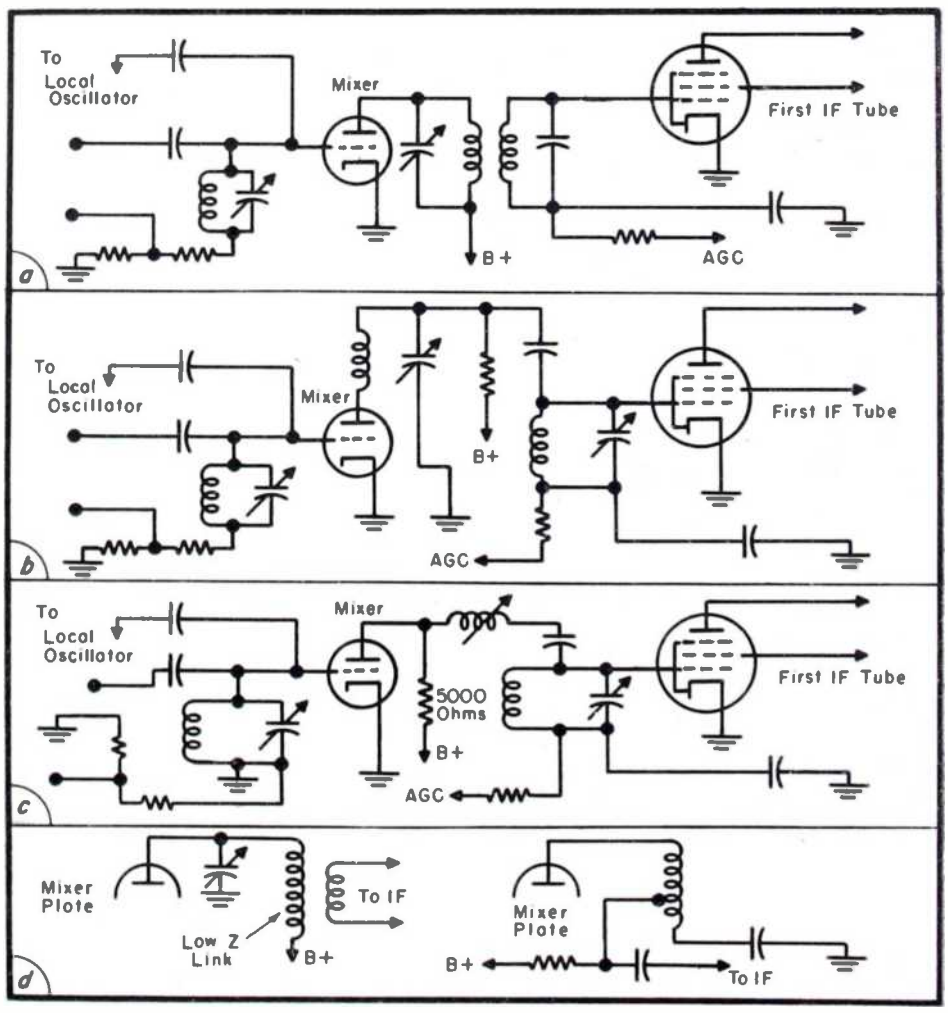
The local oscillator invariably operates above the incoming channel frequency to reduce the frequency range to which the oscillator must tune. In the split-sound *if* receiver system, it was necessary to operate the oscillator frequency above the incoming channel frequency to maintain the proper position of the sound and video carrier frequencies at the output of the mixer stage.

Thus, in an intercarrier-sound TV receiver with a 44-mc *if* operating in the *vhf* bands, the local oscillator must operate between 54+44=98 mc and 216+44=260 mc, which is a frequency range of 260/98=2.66:1. If the oscillator was to operate below the incoming channel frequency with a 44-mc *if* in the same bands, the oscillator stage would operate between 54−44=10 mc and 216−44 =172 which is a frequency range of 172/10=17.2:1.

One of the advantages of the present ultraudion oscillator circuit, other than circuit simplicity, is the fact that the cathode of the oscillator tubes is at *rf* and *af* ground. A grounded-cathode stage is less susceptible to hum modulation (at 60 cps) than is a circuit whose cathode is above *af* ground, especially if there is appreciable heater-to-cathode leakage within the tube. For the same reason, the cathodes of most *vhf* tuner mixer tubes are also grounded.

The most critical tube parameters for ultraudion oscillator usage are the

(*Continued on Page 22*)



(Right)

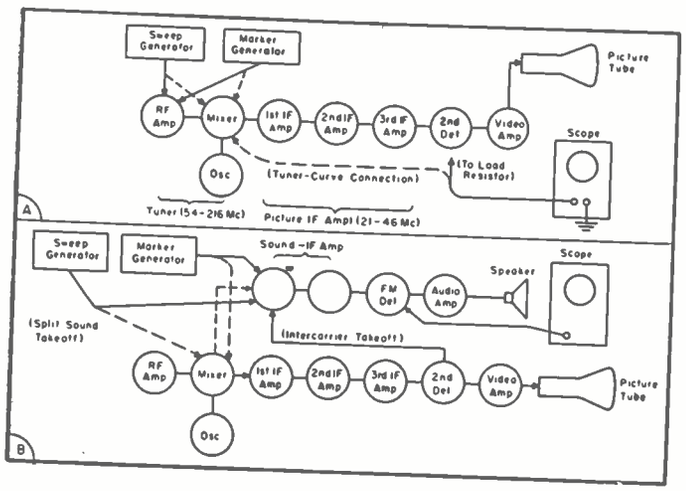
FIG. 2: FOUR TYPES of coupling circuits. Mixer - coupling - transformer system is shown in (a). The direct coupling system appears in (b). In (c) we have a direct-coupling circuit which contains a pi network, which has excellent spurious signal rejection. Two coupling systems frequently used are illustrated in (d). Low-impedance link refers to secondary of (d).

Alignment of TV Chassis Using

A Report on The Procedures Developed

by RHYS SAMUEL

Commercial Engineering, Components Division, RCA



(Left)

FIG. 1: TYPICAL TEST setups for conventional alignment: (a) Tuner and picture-if amplifier test setup; (b) sound-if amplifier and FM-detector test setup.

ALTHOUGH THE PRINCIPLES of the marker-adder system of TV alignment have been known for many years, they were not too widely applied. Recently the need for the technique has become more apparent and a growing number have begun to use this method to align their chassis. To simplify the operation, individual marker-adder units have been developed. Such devices permit calibrating pips from the marker generator to be added to the sweep-response curve after the sweep signal has been taken out of the receiver under alignment.

This system of marking a response curve has been found to offer many advantages, including elimination of all of the sweep-curve distortion caused by markers when they are fed through the receiver. Alignment of traps is also facilitated because marker *suckout* does not occur when the marker signal is added to the trace after the sweep signal has passed through the trap. One marker-adder,* developed recently, also provides a choice of marker shapes and sizes.

Conventional Alignment Test Setups

One typical setup used for *rf*-alignment is shown in Fig. 1*a*. The *rf*-output cables shown as solid lines from both the sweep and marker generators are connected to the antenna terminals of the receiver. The sweep generator is set to sweep the full width of one of the TV channels, and the marker generator is tuned to deliver a calibrating marker or markers which fall within the channel frequency band.

With this setup, it is possible to observe the bandpass characteristics of the tuner on each of the 12 *vhf* TV channels by connection of the 'scope into an appropriate signal takeoff point in the tuner. On some tuners, a demodulated signal is available from a test point; on other tuners, it is necessary to use a demodulator probe in conjunction with the oscilloscope.

If it is desired to make an overall bandpass check of the receiver, the 'scope can be connected across the load resistor of the second detector. The response curve observed at this point will be affected by the bandpass characteristics of the circuits in the tuner and the picture-*if* amplifier.

Alignment of the picture-*if* amplifier can be checked by connection of the sweep and marker generators as shown by the dotted lines. Both generators are set to deliver output signals in the intermediate-frequency region used by the receiver under test; the 'scope probe must be connected to the second-detector load resistor. The response curve displayed with this test arrangement will include the effects of all the tuned circuits, including traps, located in the picture-*if* amplifier.

Alignment of the sound-*if* amplifier and FM detector can be checked in similar fashion, as shown in *b* of Fig. 1. Here, the sweep and marker generators are set to the sound inter-

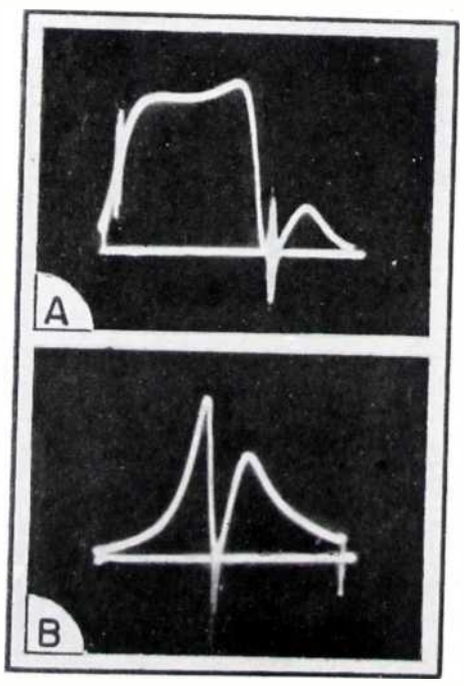
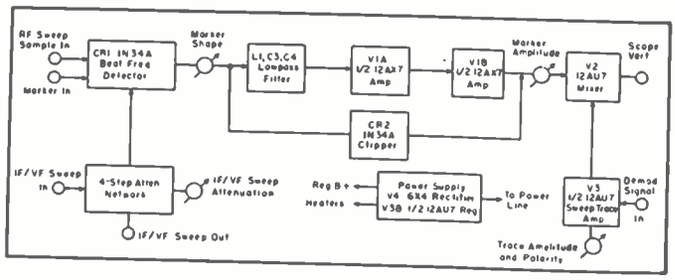


FIG. 3: TRAP NOTCHES: Overall response curve with dual markers from marker adder is illustrated in (a); note high-amplitude marker in trap notch at right. Response curve at sound takeoff transformer showing sharp hole provided by if picture-carrier trap, is shown in (b). Use of positive-clipped marker does not obscure trap notch.

(Below)

FIG. 2: BLOCK DIAGRAM of RCA WR-70A rf/if/vf marker-adder. The marker-adder contains four tubes, including the power-supply rectifier and a specially designed attenuator system for use on if video signals. The instrument is equipped with three coax jumper cables and a coax pickup cable for connection to other test equipment and to the TV receiver.



**RCA WR-70A RF/IF/VF Marker-Adder*

Marker-Adder Techniques

For The RF and IF–VF Stages of TV Chassis

mediate frequency, usually 4.5 mc, and the 'scope is connected across the output load resistor of the FM discriminator or ratio detector.

In all of these familiar setups, both the sweep and marker signals pass through the circuits under test. This arrangement, however, is a primary source of distortion of the response curve, and in these applications, the calibrating marker rides on top of the sweep curve. Unless great care is taken during the initial adjustments of equipment, too much signal injected into the receiver will cause overloading of the receiver circuits and result in distortion of the sweep and marker traces. In addition, it may be necessary to apply a high-amplitude marker signal to override the hash on the curve. If the marker must be positioned on the slope of a curve, it may also be necessary to use so much signal that the curve is distorted.

A high-amplitude marker is characterized by a relatively wide base which can obscure a considerable portion of the sweep curve. Markers of this type project both above and below the sweep-trace line, making it difficult to identify the contours of curve notches and slopes.

Another problem occurs when the foregoing method is used during trap alignment. Traps are hi-Q tuned circuits which require fairly precise adjustment. If the trap is set correctly, it should be impossible to feed a trap-frequency signal of normal voltage through it. To resolve this problem the marker generator is tuned back and forth through the trap frequency and one must estimate at what point on the dial the marker pip completely disappears. Another method consists of feeding the maximum signal through the trap and producing a marker pip by brute force.

In the marker-adder system of alignment the foregoing problems do not obtain. To illustrate, the unit, diagrammed in block form in Fig. 2, affords a choice of marker shapes to permit selection of the type of marker best suited to the response curve under observation: Negative clipped, positive clipped, positive and negative peaks (wide band), and positive and negative peaks (narrow band).

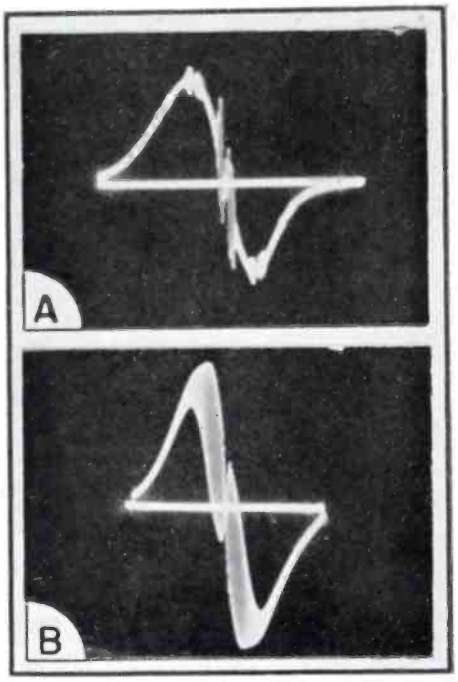
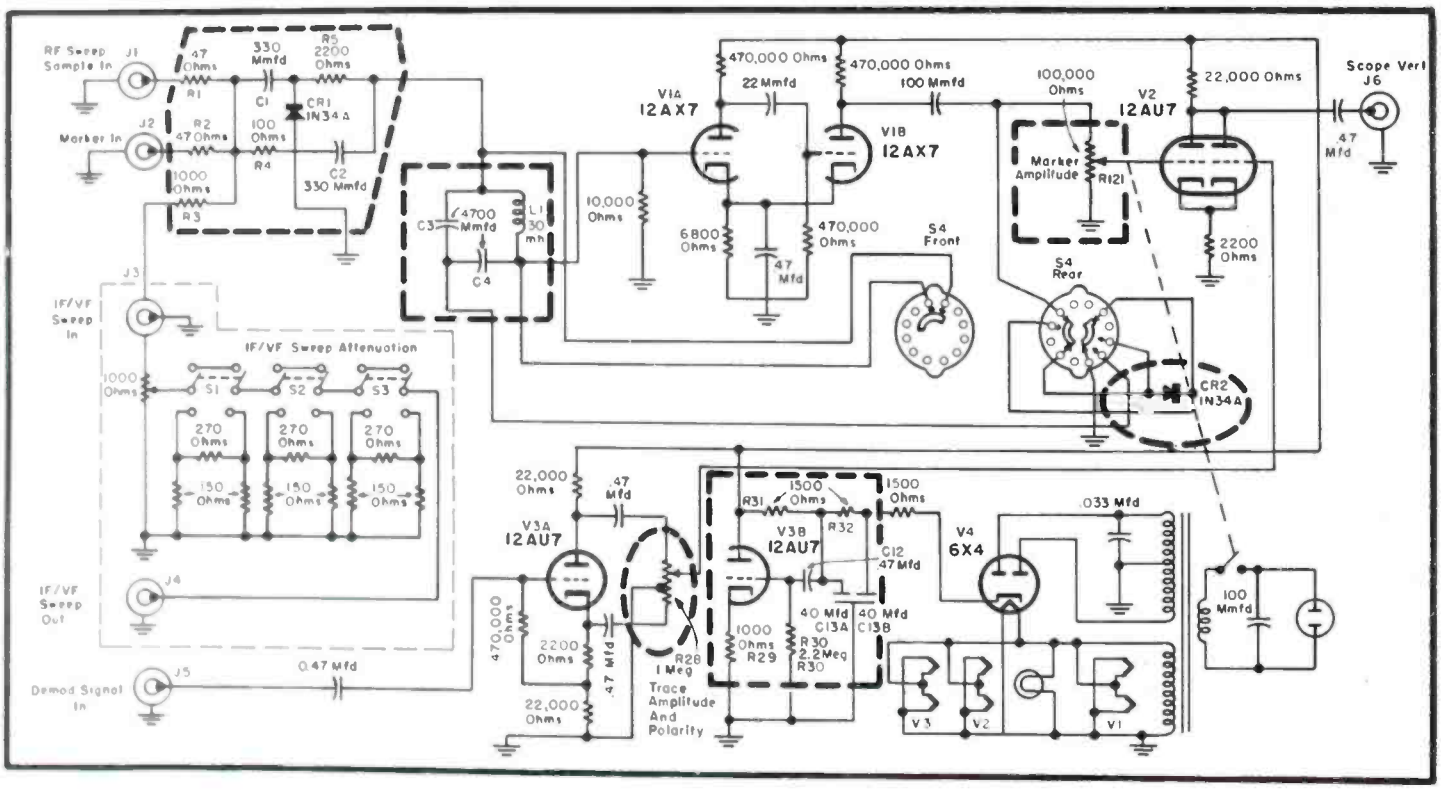


FIG. 4: EFFECTS of narrow and wide-band markers on discriminator S curve. Trace in (a) is that of a narrow-band-diamond marker with 150-kc sideband markers on peaks of curve. Distortion produced by use of wide-band marker appears in (b) trace.

The amplitude of any of the markers can be adjusted over a considerable range by means of a *marker amplitude* control without seriously

(*Continued on page 22*)

FIG. 5: COMPLETE CIRCUIT diagram of RCA marker-adder. Circled portions of the schematic are analyzed in text.



Tuner Mixers-Oscillators

(*Continued from page* 19)

tubes' interelectrode capacities, transconductance, low-line voltage transconductance, and microphonism. The tube transconductance is important in tuner local-oscillator applications, because this determines the oscillator-output voltage which subsequently establishes the grid bias of the mixer stage. Mixer-stage grid bias determines the operating point on the mixer transfer curve which further determines the mixer's conversion gain.

Other Mixer-Oscillator Considerations

Several important tuner mixer and oscillator circuit features are the methods of coupling the mixer stage to the grid of the receiver's first *if* amplifier, the methods of coupling the local oscillator to the mixer stage, and the types of mixer-oscillator tube combinations used.

Two popular methods of mixer output coupling are used at present. One is the coupling transformer and the other is the direct coupling system; Figs. 2*a*, *b* (p. 19). A coupling circuit which contains a *pi* network with excellent spurious signal rejection is illustrated in *c* of Fig. 2. Two other coupling systems frequently used are shown in Fig. 2*d*.

Oscillator injection to the mixer stage may be accomplished in one of three principle ways: (1) capacitive coupling through the channel selector switch in the mixer grid circuit; (2) inductive coupling between mixer grid coil and oscillator tank coil; and (3) capacitive coupling using a physical capacitor.

The last two coupling methods stated are widely used today. The inductive coupling method can be easily used with strip-type turret tuners.

Marker-Adders

(*Continued from page* 21)

changing the width of the marker base on the sweep trace. Also available is a *trace amplitude* and *polarity* control to adjust the amplitude of the sweep trace displayed on the 'scope; this control has no effect on the amplitude of the marker pip. The sweep-response curve may be displayed in an *upright* or *inverted* position, depending upon the setting of this control. As the control is rotated from the *normal* to *reversed* settings, the sweep trace will vary in amplitude from maximum in one vertical direction to maximum in the opposite vertical direction. The polarity or the displayed trace at any setting of this control will depend upon the polarity of the sweep signal taken from the receiver.

When the marker-adder is used in an *rf*-test setup, a sample voltage is fed first from the *rf* sweep generator into the beat-frequency detector circuit, consisting of a crystal diode and associated components, through a *rf-sweep sample in* connector. This *rf*-sample voltage must be taken out of the *rf-sweep* generator ahead of the attenuator circuit to insure a constant voltage level at the input to the marker adder, regardless of the setting of the attenuator control on the generator. A sampling terminal is provided on

some sweep generators and can be added on others.** The *rf*-marker signal at the desired marker frequency is taken directly from the *rf*-output connector of the marker generator and fed into a *marker-in* terminal. The sweep and marker signals are mixed in the crystal-diode-detector circuit and a beat-frequency (difference) signal is obtained. The beat-frequency differences between the sweep and marker signals will vary from zero to the maximum swing of the sweep excursion. Only a limited band of beat-frequencies is selected to form the marker signal.

12AX7 Amp Stages

The beat signal is applied to 12AX7 amplifier stages, which amplify the signal. The output from the 12AX7 is then applied to a mixer stage, (12AU7), through a *marker - amplitude* control which adjusts marker height. Marker shape and polarity are determined by a 30-mh inductor and a pair of 4700-mmfd capacitors, which comprise a low-pass filter, and a 1N34A, which provides clipping. A rotary switch in this circuit provides a choice of the markers. In the first three positions of the switch, the 30-mh coil in the switch network is shorted out and the 4700-mmfd coil-bridging capacitors are disconnected from ground. In the fourth position, the beat signal is passed through the low-pass filter which filters out high-frequency components of the signal, resulting in a narrow marker on the 'scope trace. The filter also serves to keep low-frequency modulation on the marker signal, such as 150-kc sideband-marker harmonics, from modulating the trace during FM-detector alignment. In positions 2 and 4 of the switch, the 1N34A is disconnected and no clipping occurs. In position 1, the crystal clips the lower half of the marker; in position 3, polarity of the crystal connections is reversed and the top half of the marker is clipped.

Demodulated Sweep Traces

The demodulated sweep trace is taken from the receiver at a demodulated-signal point in the tuner, at the second detector, or at high-frequency test points through a demodulator probe. The demodulated signal is fed to a 12AU7 sweep-trace amplifier through the *demod-signal-in* connector. This tube provides a small degree of amplification of the sweep signal and, in conjunction with the 1-megohm *trace amplitude and polarity* control, provides a means of adjusting polarity and amplitude of the trace displayed on the 'scope screen. The sweep signal is coupled from the 12AU7 sweep-trace amp to the 12AU7 adder stage, where the marker pip is superimposed on the sweep trace. The output signal from the adder stage is available at the *'scope-vert* connector for application to the vertical-amplifier section of the 'scope.

Freedom from *bounce*, *jitter*, and other undesirable 'scope-trace effects is provided by a voltage-stabilizing circuit consisting of one-half of a 12AU7 and associated resistors and capacitors. The component values were chosen to provide a long time constant. Any variation, such as a line-voltage surge, in the output voltage from the power supply, is applied to the grid of the 12AU7 tube.

(*Continued on page 24*)

**Such as the RCA WR-59-series TV sweep generators.*

Marker-Adders

(*Continued from page 23*)

Then an out-of-phase signal at the plate causes cancellation of the surge voltage and a high degree of trace stability is obtained.

Operation During IF/Video Alignment

The advantages of the marker adder and the method of generating the marker signal described are the same for *if/vf* alignment except that the *if/vf* signal from the sweep generator must be handled differently. For generation of an *if/vf* marker, it is necessary, as in the case of an *rf* marker, to apply part of the *if/vf*-sweep signal to the beat-frequency detector circuit. Because most *if/vf*-sweep generators are not equipped with a sample voltage terminal located ahead of the *if/vf* attenuator, it is necessary to feed the full *if/vf*-output voltage from the sweep generator to the marker adder and to provide an additional means of attenuation before the sweep signal is applied to the receiver undergoing alignment. Part of the full *if/vf* signal is sampled out in the marker adder and fed to the beat-frequency detector. These requirements are met by feeding the maximum *if/vf* signal from the sweep generator directly into the marker adder through a *if/vf sweep-in* connector. Part of the sweep voltage is fed to the beat-frequency detector circuit through a 1000-ohm resistor. The sweep signal is taken out of the marker adder through the *if/vf* attenuator section. The output sweep voltage is available at the *if/vf sweep out* connector for application to the receiver. The demodulated sweep signal from the receiver is then fed into the *demod-signal-in* terminal.

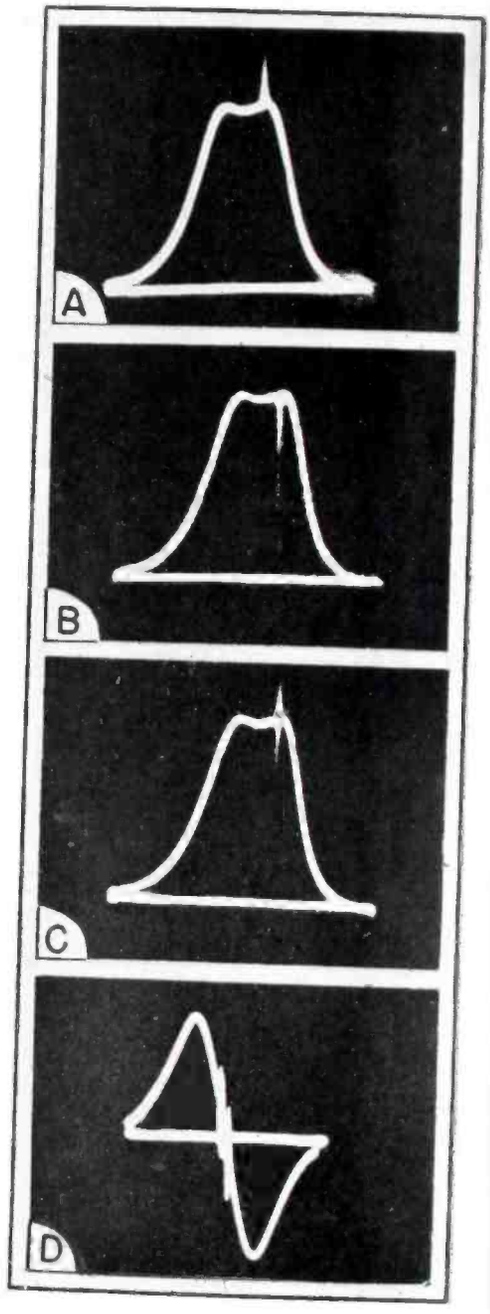
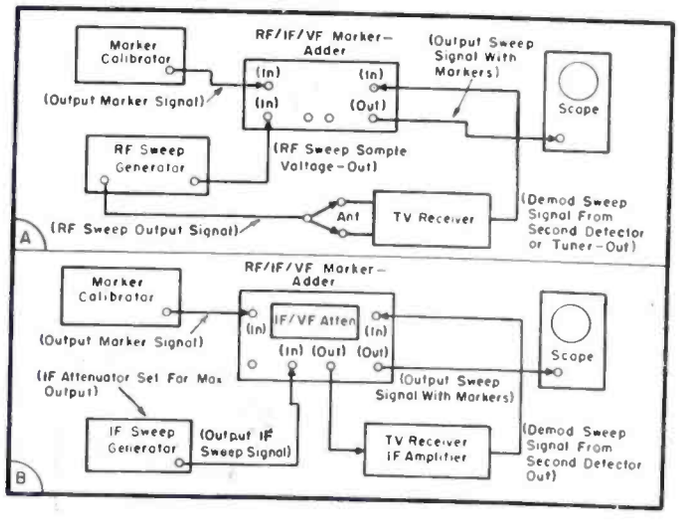


FIG. 6: FOUR DIFFERENT TYPES of markers produced by marker-adder: (a) Negative-clipped marker; (b) Positive-clipped marker; (c) Positive-and negative-peak marker (wide band); (d) Positive- and negative-peak marker (narrow band).



(Left)

FIG. 7: RF-IF alignment test setups with marker-adder. The rf arrangement is shown in (a); the if in (b).

ASSOCIATIONS

TSA, WASHINGTON, D. C.

AT THE FIRST ANNUAL meeting of the Television Service Association of Metropolitan Washington, D. C., *Robert Peters* was elected president; *Bernard Bognovitz*, vice president, and *Carl Johnston*, treasurer. *Robert Trollinger* and *George B. Sharpe* were elected to the board of directors.

Hymie Nussbaum is executive secretary of TSA.

Bernie Bognovitz is also serving as editor of *TSA News*. Assistants include *Robb Peters* and *Herman Gainen*. *Carl Johnston* is in charge of the advertising department. Contributors to *TSA News* include *Norman Selinger*, *James Crane* and *Hymie Nussbaum*.

TRT, KANSAS CITY, MO.

P. A. Scorr, chairman of the executive committee of the Television and Radio Technician Association, Kansas City, Mo., and instructor at the Central Technical Institute, resigned recently to accept a temporary transfer to CTI's California Air College, Hollywood, Calif.

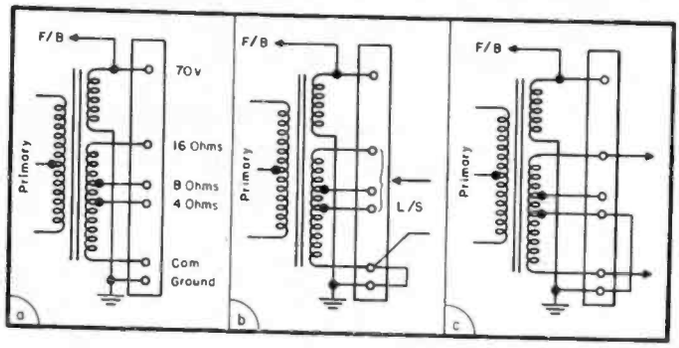
Scott's new assignment will include the setting up of an electronics division in the California school.

By a unanimous vote TRT's executive committee selected *L. A. Betros* to complete Scott's term for 1957.

TEN YEARS AGO IN SERVICE

INCREASING PRODUCTION and sales of TV-FM receivers boomed installation-repair-clinic activity. . . . A record breaking production of over 700,000 AM FM receivers for the year was forecast by industry heads. . . . One manufacturer announced a nationwide lecture program, covering 23 major cities throughout the country, featuring demonstrations and talks on sight and sound chassis. . . . Associations in the east detailed plans for a fall symposium headlining television and FM developments. . . . Instrument manufacturers revealed designs of antenna locators and field-strength meters for use with TV and FM antennas . . . The first exclusive report on FM antennas and transmission lines was published. . . . Highlights of first multiple TV-antenna system for apartment houses, demonstrated in New York City, were disclosed. . . . Projection type TV receivers, providing 15" x 20" images in lid of console, were shown in a field test. . . .

FIG. 1: OUTPUT TRANSFORMER tapping arrangements. (a)—basic connections; (b)—connections for 4, 8 or 16-ohms, with one side grounded; (c)—connection for 16 ohms with center-tapped ground. (Bogen)



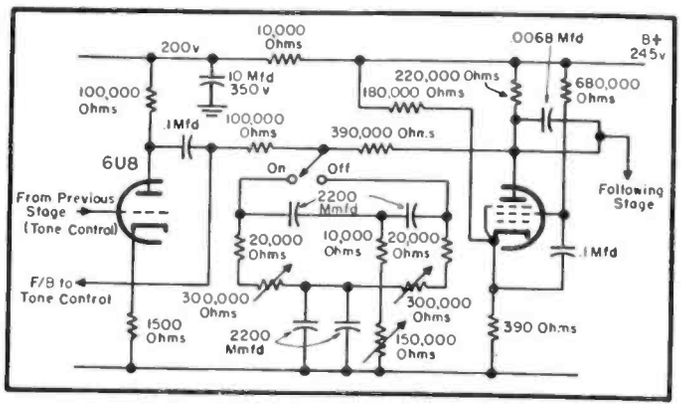


FIG. 2: SCHEMATIC FOR twin-T-with-feedback slot circuit that provides anti-acoustic-feedback action. (Bogen)

Outdoor Amplifiers For Commercial Sound

Output Requirements . . . Feedback Control Systems

by NORMAN CROWHURST

FLEXIBLE OUTPUT is extremely important in an outdoor system. In flexible-output-type amplifiers the normal 4, 8 and 16-ohm winding with a *common* at one end, is not directly connected to ground. The 70-*v* winding is isolated from this output winding and does have the side connected to ground; it also provides the connection for negative feedback. This arrangement has been found to give the best possible operation for the 70-*v* winding, which is the output connection likely to get the greatest variety of impedances connected to it. Normally the 16-ohm tap will be connected to a 16-ohm loudspeaker, or accordingly on the other taps.

A strap is provided on these models, so that the common terminal of the 4, 8, 16-ohm winding can be strapped to ground, or else the center tap of the 16-ohm winding can be grounded, by connecting to the 4-ohm tap. This provides a lower voltage output than the 70-*v* line with a center-tapped ground.

Bypassing Requirements

Failure to use bypass capacitors with separate resistors in low-level distortion amplifiers[1] not only reduces gain by regeneration; it reduces output. If a single resistor is used, it is best, in achieving a good output with a smooth overload characteristic, *not* to use a bypass capacitor. The low-level distortion may be a little higher, but any overload will invariably initiate serious crossover distortion due to momentary overbiasing, which sounds a lot worse.

If separate resistors are used, it is best to bypass one cathode to the other, rather than both to ground. This can be done in two ways: With a reversible electrolytic, in which case only one is required, or with a pair of non-reversible type, in which case a relatively high resistor is used for polarization.

[1] *Outdoor Amplifiers*; June, 1957, SERVICE.

OUTDOOR-INDOOR SOUND system amplifiers designed for store, club, church, office, school, warehouse, factory, auction and entertainment applications. Available in 10, 15 and 30-watt types. When used with trumpet speakers 10-watt amplifier is said to cover up to 20,000 square feet; 15-watt model up to 50,000 square feet and the 30 watt, 100,000 square feet. Phono tops are available for both 15 and 30-watt models. (Precision Electronics Inc., 9101 King Street, Franklin Park, Ill.

Anti-Feedback Controls

Another feature that is convenient for *pa* work is anti-feedback control; a twin T-network, the circuit of which is shown at Fig. 2. Here we find a 6U8, with the triode section operating as part of the preamplifier, while the pentode section provides feedback for the twin-T. In the *off* position, this combination acts as a straight amplifier.

Variable-Frequency Adjustments

When the control is turned to the *on* position, a three-ganged variable resistance adjusts the frequency of the twin-T to provide a sharp rejection filter that will absorb the frequency at which acoustic feedback first commences. This enables the amplifier to be turned up a little higher until the next feedback point is encountered. Negative feedback over the twin-T, from the plate of the pentode section, using the 390,000-ohm resistor, serves to sharpen the rejection response so that, apart from a very narrow band slot, the amplifier response remains flat.

ONLY UNIVERSITY OFFERS A COMPLETE RANGE OF DRIVERS

Versatility and Adaptability Unlimited . . . to Match Every Soundcasting Requirement!

Model PA-50

Model PA-HF

Model SA-30

Model SA-HF

Model MA-25

ALL NEW DESIGN... ALL FROM ONE RELIABLE SOURCE... ALL BUILT TO UNIVERSITY'S SUPERB QUALITY STANDARDS

Most Efficient
Widest Response
Highest Power
Greatest Output
Best Value
Always Dependable

Model PA-50 – The ultimate in deluxe, advance-design. Features: extended high and low frequency range, highest continuous duty power capacity, Super *W* magnet, bi-sectional construction, greatest conversion efficiency, husky built-in multi-match transformer with terminals conveniently located at base of unit. Especially recommended for church chimes, carillons, organs; fast set-up time ideal for rental or semi-permanent systems; outstanding performance characteristics. The answer to the toughest sound problem. Nothing finer!

Response: 70 to 10,000 cps. Power Capacity: Full Range 50 watts, Adjusted Range* 100 watts. Impedance: 16 ohms. Transformer Impedances: 100/165/250/500/1000/-2000 ohms, 70 v. Line Power Taps: 50/30/20/10/5/2.5 watts. List Price: $57.50.

Model PA-HF – Without question the finest driver unit ever offered. For applications requiring the greatest power handling capacity, maximum sensitivity, widest range frequency, response, *plus* rugged lifetime construction. Features *completely die-cast* aluminum housing. Watertight voice terminals are located at base of housing for added convenience. Increased sound output cuts amplifier requirements in half!

Response: 70 to 10,000 cps. Power Capacity: Full Range 50 watts, Adjusted Range* 100 watts. Impedance: 16 ohms. List Price: $47.50.

Model SA-30 – High efficiency and response of Model SA-HF, plus "battleship" construction for maximum durability against abuse or in hazardous environments. *Completely die-cast* aluminum housing and built-in matching transformer for connection to high impedance lines or "constant voltage" systems. Exclusive water-tight dural gland nut cable entrance. Shockproof bi-sectional speaker construction.

Response: 80 to 10,000 cps. Power Capacity: Full Range 30 watts, Adjusted Range* 60 watts. Impedance: 16 ohms. Transformer Impedances: 45/165/250/500/1000/2000 ohms, 70 v. Line Power Taps: 30/20/10/5/2.5 watts. List Price: $47.50.

Model SA-HF – Often called "the workhorse of the sound industry." Meets most p.a. and industrial requirements. Response to 10,000 cycles and more efficient than the Model MA-25. Will deliver that extra punch needed to cut through heavy noise. Use for speech or high quality music. Tropicalized and hermetically sealed for continuous top flight performance even under adverse weather conditions.

Response: 80 to 10,000 cps. Power Capacity: Full Range 30 watts, Adjusted Range* 60 watts. Impedance: 16 ohms. List Price: $36.00.

Model MA-25 – Use this rugged, weather-proof driver unit where response to 6500 cycles is adequate or to preserve "balance" when used with high cut-off frequency trumpets. Low in cost, high in quality, featuring high efficiency magnet, tropicalized 2" voice coil, "rim-centered" breakdown-proof bakelite diaphragm.

Response: 85 to 6500 cps. Power Capacity: Full Range 25 watts, Adjusted Range* 50 watts. Impedance: 16 ohms. List Price: $27.50.

**Program response adjusted to horn cut-off.*

WITH THESE TRUMPETS

USE ANY UNIVERSITY DRIVER FOR EFFICIENCY, ECONOMY AND ADAPTABILITY NEVER BEFORE POSSIBLE!

DIRECTIONAL–4 MODELS

RADIAL–3 MODELS

SUPER POWER–2 MODELS

WIDE ANGLE–2 MODELS

THE SUPER-POWER YOU WANT ...WHEN YOU WANT IT!

With the 2YC ACCESSORY CONNECTOR, you can apply the output of any two drivers to the same trumpet... meet any budget limitation ... and get exactly the frequency response, efficiency and power capacity you need. Up to 200 watts—using standard stock drivers!

RTA, WEA ADAPTERS ... for fitting University drivers and trumpets with 1 3/8" – 18 threads to equipment having 1 7/16"–16 threads.

LISTEN

University® *sounds better*

COMMERCIAL-INDUSTRIAL

FOR FURTHER INFORMATION WRITE UNIVERSITY LOUDSPEAKERS, INC., 80 SOUTH KENSICO AVENUE, WHITE PLAINS, N. Y.

CATALOGS—BOOKS

JOHN F. RIDER PUBLISHER, INC., 116 W. 14th St., New York 11, N. Y., has announced publication of the third supplement to the *Receiving Tube Substitution Guidebook* by H. A. MIDDLETON, which contains more than 200 European to American tube substitutions and over 230 American to European tube substitutions. The book details the necessary wiring changes. Volume also provides 830 receiving tube and over 200 picture tube substitutions as well. Priced at $1.35.

° ° °

BELDEN MANUFACTURING COMPANY, Chicago, Ill. has released an electronic wire and cable catalog (857) containing information on audio and mike cables, and hookup wire.

° ° °

ELECTRO PRODUCTS LABORATORIES, 4500 N. Ravenswood Ave., Chicago 40, Ill., have prepared a 4-page folder, explaining the construction and operating principles of filtered *dc* power supplies which utilize a choke input—type filter circuit and are designed for testing transistor auto radios, transistor portable radios, and tube auto radios. The unit operates on *ac* and handles 6/12-v tube radios, as well as transistor models.

° ° °

UNITED MOTORS SERVICE, division of General Motors, Detroit 2, Mich., has announced publication of a 60-page illustrated Delco electronic parts catalog. Listed are tubes, vibrators, auto antennas, speakers, auto radio components and all parts for the Guide *autronic eye* automatic headlamp control. Parts are alphabetically listed by make of car, and are indexed for application reference by distributors, dealers and Service Men.

° ° °

MCGRAW-HILL Book Information Service, 327 W. 41 St., N. Y. 36, N. Y., has announced the publication of *Small-Appliance Servicing* by P. T. BROCKWELL, JR.

The book offers basic appliance principles, testing and servicing techniques. It deals with the seven types of appliances most often brought into the repair shop: irons, toasters, mixers, roasters, coffee makers, waffle and sandwich grills, and rotisseries. Details fundamental constructional and operational knowledge that can be applied to repair of all makes and models. 225 pages; priced at $4.50.

ACCESSORIES

VIBRATOR POWER SUPPLY

A VIBRATOR-power supply, *Supreme 175*, featuring a fan-cooled vibrator, is now available from Terado Co., 1068 Raymond Ave., St. Paul 14, Minn.

Unit rating of 175 to 200 *w* is said to be ample for all requirements from a 12-*v* battery source. Supply can be used for operation of portable TV sets, power tools and tape recorders.

° ° °

LINE VOLTAGE ADJUSTER

A LINE-VOLTAGE adjuster, *LA 350*, for boosting or reducing voltage to assure best operation at approximately 115 *v*, has been introduced by Anchor Products Co., 2712 W. Montrose Ave., Chicago 18, Ill.

Unit, it is said, can increase or decrease voltage approximately 10%. Four-position switch permits selection of *off*, *normal*, *10-v up* and *10-v down*. Input ranges from 100 to 130 *v*; output from 110 to 120 *v*. Designed for 60-cycle *ac* 3-*amp* operation. For use with units rated up to 300 *w*.

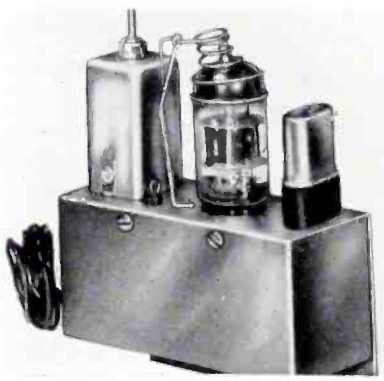
° ° °

COLOR-AUDIO-SCAN ADAPTERS

TWO ACCESSORIES FOR ADDING color and sound to the B&K model 1000 Dyna-Scan video generator have been announced by B&K Manufacturing Co., 3731 N. Southport Ave., Chicago 13, Ill.

One item, the model C15 *Color-Scan* (shown below) adds crystal-controlled rainbow display (orange, red, magenta, blue, cyan, green). Permits testing of color sync circuits, checking hue-control range, alignment of color demodulators.

The second unit, model S16 *Audio-Scan* adds FM sound transmission 4.5-mc above video carrier, with modulation from any available audio source. Enables one to combine speech or music with video display. Can be modulated with built-in 400-cycle tone generator for test signal or from external signal source.



TEST INSTRUMENTS

TRANSISTOR POWER SUPPLY

A transistorized regulated power supply, Transiply, has been introduced by Kay Electric Company, 14 Maple Ave., Pine Brook, N. J.

Unit is said to provide characteristics of an infinite life battery, and incorporates flexibility of a continuously variable output voltage.

May be used as power supply for transistor circuitry, and to regulate filament and bias currents.

• • •

FLUTTER METER

A flutter and wow meter, FL-3D, to measure flutter content in recording and reproducing systems as established by the IRE, ASA and SMPTE, has been developed by D & R Ltd., 402 E. Gutierrez St., Santa Barbara, Calif. Device offers selectable wow and flutter filters, and rms calibration.

• • •

IMPEDANCE BRIDGE KIT

An impedance meter, IB-2A (kit), has been announced by Heath Co., Benton Harbor 11, Mich. Features constant line-out voltage, built in power supply, a 1000-cycle generator, and vacuum-tube detector. A 100-0-100 μa meter provides for null indications. Measures resistance from 0.1 ohm to 10 megohms, capacitance from 10 mmfd to 100 mfd, inductance from 10 mh to 100 h, and storage factor (Q) from 0.1 to 1,000.

Employs Wheatstone, capacity comparison, Maxwell and Hay bridges.

Auto Antenna Display

(Right)

SALES KIT designed to hold three Snyder 18-D Imperial single-mast indoor TV antennas (blonde, mahogany and ebony) to permit showing of all three simultaneously. Sales kit measures 18" by 28".

(Left)

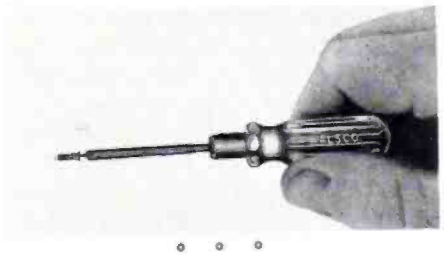
COUNTER STAND for Delco auto antenna, which features a mount to display the antenna and a pocket for carrying folders which describe the U-M-S line of Delco auto antennas.

Indoor Antenna Sales Kit

BENCH-FIELD TOOLS

SCREWDRIVER FOR TINY SCREWS

A WEDGE-ACTION screwdriver, *Mini-hold*, designed to grip extremely tiny screws (Nos. 1 to 4) has been announced by Walsco Electronics Manufacturing Co., 100 W. Green St., Rockford, Ill. Screwdriver measures 2⅞" overall.



o o o

FURNITURE CLEAN-POLISH KIT

A MONTH-LONG TOOL SPECIAL, a *TV and Furniture Beauty Kit*, has been announced by General Cement Manufacturing Co. (Division of Textron, Inc.), 400 S. Wyman St., Rockford, Ill.

Included in package is Creme-O-Wax polish, skratch stiks in three different wood colors, and a squeeze bottle of TV lens cleaner.

o o o

MINIATURE SOLDERING IRON

A MINIATURE SOLDERING iron, for use with miniaturized and printed circuitry, has been announced by the Industrial Heating Dept., General Electric Co., Schenectady 5, N. Y.

Weighing less than 1½ ounces, the iron features a tiny tubular heater, located in the extreme tip, which develops a temperature of 750° to 850° *F*. Unit is rated 6 *v*, 12 *w*. Available with 6-*v* transformer integral with a 6' cordset.

o o o

ALLIGATOR CLIPS

A SERIES OF ALLIGATOR CLIPS with cord strain-relief ears and an extruded hinge, type *70*, has been announced by Mueller Electric Co., 1573 E. 31 St., Cleveland 14, O.

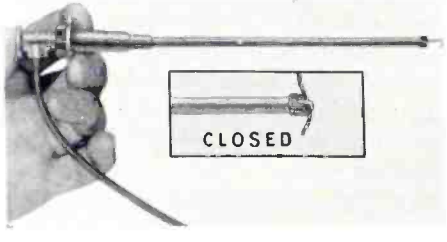
Teeth have been designed to grip all shapes at different angles. Included in the series are cadmium-plated steel units with or without screw (for soldering connection) and a solid copper clip with screw connection.

o o o

FLEXIBLE GRIP PROBE

A PLASTIC PROBE, *Griprobe*, to grip-hold terminals, tube sockets, lugs and wires, has been developed by Standard Electronics, Inc., 5523 Satsuma Ave., Burbank, Calif.

Features interior spring mechanism. Press of thumb releases a hook-shaped metal probe; removing thumb, closes self-lock grip.



FM Mobile Receiver

(*Continued from page 9*)

born case of interference will require special attention.

With the receiver installed in the car and the antenna connected, the car motor should be started. Ignition noise can be distinguished by its popping sound at idling speed. This noise may be reduced by installing a suppressor in the main high-voltage lead; preferably the type which is contained within the wire itself. The spark plugs should be replaced with resistor-types, or quality suppressors can be added at each spark plug. A shielded type .5-mfd capacitor with a short lead should be connected to the armature terminal of the generator to correct generator noise. A similar capacitor can be used at the voltage regulator and other points of interference.

Service Notes

(*Continued from page 14*)

indication will be materially different when the ohmmeter test prods are reversed.

Not only will misleading indications be obtained, but the transistors themselves can be permanently damaged by resistance measurement.

If resistance measurements are to be made in a transistor radio, the transistors should be removed from the circuit to be tested. If the transistors are soldered in on a printed-circuit board, it will be best to unsolder one terminal of the component to be tested.

Current measurements are seldom made in the servicing of radios because of the difficulty in making such measurements.

However, transistor circuit design is based primarily on current flow and not upon voltage. Although current measurements are not readily made, the *dc* voltage drop across circuit resistors can sometimes be used to provide a reasonably accurate indication of current.

In RCA models 8-BT-9 and 9-BT-9 the *no-signal* emitter currents are as follows:

Q_1 (2N140) .65 ma	Q_4 (2N109) 1.2 ma
Q_2 (2N139) .52 ma	Q_5 (2N109) 1.8 ma
Q_3 (2N139) .95 ma	Q_6 (2N109) 1.8 ma

The collector currents in other models are of similar magnitude with the exception of models 8-BT-7 and 8-BT-8. The audio amplifier of these two models is class A and the single output transistor has a rated no-signal emitter current of 10.7 ma; the current has little variation with audio output variation.

110° TV Chassis

(*Continued from page* 12)

the top and the bottom of the cabinet. In the console for this set, the chassis is mounted on a metal rail extending across the back of the receiver. The chassis is prevented from falling for- by two small extensions, one neath the tuner, and the other extending towards the right rear of the cabinet. Screws from the back cover go through these rails and through the metal extensions locking chassis in place.

Horizontal Deflection Circuit

ross-sectional views of the new and the old 70° yokes appear g. 3 (p. 12). It will be noted that indings of the 110° yoke are to the bell of the picture tube, core material of the yoke d in a similar manner. ures added to the smaller eter add up to a yoke uperior to that of the pre- deflection yokes. In ad- the windings are flared oke, the center of de- forward into the bell tube. This design en- ing to get a 110° ithout corner-cutting. with any deflection itself must be fully he bell of the picture pperation.

nultivibrator is used horizontal signal. It upled multivibrator popular 6CG7. gn idea of the g system was to can with approx- r the picture tube ntional and well To do this, the vibrator was fed orizontal output is output tube ized, but very mer. Efficiency pendent upon vice Men are aterial used former. But vare of, is whether l saturate into the core

4 (p. are gh a

creased magnetic flux will be developed with an increase of applied electrical power. At this point the core of the transformer is considered to be saturated. In the lower section of the drawing, we see the same electromagnet, except that an additional winding has been added. By following the current flowing through the winding, it can be observed that the current is flowing in opposite directions through the two windings; therefore, the magnetic field being developed by the two windings will cancel.

In conventional-scan transformers, the core is partially saturated by the *dc* flowing in the windings. This *dc* is the B+ for the plate of the driver tube. This means that only a limited amount of *rf* power can be handled by the core material. To be conventional, simply enlarging the size of the core material would overcome this problem. Engineering did not want to do this as it would lead to other problems in the transformer itself. Instead, it was felt that the portion of core material, that was being *lost* due to the *dc* flowing in the horizontal scan transformer, should be eliminated. To do this, an additional winding was placed on the horizontal scan

(*Continued on page* 34)

TEST INSTRUMENTS

TRANSISTOR POWER SUPPLY

A TRANSISTORIZED REGULATED POWER supply, Transiply, has been introduced by Kay Electric Company, 14 Maple Ave., Pine Brook, N. J.

Unit is said to provide characteristics of an infinite life battery, and incorporates flexibility of a continuously variable output voltage.

May be used as power supply for transistor circuitry, and to regulate filament and bias currents.

o o o

FLUTTER METER

A FLUTTER AND WOW METER, *FL-3D*, to measure flutter content in recording and reproducing systems as established by the IRE, ASA and SMPTE, has been developed by D & R, Ltd., 402 E. Gutierrez St., Santa Barbara, Calif. Device offers selectable wow and flutter filters, and *rms* calibration.

o o o

IMPEDANCE BRIDGE KIT

AN IMPEDANCE BRIDGE 1B-2A (kit), has been announced by Heath Co., Benton Harbor 11, Mich. Features constant filament voltage, built in power supply, a 1000-cycle generator, and vacuum-tube detector. A 100-0-100 μa meter provides for null indications. Measures resistance from 0-1 ohm to 10 megohms; capacitance from 10 mmfd to 100 mfd; inductance from 10 mh to 100 h; and storage factor (Q) from 0.1 to 1,000.

Employs Wheatstone, capacity comparison, Maxwell and Hay bridges.

Auto Antenna Display

(Right)

SALES KIT designed to hold three Snyder 10-D Imperial single-mast indoor TV antennas (blonde, mahogany and ebony) to permit showing of all three simultaneously. Sales kit measures 18" by 28".

(Left)

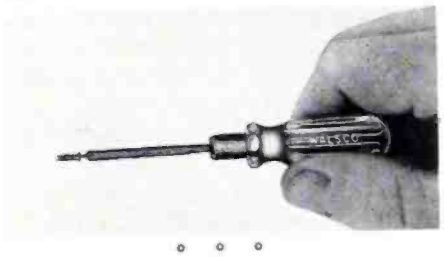
COUNTER STAND for Delco auto antennas, which features a mount to display the antenna and a pocket for carrying folders which describe the U-M-S line of Delco auto antennas.

Indoor Antenna Sales Kit

BENCH-FIELD TOOLS

SCREWDRIVER FOR TINY SCREWS

A WEDGE-ACTION screwdriver, *Mini-hold*, designed to grip extremely tiny screws (Nos. 1 to 4) has been announced by Walsco Electronics Manufacturing Co., 100 W. Green St., Rockford, Ill. Screwdriver measures 2⅞" overall.



o o o

FURNITURE CLEAN-POLISH KIT

A MONTH-LONG TOOL SPECIAL, a *TV and Furniture Beauty Kit*, has been announced by General Cement Manufacturing Co. (Division of Textron, Inc.), 400 S. Wyman St., Rockford, Ill.

Included in package is Creme-O-Wax polish, skratch stiks in three different wood colors, and a squeeze bottle of TV lens cleaner.

o o o

MINIATURE SOLDERING IRON

A MINIATURE SOLDERING iron, for use with miniaturized and printed circuitry, has been announced by the Industrial Heating Dept., General Electric Co., Schenectady 5, N. Y.

Weighing less than 1½ ounces, the iron features a tiny tubular heater, located in the extreme tip, which develops a temperature of 750° to 850° *F*. Unit is rated 6 *v*, 12 *w*. Available with 6-*v* transformer integral with a 6' cordset.

o o o

ALLIGATOR CLIPS

A SERIES OF ALLIGATOR CLIPS with cord strain-relief ears and an extruded hinge, type *70*, has been announced by Mueller Electric Co., 1573 E. 31 St., Cleveland 14, O.

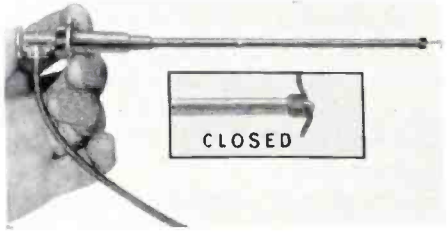
Teeth have been designed to grip all shapes at different angles. Included in the series are cadmium-plated steel units with or without screw (for soldering connection) and a solid copper clip with screw connection.

o o o

FLEXIBLE GRIP PROBE

A PLASTIC PROBE, *Griprobe*, to grip-hold terminals, tube sockets, lugs and wires, has been developed by Standard Electronics, Inc., 5523 Satsuma Ave., Burbank, Calif.

Features interior spring mechanism. Press of thumb releases a hook-shaped metal probe; removing thumb, closes self-lock grip.



TEST INSTRUMENTS

TRANSISTOR POWER SUPPLY

A TRANSISTORIZED REGULATED POWER supply, Transiply, has been introduced by Kay Electric Company, 14 Maple Ave., Pine Brook, N. J.

Unit is said to provide characteristics of an infinite life battery, and incorporates flexibility of a continuously variable output voltage.

May be used as power supply for transistor circuitry, and to regulate filament and bias currents.

° ° °

FLUTTER METER

A FLUTTER AND WOW METER, *FL-3D*, to measure flutter content in recording and reproducing systems as established by the IRE, ASA and SMPTE, has been developed by D & R, Ltd., 402 E. Gutierrez St., Santa Barbara, Calif. Device offers selectable wow and flutter filters, and *rms* calibration.

° ° °

IMPEDANCE BRIDGE KIT

AN IMPEDANCE BRIDGE 1B-2A (kit), has been announced by Heath Co., Benton Harbor 11, Mich. Features constant filament voltage, built in power supply, a 1000-cycle generator, and vacuum-tube detector. A 100-0-100 μa meter provides for null indications. Measures resistance from 0-1 ohm to 10 megohms; capacitance from 10 mmfd to 100 mfd; inductance from 10 mh to 100 h; and storage factor (Q) from 0.1 to 1,000.

Employs Wheatstone, capacity comparison, Maxwell and Hay bridges.

Auto Antenna Display

(Left)

COUNTER STAND for Delco auto antennas, which features a mount to display the antenna and a pocket for carrying folders which describe the U-M-S line of Delco auto antennas.

Indoor Antenna Sales Kit

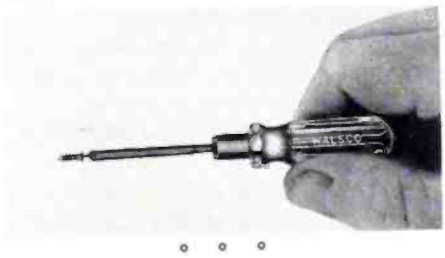
(Right)

SALES KIT designed to hold three Snyder 10-D Imperial single-mast indoor TV antennas (blonde, mahogany and ebony) to permit showing of all three simultaneously. Sales kit measures 18" by 28".

BENCH-FIELD TOOLS

SCREWDRIVER FOR TINY SCREWS

A WEDGE-ACTION screwdriver, *Mini-hold*, designed to grip extremely tiny screws (Nos. 1 to 4) has been announced by Walsco Electronics Manufacturing Co., 100 W. Green St., Rockford, Ill. Screwdriver measures 2⅞" overall.



° ° °

FURNITURE CLEAN-POLISH KIT

A MONTH-LONG TOOL SPECIAL, a *TV and Furniture Beauty Kit*, has been announced by General Cement Manufacturing Co. (Division of Textron, Inc.), 400 S. Wyman St., Rockford, Ill.

Included in package is Creme-O-Wax polish, skratch stiks in three different wood colors, and a squeeze bottle of TV lens cleaner.

° ° °

MINIATURE SOLDERING IRON

A MINIATURE SOLDERING iron, for use with miniaturized and printed circuitry, has been announced by the Industrial Heating Dept., General Electric Co., Schenectady 5, N. Y.

Weighing less than 1½ ounces, the iron features a tiny tubular heater, located in the extreme tip, which develops a temperature of 750° to 850° *F*. Unit is rated 6 *v*, 12 *w*. Available with 6-*v* transformer integral with a 6' cordset.

° ° °

ALLIGATOR CLIPS

A SERIES OF ALLIGATOR CLIPS with cord strain-relief ears and an extruded hinge, type *70*, has been announced by Mueller Electric Co., 1573 E. 31 St., Cleveland 14, O.

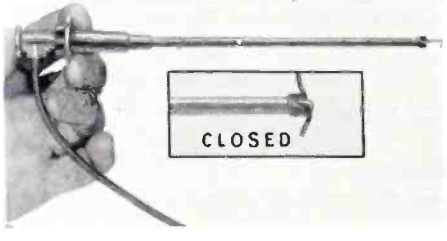
Teeth have been designed to grip all shapes at different angles. Included in the series are cadmium-plated steel units with or without screw (for soldering connection) and a solid copper clip with screw connection.

° ° °

FLEXIBLE GRIP PROBE

A PLASTIC PROBE, *Griprobe*, to grip-hold terminals, tube sockets, lugs and wires, has been developed by Standard Electronics, Inc., 5523 Satsuma Ave., Burbank, Calif.

Features interior spring mechanism. Press of thumb releases a hook-shaped metal probe; removing thumb, closes self-lock grip.



FM Mobile Receiver

(*Continued from page* 9)

born case of interference will require special attention.

With the receiver installed in the car and the antenna connected, the car motor should be started. Ignition noise can be distinguished by its popping sound at idling speed. This noise may be reduced by installing a suppressor in the main high-voltage lead; preferably the type which is contained within the wire itself. The spark plugs should be replaced with resistor-types, or quality suppressors can be added at each spark plug. A shielded type .5-mfd capacitor with a short lead should be connected to the armature terminal of the generator to correct generator noise. A similar capacitor can be used at the voltage regulator and other points of interference.

Service Notes

(*Continued from page* 14)

indication will be materially different when the ohmmeter test prods are reversed.

Not only will misleading indications be obtained, but the transistors themselves can be permanently damaged by resistance measurement.

If resistance measurements are to be made in a transistor radio, the transistors should be removed from the circuit to be tested. If the transistors are soldered in on a printed-circuit board, it will be best to unsolder one terminal of the component to be tested.

Current measurements are seldom made in the servicing of radios because of the difficulty in making such measurements.

However, transistor circuit design is based primarily on current flow and not upon voltage. Although current measurements are not readily made, the *dc* voltage drop across circuit resistors can sometimes be used to provide a reasonably accurate indication of current.

In RCA models 8-BT-9 and 9-BT-9 the *no-signal* emitter currents are as follows:

Q_1 (2N140) .65 ma	Q_4 (2N109) 1.2 ma
Q_2 (2N139) .52 ma	Q_5 (2N109) 1.8 ma
Q_3 (2N139) .95 ma	Q_6 (2N109) 1.8 ma

The collector currents in other models are of similar magnitude with the exception of models 8-BT-7 and 8-BT-8. The audio amplifier of these two models is class *A* and the single output transistor has a rated no-signal emitter current of 10.7 ma; the current has little variation with audio output variation.

110° TV Chassis

(*Continued from page* 12)

the top and the bottom of the cabinet. In the console for this set, the chassis is mounted on a metal rail extending across the back of the receiver. The chassis is prevented from falling forward by two small extensions, one underneath the tuner, and the other extending towards the right rear of the cabinet. Screws from the back cover go through these rails and through the metal extensions locking the chassis in place.

The Horizontal Deflection Circuit

Cross-sectional views of the new 110° and the old 70° yokes appear in Fig. 3 (p. 12). It will be noted that the windings of the 110° yoke are flared onto the bell of the picture tube, and that the core material of the yoke itself is flared in a similar manner. These features added to the smaller neck diameter add up to a yoke efficiency superior to that of the previously-used deflection yokes. In addition, since the windings are flared on the 110° yoke, the center of deflection is now forward into the bell of the picture tube. This design enabled engineering to get a 110° diagonal scan without corner-cutting. Of course, as with any deflection yoke, the yoke itself must be fully forward against the bell of the picture tube for proper operation.

A horizontal multivibrator is used to develop the horizontal signal. It is a cathode-coupled multivibrator using the new popular 6CG7. The basic design idea of the horizontal scanning system was to develop a 110° scan with approximately 17,000 *v* for the picture tube by utilizing conventional and well known driver tubes. To do this, the output of the multivibrator was fed to the grid of the horizontal output tube, a 12DQ6. This output tube drives a new small-sized, but very efficient output transformer. Efficiency of this transformer is dependent upon cancellation of flux. Service Men are familiar with the core material used in a horizontal scan transformer. But what they may not be aware of, is that with all electromagnets, whether they be *dc* or *ac,* the core will saturate if the amount of power put into the windings is greater than the core material can handle.

This point is illustrated in Fig. 4 (p. 12), where two electromagnets are shown. If *dc* is caused to flow through the windings on the upper magnet, a point will be reached where no increased magnetic flux will be developed with an increase of applied electrical power. At this point the core of the transformer is considered to be saturated. In the lower section of the drawing, we see the same electromagnet, except that an additional winding has been added. By following the current flowing through the winding, it can be observed that the current is flowing in opposite directions through the two windings; therefore, the magnetic field being developed by the two windings will cancel.

In conventional-scan transformers, the core is partially saturated by the *dc* flowing in the windings. This *dc* is the B+ for the plate of the driver tube. This means that only a limited amount of *rf* power can be handled by the core material. To be conventional, simply enlarging the size of the core material would overcome this problem. Engineering did not want to do this as it would lead to other problems in the transformer itself. Instead, it was felt that the portion of core material, that was being *lost* due to the *dc* flowing in the horizontal scan transformer, should be eliminated. To do this, an additional winding was placed on the horizontal scan

(*Continued on page* 34)

FM Mobile Receiver

(Continued from page 9)

from case of interference will require special attention.

With the receiver installed in the car and the antenna connected, the car motor should be started. Ignition noise can be distinguished by its popping sound at idling speed. This noise may be reduced by installing a suppressor in the main high-voltage lead, preferably the type which is contained within the wire itself. The spark plugs should be replaced with resistor-types, or quality suppressors can be added at each spark plug. A shielded type .5-mfd capacitor with a short lead should be connected to the armature terminal of the generator to correct generator noise. A similar capacitor can be used at the voltage regulator and other points of interference.

Service Notes

(Continued from page 14)

indications will be materially different when the ohmmeter test prods are reversed.

Not only will misleading indications be obtained, but the transistors themselves can be permanently damaged by resistance measurement.

If resistance measurements are to be made in a transistor radio, the transistors should be removed from the circuit to be tested. If the transistors are soldered in on a printed circuit board, it will be best to unsolder one terminal of the component to be tested.

Current measurements are seldom made in the servicing of radios because of the difficulty in making such measurements.

However, transistor circuit design is based primarily on current flow and not upon voltage. Although current measurements are not readily made, the dc voltage drop across circuit resistors can sometimes be used to provide a reasonably accurate indication of current.

In RCA models 8-BT-9 and 9-BT-9 the no-signal emitter currents are as follows:

Q1 (2N140) .85 ma	Q5 (2N109) 1.2 ma
Q2 (2N139) .52 ma	Q6 (2N109) 1.8 ma
Q3 (2N139) .85 ma	Q7 (2N109) 1.8 ma

The collector currents in other models are of similar magnitude with the exception of models 8-BT-7 and 8-BT-8. The audio amplifier of these two models is class A and the single output transistor has a rated no-signal emitter current of 10.7 ma; the current has little variation with audio output variation.

110° TV Chassis

(*Continued from page 12*)

the top and the bottom of the cabinet. In the console for this set, the chassis is mounted on a metal rail extending across the back of the receiver. The chassis is prevented from falling forward by two small extensions, one underneath the tuner, and the other extending towards the right rear of the cabinet. Screws from the back cover go through these rails and through the metal extensions locking the chassis in place.

The Horizontal Deflection Circuit

Cross-sectional views of the new 110° and the old 70° yokes appear in Fig. 3 (p. 12). It will be noted that the windings of the 110° yoke are flared onto the bell of the picture tube, and that the core material of the yoke itself is flared in a similar manner. These features added to the smaller neck diameter add up to a yoke efficiency superior to that of the previously-used deflection yokes. In addition, since the windings are flared on the 110° yoke, the center of deflection is now forward into the bell of the picture tube. This design enabled engineering to get a 110° diagonal scan without corner-cutting. Of course, as with any deflection yoke, the yoke itself must be fully forward against the bell of the picture tube for proper operation.

A horizontal multivibrator is used to develop the horizontal signal. It is a cathode-coupled multivibrator using the new popular 6CG7. The basic design idea of the horizontal scanning system was to develop a 110° scan with approximately 17,000 *v* for the picture tube by utilizing conventional and well known driver tubes. To do this, the output of the multivibrator was fed to the grid of the horizontal output tube, a 12DQ6. This output tube drives a new small-sized, but very efficient output transformer. Efficiency of this transformer is dependent upon cancellation of flux. Service Men are familiar with the core material used in a horizontal scan transformer. But what they may not be aware of, is that with all electromagnets, whether they be *dc* or *ac*, the core will saturate if the amount of power put into the windings is greater than the core material can handle.

This point is illustrated in Fig. 4 (p. 12), where two electromagnets are shown. If *dc* is caused to flow through the windings on the upper magnet, a point will be reached where no increased magnetic flux will be developed with an increase of applied electrical power. At this point the core of the transformer is considered to be saturated. In the lower section of the drawing, we see the same electromagnet, except that an additional winding has been added. By following the current flowing through the winding, it can be observed that the current is flowing in opposite directions through the two windings; therefore, the magnetic field being developed by the two windings will cancel.

In conventional-scan transformers, the core is partially saturated by the *dc* flowing in the windings. This *dc* is the B+ for the plate of the driver tube. This means that only a limited amount of *rf* power can be handled by the core material. To be conventional, simply enlarging the size of the core material would overcome this problem. Engineering did not want to do this as it would lead to other problems in the transformer itself. Instead, it was felt that the portion of core material, that was being *lost* due to the *dc* flowing in the horizontal scan transformer, should be eliminated. To do this, an additional winding was placed on the horizontal scan

(*Continued on page 34*)

110° TV Chassis

(*Continued from page* 33)

transformer in the same direction as the main auto-winding. By proper circuit connections, the B+ current for the horizontal output tube is made to flow in one direction through the additional winding, and in the other direction through the main auto-winding. In other words, the B+ is flowing in one direction for one winding, and in the opposite direction for the other winding. This opposite *dc* flow will cause field cancellation of the *dc* component. Therefore, all the core material can be used to handle the *rf* energy; this is shown in Fig. 5 (p. 12). This means that a much smaller core material can be used over conventional transformers. This increased efficiency, in conjunction with the new high sensitivity yoke, eliminated the scan problem that was anticipated.

The Vertical Deflection Circuit

The vertical deflection circuit (Fig. 6; p. 12) incorporates a dual-triode tube. This is a new type tube, the 10DE7, specifically designed for this application. It is a dissimilar triode; that is, one of the triode sections has a lower plate dissipation than the other.

Although we have a plate-coupled multivibrator circuit, one triode is developing considerable power to drive the yoke. The feedback circuits to maintain this oscillator are from plate pin 1 back through C_{315}, R_{314}, and C_{312} to grid pin 7. The other feedback circuit is from plate pin 6 through C_{313} to grid pin 2. The free running frequency of this oscillator is controlled by adjusting R_{317} which changes the rate of discharge of C_{314} and C_{312}. These capacitors are charged each time V_{9A} draws grid current. By decreasing the resistance of R_{317}, the discharge time is shortened and the oscillator speeds up.

Some of the B+ voltage for V_{9A} is drawn from boost through the height control in series with thermistor R_{320}. This thermistor is in the circuit to control picture size change during warmup time. This is necessary as the *dc* resistance of the yoke changes as it warms up. This upsets the circuit in such a manner that the picture would change height if this thermistor were not in the circuit. At the same time, this change in resistance of the yoke could cause the vertical speed of the circuit to change. In order to prevent this, thermistor R_{319} is located in the feedback circuit from plate pin 1 to grid pin 7. These thermistors will prevent any change in picture size or hold during warmup.

The left triode section of the 10DE7 (V_{9A}) receives its plate supply voltage from two different sources, both of which

go through the height control R_{322}. The primary source is through R_{321} to the 250-v B+ source. The other source is through the thermistor R_{323} to *B* boost. If V_{9A} were not returned to B+, the oscillator would be slow in starting as *B* boost is the last voltage to be developed after the receiver is turned on. Therefore, no protective grid bias would be available for V_{9B}. This bias voltage is developed across the *RC* network in the grid of V_{9A}. With B+ available immediately to both sections, the oscillator will start, developing its protective bias, even though it may be running at reduced amplitude. When boost voltage is available from the *hv* supply, the oscillator will lock in at the proper amplitude and linearity. In addition a small amount of protective bias is incorporated in the triode output section by R_{316} which is bypassed by C_{303}.

C_{316}, a .47-mfd capacitor, is located across the deflection coil. This prevents pulses from the horizontal winding being coupled back into the vertical output tube. This large capacitor has a very low reactance at 15,750 cps, and acts as a short circuit to pulses of this frequency. However, the reactance is high enough at 60 cps to prevent severe loading. If horizontal pulses were allowed to feed back into the vertical oscillator circuit, it would disrupt interlace.

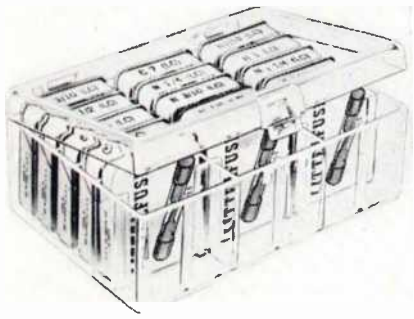
Retrace blanking is accomplished by developing a pulse in the vertical retrace plate PP_{200}. This pulse is developed by the discharge of C_{311} through R_{224} and C_{221}. This negative-going pulse is coupled to grid pin 5 of the 21CQP4 picture tube and is used to drive the picture tube into cutoff during vertical retrace time.

° ° °

PLASTIC FUSE CADDY

A PLASTIC caddy, designed to fit into a compartment in a tube caddy, has been announced by Littelfuse, Inc., Des Plaines, Ill. Contains an assortment of 15 *LC* (limited current) fuse types said to cover 94% of service requirements for this new type of fuse. Caddy has 3 spare compartments for carrying of additional fuses.

LC fuses have been developed to make it physically impossible to fuse equipment at a higher rating than the manufacturers originally intended.



AUDIO
INSTALLATION AND SERVICE
Phono • Tape • PA
Cartridges • Needles • Amplifiers • Speakers

Changing Needles In Phonos . . . Cures For Oscillator Drift In Radio - Phonos . . . Remedies For Vibration - Distortion Due To Mechanical Feedback‡ . . . Curbing Speaker-Grille Vibration . . . Magnetic - Head Shield Installation . . . Crystal - Ceramic Pickup Replacement With Magnetic-Types

FAILURE to replace promptly the sapphire stylus, which begins to deteriorate after approximately 100 hours of normal usage, can result in loss of the high frequencies, excessive noise or hiss. If the stylus is very bad, distortions will be evident which will usually result in record deterioration.

To replace either the 78 or *lp* stylus in DuMont phono models the small screw holding the stylus to the cartridge should be removed, the new stylus placed in position, and the small screw replaced.

If the phono is being played rather extensively, it may be more economical to use a diamond *lp* stylus replacement.

Cures for Drift in Radio-Phonos

SOME ISOLATED field complaints have been received regarding oscillator drift in DuMont RA-349 Tanglewood models, experienced when tuned to the high end of the AM radio dial.

It has been found that this condition can be corrected by replacing the oscillator coil with an improved type, which provides a larger oscillator injection voltage, thereby increasing AM sensitivity.

This replacement coil has been incorporated in all production units, with the exception of approximately the first hundred units.

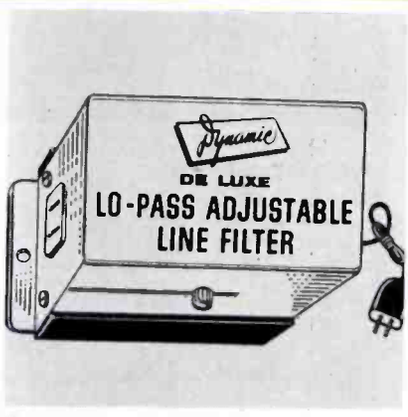
It is recommended that where the foregoing complaint is encountered, and tube and component tests fail to uncover the defect, the oscillator coil should be physically inspected to determine if it is the original part, which is approximately 2" high (the replacement is only 1" high) and is mounted to the chassis on a wooden dowel (the replacement is mounted on the chassis by direct soldering). If the original part is used, the replacement (part 21008121) should be installed.

Vibration-Distortion Remedy

WITH BASS in DuMont RA-335 Governor Winthrop phonos set from 70% to full, and the volume at 50%, it has been found that loud vibration and distortion, which occur in the sound, vibrates the changer so badly that the tone arm does not stay on the record. This fault due to accoustical (mechanical) feedback, can be remedied by checking the changer to be sure it is floating freely; i.e., the two changer shipping bolts (Phillipshead bolts on changer face plate) have been fully loosened.

If vibration continues, the two changer shipping bolts should be re-

CAST ALUMINUM BIDIRECTIONAL speaker baffle that is 11" in diameter, weighs 2 pounds and accommodates 8" speakers. Mounts to ceiling or wall. (Lowell Manufacturing Co., 3030 Laclade Station Road, St. Louis 17, Mo.



ADJUSTABLE LO-PASS line filter designed to eliminate noise picked up through ac or dc lines; automatic attenuation above 10 kc. Features a dual ferrite filter, and a variable filter adjustment control. (Model DAF300; Dynamic Electronics, Inc., 73 - 39 Woodhaven Boulevard, Forest Hills, L. I., N. Y.)

ALL-WEATHER wide-angle (30 w cont; 50 w peak) pa speaker with an acousti-matched built-in driver (reproducer) unit. Has a one-piece main flare and unit cover; a pressure moulding of reinforced polyester fibreglass. (Model CP-44 King Cobra-Jector; Atlas Sound Corp., 1451 39 St., Brooklyn 18, N. Y.)

moved completely, and the changer seated properly in position. (These bolts may then be reinserted providing they do not touch the side of the holes in the changer mounting board).

In some sets a cloth tape, 1" wide, has been used to secure the changer during shipment. This tape must also be removed to permit the changer to float freely.

Speaker Grille Vibration Checks

UNDER CERTAIN conditions, metal speaker grilles can produce annoying vibration when the phonos are in operation.

To eliminate this possibility, Magnavox has introduced several production modifications. To check the source of the trouble the phono should be played at maximum bass and high volume with either a test or an organ record. The spot causing the rattle may be located by moving the hand around the edge of the metal grille. When the correct location is determined, a small piece of sponge rubber or an equivalent sound-deadening material should be inserted between the metal grille and the trim.

In the Magnavox 293C and 294C, if the rattling is caused by the metal grille vibrating against the baffle board itself, it may be necessary to remove the metal grille and bow it from the sides about two inches. The grille should be replaced with the bow towards the baffle board.

In the 295C, if the rattling is caused by the metal grille vibrating against the baffle board, the metal grille should be removed and bowed inward from the sides about two inches. Also two sponge rubber strips (part 440993-2) should be cemented to the baffle board. These strips should be seven inches from each end of the baffle and cemented vertically. The metal grille should be replaced with the bowed side toward baffle board. Edges of the grille should be checked for rattles and eliminated by damping as set forth in the foregoing paragraph.

Handling Magnetic Head Shields

THE TR-2-5 TAPE mechanism used in RCA 7-HFR-1 and the TR-2-6 tape mechanism used in models 8-STP-1 and 8-STP-2 use head shields made of nickel-iron alloy.

These shields are hydrogen annealed after fabrication to impart the desired magnetic shielding properties.

The effectiveness of these shields is greatly reduced when subjected to shock, hammering or any other physical mistreatment. Extreme care must be exercised to prevent any rough handling. The shields must not be dropped.

If physical mistreatment occurs, it will show up as hum caused by magnetic radiation to the head; the effects of mistreatment can be overcome only by reannealing.

The metal covering of the head used in models 7-TR-2, 7-TR-3 and C-TRC-1 is made of mu-metal and requires the same handling precautions as the head shields.

Crystal-Ceramic Pickup Replacement with Magnetic Types

IN TRYING to substitute magnetic or variable-reluctance cartridges in place of crystal and ceramic pickups excessive hum often occurs.

This hum is mainly due to induction from the magnetic field of the drive motor. Crystal and ceramic pickups are unaffected by this magnetic field. Magnetic and variable-reluctance pickups must be provided with a preamplifier to obtain the equivalent output from the speaker. The hum is also amplified by the preamplifier.

To minimize hum when using magnetic pickups on RCA three and four-speed record changers (930409, 930800, RP-197 and RP-205 models) a four-pole motor and a heavy turntable should be used.

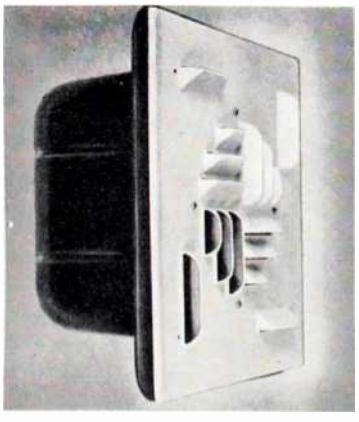
To minimize hum when using magnetic pickups on 45 record changers (RP-168 and RP-190) shielding must be provided and can be accomplished be either of two methods.

The motor can be shielded with a metal box, preferably of .020" steel. An inner box of non-magnetic metal will provide additional shielding. When such a box shield is added, it will also raise the impedance of the motor and reduce its torque. To overcome this difficulty, it will be necessary to raise the voltage applied to the motor. The power consumption of the motor should be measured

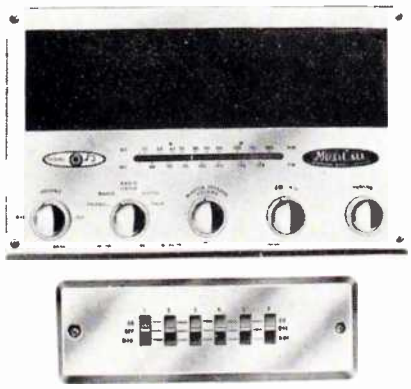
(*Continued on page* 39)

---

‡*Based on information supplied by* ***W. E. Whitacre****, Service Manager and* ***Jerome Roth****, Service Publications, Allen B. DuMont Laboratories, Inc.*



BASS REFLEX ENCLOSURE said to replace one standard acoustical tile when used in ceiling installations. Unit consists of a plaster ring, bass reflex enclosure and spiral sound faceplate which incorporates directional ports to provide a 360° dispersion pattern. Present model accommodates 8" speaker. (SBR 8 DS; Fourjay Industries, 2360 West Dorothy Lane, Dayton 9, Ohio.)



COMBINATION AM-FM-INTERCOM system which features an 8-tube ac-dc receiver with a phono-jack, a master station, separate control box for remote stations, three 5" interior speakers and one 4" front-door speaker-mike. All speakers have a volume control and a spring-controlled talk-listen switch. (Model 676M; Musicall Corporation, Los Angeles, Calif.)

TRANSISTORIZED PREAMP with a matched function output switch which controls the output levels, giving one a choice of either 1 or 3-v output, to provide optimum matching to any basic amplifier, both from a hum and noise standpoint, as well as to provide sufficient signal to drive a basic amplifier. (PR45; Madison Fielding Corp., 863 Madison St., Brooklyn 21, N. Y.)

TV Antennas

(*Continued from page* 16)

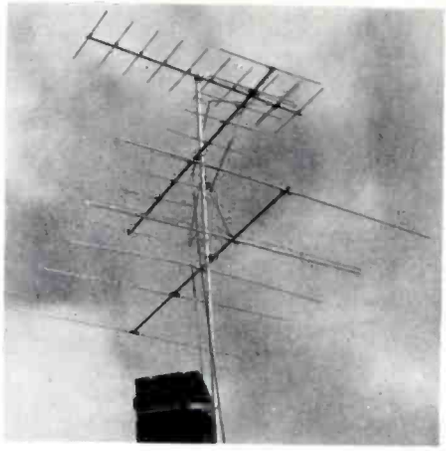
the antenna shows visible indications of *old-age*.

Then one can mount a control antenna (this need not be a permanent installation) and run a transmission line from the control antenna to a central point where immediate switching between the existing antenna and the control can be made. You will find that the set owner will be very much interested in observing this test.

By recording these readings on a direct basis, and taking similar readings after the antenna has been replaced, the set owner will be readily convinced of the need for a new antenna and will become an excellent advertisement for future antenna installations.

It is not necessary to recommend the replacement of the existing antenna with one of the same design. There are many areas where *cut-for-channel* antennas can be replaced

(*Continued on page* 39)



NEW INSTALLATION in which new antennas identical to those used in the original installation were employed. Improved pictures obtained with these antennas are shown on page 16.

Channel	Field Strength Meter Readings		Db Gain	
	Old Installation	*New Installation*		
3	42	99	7	(measured using standard
8	55	85	3.2	broadcast signal.)
3	35	88	8	(measured using mobile
8	50	80	4.1	laboratory signal.)

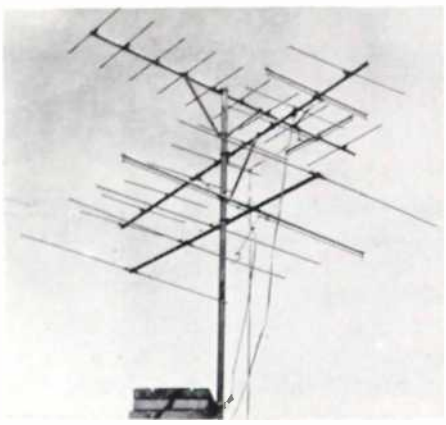
TABLE 1: COMPARATIVE READINGS obtained for new and old antennas. See page 16 for installation data.

ADVERTISERS IN SERVICE

JULY, 1957

TV Antennas

(*Continued from page 38*)



ORIGINAL ANTENNA installation consisting of models cut-for-channels; Taco 1850 and 1325.

with an all-channel antenna to provide full coverage of the stations now in the area.

Service Engineering

(*Continued from page 15*)

$4,000 worth of electronic gear on board.

Besides commercial gear, many boats are equipped with TV sets installed and serviced by Marine Radio. When riding the Pacific waves, TV stations can be picked up when 100 miles out to sea. The Los Angeles area amateur mariner has a choice of the seven TV stations in Los Angeles plus those in San Diego and Santa Barbara.

Audio

(*Continued from page 37*)

before and after adding such a box shield.

Another method is to add a steel plate approximately ⅛" thick between the mechanism and the motorboard.

In most all applications, a preamplifier must be used to provide amplification and equalization; a variable reluctance pickup is lower in output and impedance than crystal and ceramic pickups.

The pickup arm must be changed to accommodate the physical difference in pickups. In most cases, the mounting screws for ceramic and crystal pickups are ⅝" apart and for reluctance pickups they are ½" apart. Stylus type will depend on cartridge design; *turnover*, *slipunder* or *turnaround*.

The counterbalance spring must provide the correct stylus force. This force should be 7 to 9 grams on three and four-speed changers, or 5 to 7 grams on 45-changers.

PERSONNEL

L. F. HOLLERAN has been appointed manager, distributor products of the RCA electron tube division. JOHN B. FARESE is now manager of entertainment tube products, and C. E. BURNETT has become manager of industrial tube products in the tube division.

Holleran

Farese

° ° °

WARREN HOWE has been appointed market analyst of the Belden Manufacturing Co., Chicago.

° ° °

JOHN MESSERSCHMITT, formerly in the renewal tube sales division of Amperex Electronic Corp., 230 Duffy Avenue, Hicksville, L. I., has been made assistant to FRANK RANDALL, vice president and general sales manager.

° ° °

ROBERT BEEBE has been named head of the communications antenna sales division of Ward Products, a division of Gabriel Co.

Beebe

Burroughs

LOUIS R. BURROUGHS has been elected vice president for broadcast and recording equipment at Electro-Voice, Inc., Buchanan, Mich. Burroughs, former E-V chief engineer, has been with E-V since its inception in 1927.

° ° °

SAM W. ARCHER has been promoted to assistant general sales manager-merchandising of the United Motors System division of General Motors Corp., Detroit 2.

° ° °

SYDNEY W. MORRELL is now vice president in charge of public relations of International Telephone and Telegraph Corp., 67 Broad St., New York 4, N. Y.

° ° °

ROBERT I. MENDELS has been elected president of Electronic Devices, Inc., 429 12th Street, Brooklyn, N. Y.

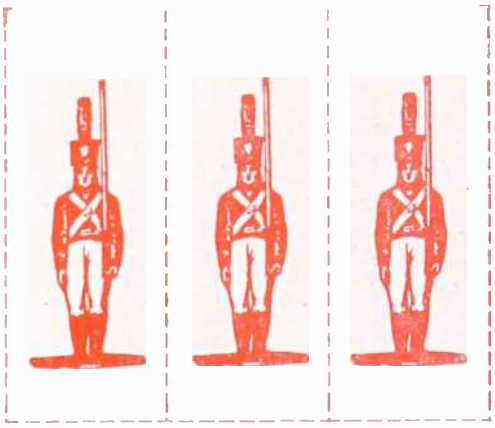
° ° °

HERBERT A. BODKIN has been appointed sales manager of Electrovox Co., Inc., 60 Franklin St., East Orange, N. J.

performance matched test equipment

for black and white

and ALL COLOR TV TESTING



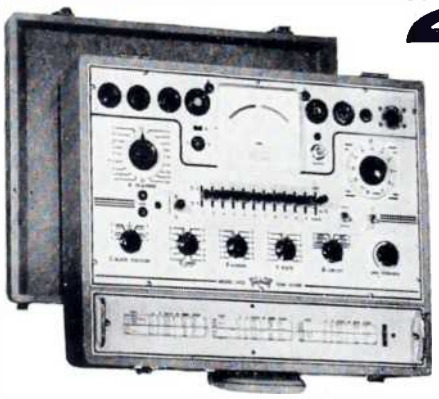
basic ! fundamental ! essential !

1

MODEL 631 VOM-VTVM

two in one tester for 100% service—VOM covers 90% of your usage, battery operated VTVM available for the other 10% when you need it. **$64.50**

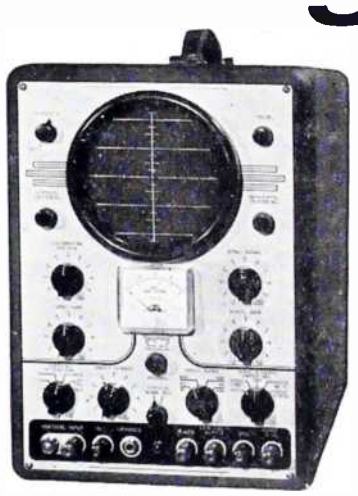
2



MODEL 3423

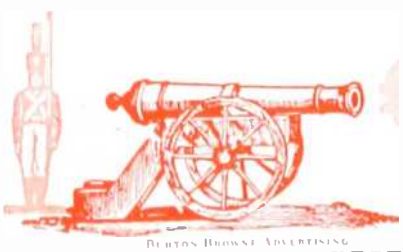
four in one—mutual conductance tube tester, transistor tester, germanium diode tester, selenium rectifier tester —checks for accuracy as circuit demands depending on the tolerance of the circuit. The patented circuit for the tube testing employs actual signal (4KC) for grid and DC bias voltage making it independent of line voltage hum. It also has a complete coverage of all tube types—six plate voltages (including 0-10 variable). Micromhos scales read 0-1,800, 0-6,000, 0-18,000 and 0-36,000. Leakage measured directly on meter 0-10 megohms. **$199.50**

3



MODEL 3441-A

three in one scope—oscilloscope, peak-to-peak meter, audio oscillator — essential for more than 50% of your Black and White Servicing—all Color Servicing. 10 mv sensitivity. 4.5 mc bandwidth. **$249.50**



TRIPLETT

These three units provide the ideal basis for the complete servicemen's test setup for black and white *and* color TV. You will want to consider also Model 3438 Dot Generator, Model 3439 Color Bar Generator, Model 3434-A Sweep Generator and other Triplett units.

TRIPLETT ELECTRICAL INSTRUMENT COMPANY • BLUFFTON, OHIO

631
Combination V O M—VTVM

630-NA
For Best Testing Around the Lab, Production Line or Bench

630
The Popular All-Purpose V-O-M

630-A
A Good Lab and Production Line V-O-M

310
The Smallest Complete V-O-M with Switch

630-T
For Telephone Service

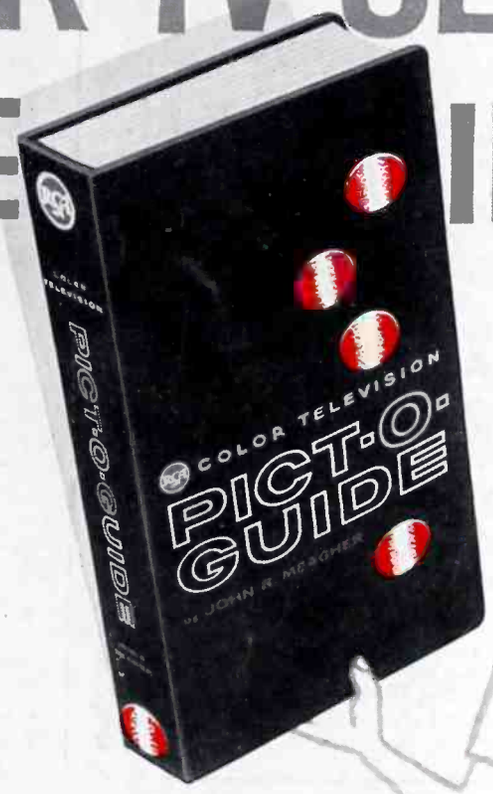
666-HH
Medium Size for Field Testing

625-NA
The First V-O-M with 10,000 Ohms/Volt AC

666-R
Medium Size with 630 Features

Just Arrived!

THE MOST USEFUL, PRACTICAL AID TO COLOR-TV SERVICING IN THE INDUSTRY



- Speeds up, simplifies installation, adjustment, and servicing of color-tv receivers
- Saves time in localizing color-tv troubles
- Profusely illustrated in full color, and monochrome
- Sturdily bound in lie-flat, multiple-ring covers

FREE OF EXTRA CHARGE WHEN YOU BUY RCA TOP-QUALITY RECEIVING TUBES!

Here's *practical* information on Color TV. Clearly written by John R. Meagher, RCA's nationally recognized authority on TV servicing and originator of the famous RCA Pict-O-Guide for black-and-white TV. It's profusely illustrated with full-color photos taken from an operating color-TV receiver. Step-by-step instructions and diagrams provide many labor- and time-saving short-cuts for *profitable* color-TV servicing. Build up your share of the dynamic color-TV service market with the new PICT-O-GUIDE. Get your copy from your RCA tube distributor...today!

NEW COLOR-TV PICT-O-GUIDE CONTAINS SECTIONS ON:
· Color Mixing · RCA Compatible Color TV System · Purity · Convergence · Gray-Scale Tracking · Color Operating Controls · Antenna Considerations · RF-IF-Bandpass Alignment · Color Test Equipment · Color-Bar Patterns · Troubleshooting · Signal Tracing · Interference · "Green Stripe" Test Signals

RCA® RECEIVING TUBES
RADIO CORPORATION OF AMERICA
Electron Tube Division Harrison, N. J.