RADIO & TELEVISION NEWS

JANUARY
1951
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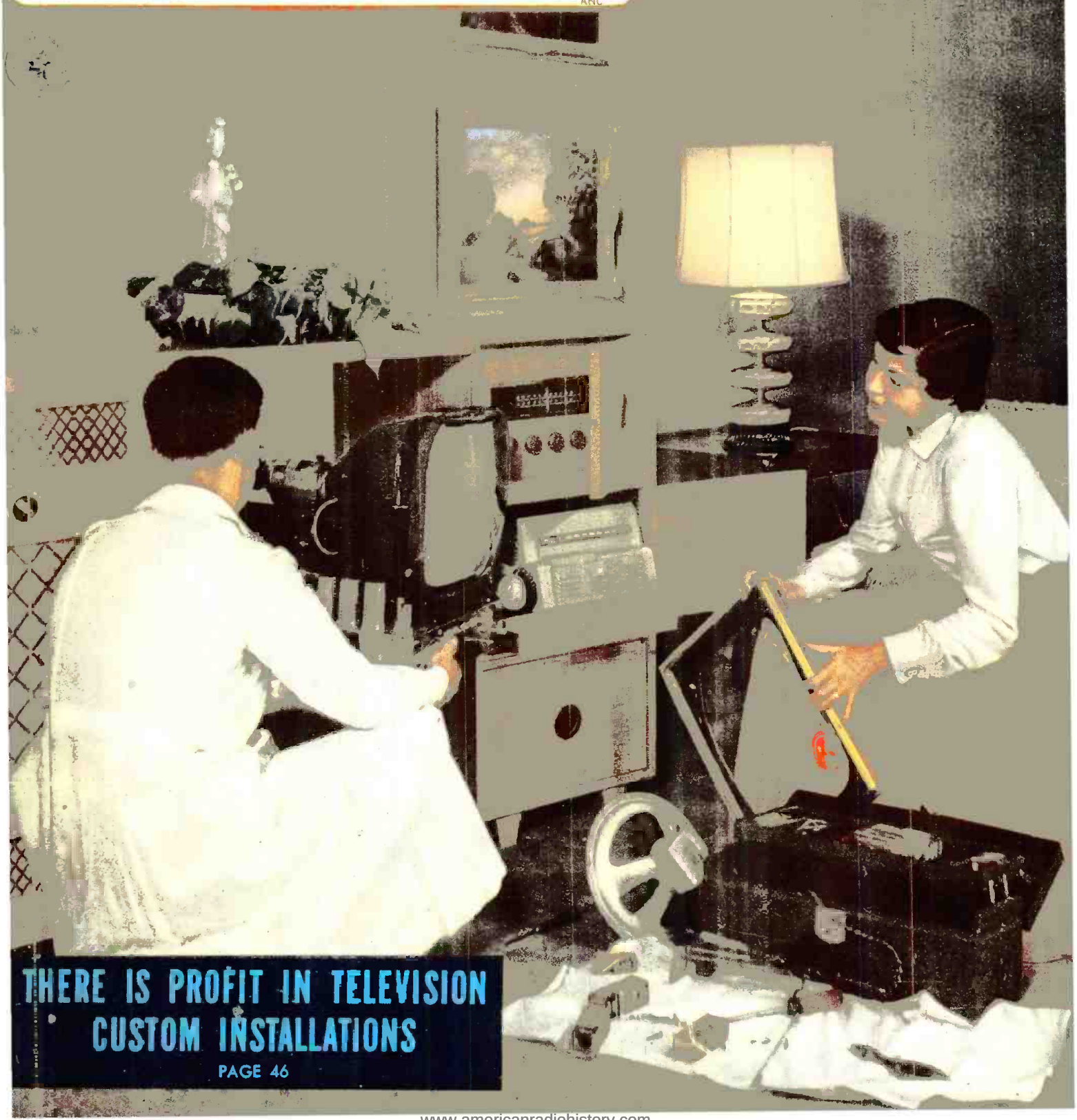

THERE IS PROFIT IN TELEVISION CUSTOM INSTALLATIONS

PAGE 46

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COVER PHOTO: Making final adjustments on a custom installation. Housed in Jensen "Customode" cabinets are, Jensen speaker, Radio Craftsman 16" TV set and AM-FM radio, and Talk-A-Phone "Chief" intercom with handset. A Milwaukee Stamping record changer is housed in bottom drawer. (Kodachrome by Art Haug)

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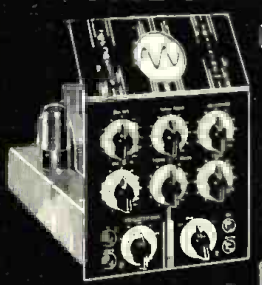
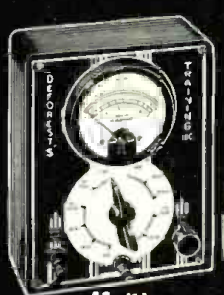


Oscilloscope

R-F Signal Generator



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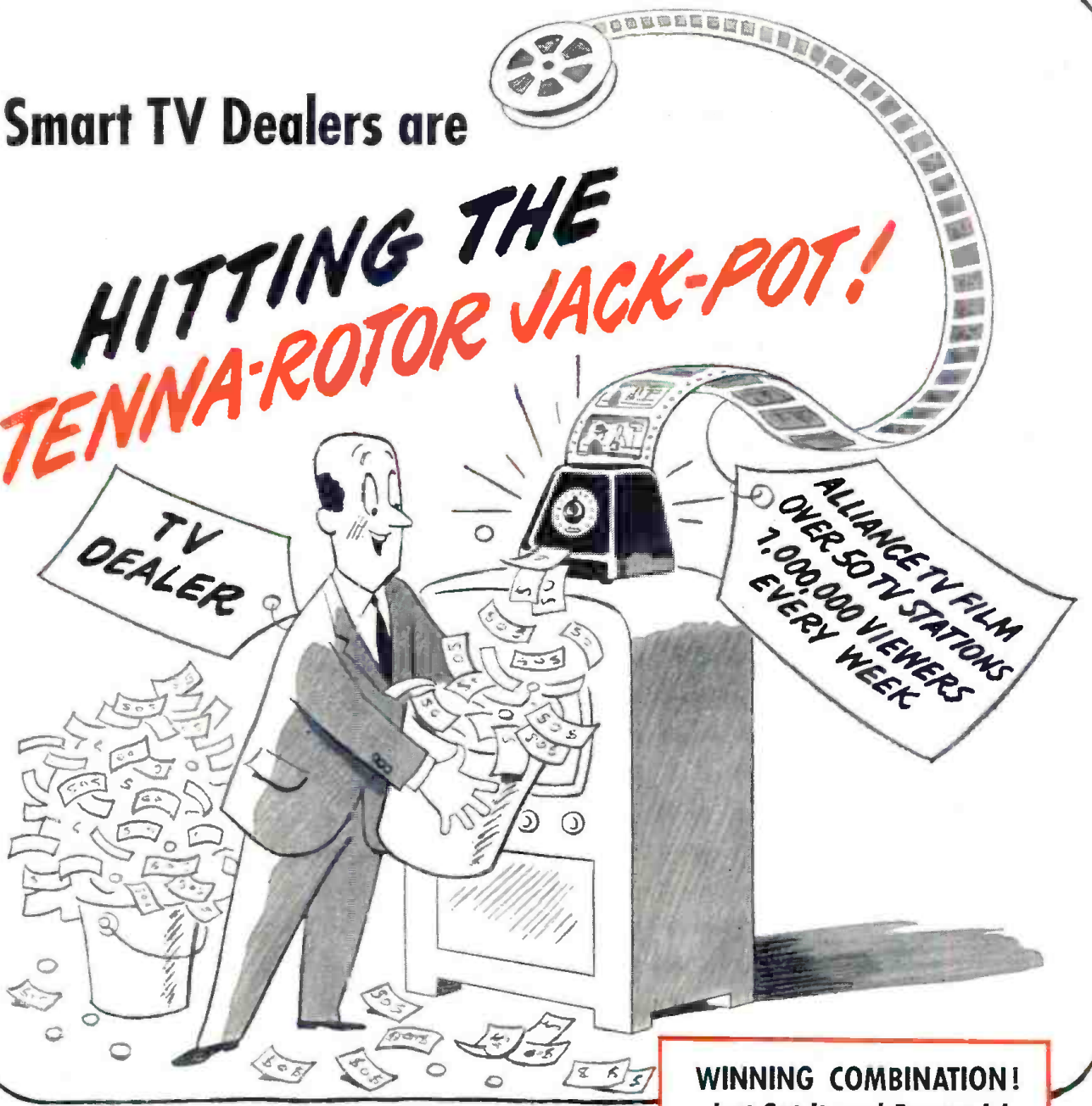

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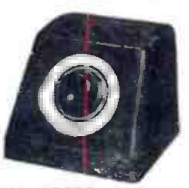

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For the RECORD

BY THE EDITOR

NEW AUDIO MAGAZINE SCHEDULED FOR MARCH

THE initial response to our recent announcement of plans to publish a new Audio Edition of RADIO & TELEVISION NEWS has been most gratifying. Ever since the publication of our annual audio issues, we have found an ever increasing interest in the many aspects of sound and related audio subjects. In attempting to satisfy all of our readers, we found that not nearly enough space was available, even in an annual audio issue, to adequately cover all of the new developments and techniques that have jelled in recent months.

In a few instances, however, the announcement was received with mixed emotions and a fear was expressed that we were going to discontinue audio subjects in RADIO & TELEVISION NEWS, placing such articles in the Audio Edition. Such is not our intention at all. Here's the reason:

We know that a large percentage of our 208,000 monthly readers have a common interest in audio, but there are many others whose preference is for service material on radio and television, amateur radio gear and gimmicks, various television subjects, communications, and for a general all-around coverage of radio and television. Accordingly, it is our responsibility to serve all interests to the best of our ability in the regular edition of RADIO & TELEVISION NEWS. We intend to continue with that policy and no changes are contemplated.

We are not disturbing the format of RADIO & TELEVISION NEWS. We are simply going to publish a new magazine, designed specifically for the audio reader who wants additional articles on audio and all its facets.

This "magazine within a magazine" means economy of production and permits the publisher to produce the material at but slight additional cost to the reader. It will be designed in similar fashion to our Radio-Electronic Engineering Edition, which is available by subscription only to engineers and persons interested solely in engineering subjects. The new magazine, *Audio*, will not be sold on the newsstands, but will be limited solely to those readers of RADIO & TELEVISION NEWS who wish the additional magazine, which will be bound within the regular edition.

The foremost audio writers in the country are already preparing material for the new edition. There will be at least five feature articles each month in the Audio Edition. Present plans call for the first edition in March 1951, providing total mobilization or curtailment of paper does not interfere.

We have made arrangements with Dr. Howard Tremaine, of the University of Hollywood, to write a complete course on audio. Here, for the first time, will be a common sense approach to a thorough understanding of all phases of audio. We believe that this series will be most profitable, not only to the student of audio, but to the engineer because of its review value.

Production Threatened by Shortages

The year, 1951, finds the entire television industry facing severe curtailments in production as the result of our defense program and the scarcity of cobalt, aluminum, and other materials and components. This curtailment of production is another real reason for sitting tight until Industry can come up with a compatible television system. As a matter of fact, this period of shortages may actually force the FCC and the Industry to shelve immediate plans for color television.

Copper is high on the scarcity list, and if the *CBS* System of color television is to hold the green light, many thousands of motors requiring copper in their construction will be required for the color disc scanner. Even now, there is a scarcity of motors of all types. Even though at this writing *CBS* has been stopped from commercial color telecasting, the FCC may eventually win out in its determined effort to give the American public the *CBS* color television system without further delay. It is also quite possible that as you read this, Industry will have perfected a compatible electronic system that may ultimately win out by sheer competition over the *CBS* system.

Color or no color, the television industry is in for a tough year and must face many hardships, if it is to continue at an adequate rate of production.

Service technicians, in the year ahead, have their greatest opportunity. Millions of television sets are not giving proper performance in the home, and authorities have estimated that approximately 70% of all television sets now in use are in need of proper realignment and other adjustments in their circuitry. Speaking of shortages, no one will challenge the statement that we still are in need of many thousands of trained television technicians, not only to take care of the 10,000,000 sets now in use, but as replacements for industry technicians called into service. Never before, and perhaps never again, will there be such an opportunity. Yes, 1951 should be a boom year for the technician. . . . O.R.

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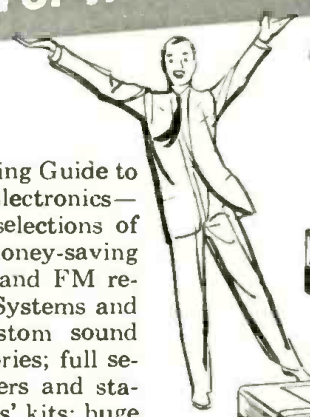

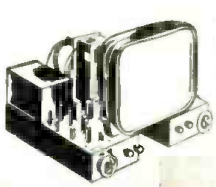

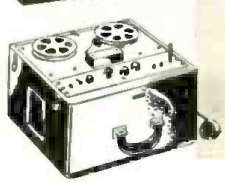

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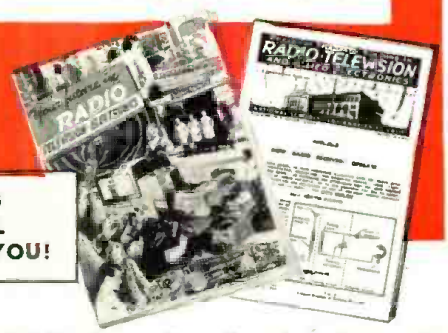

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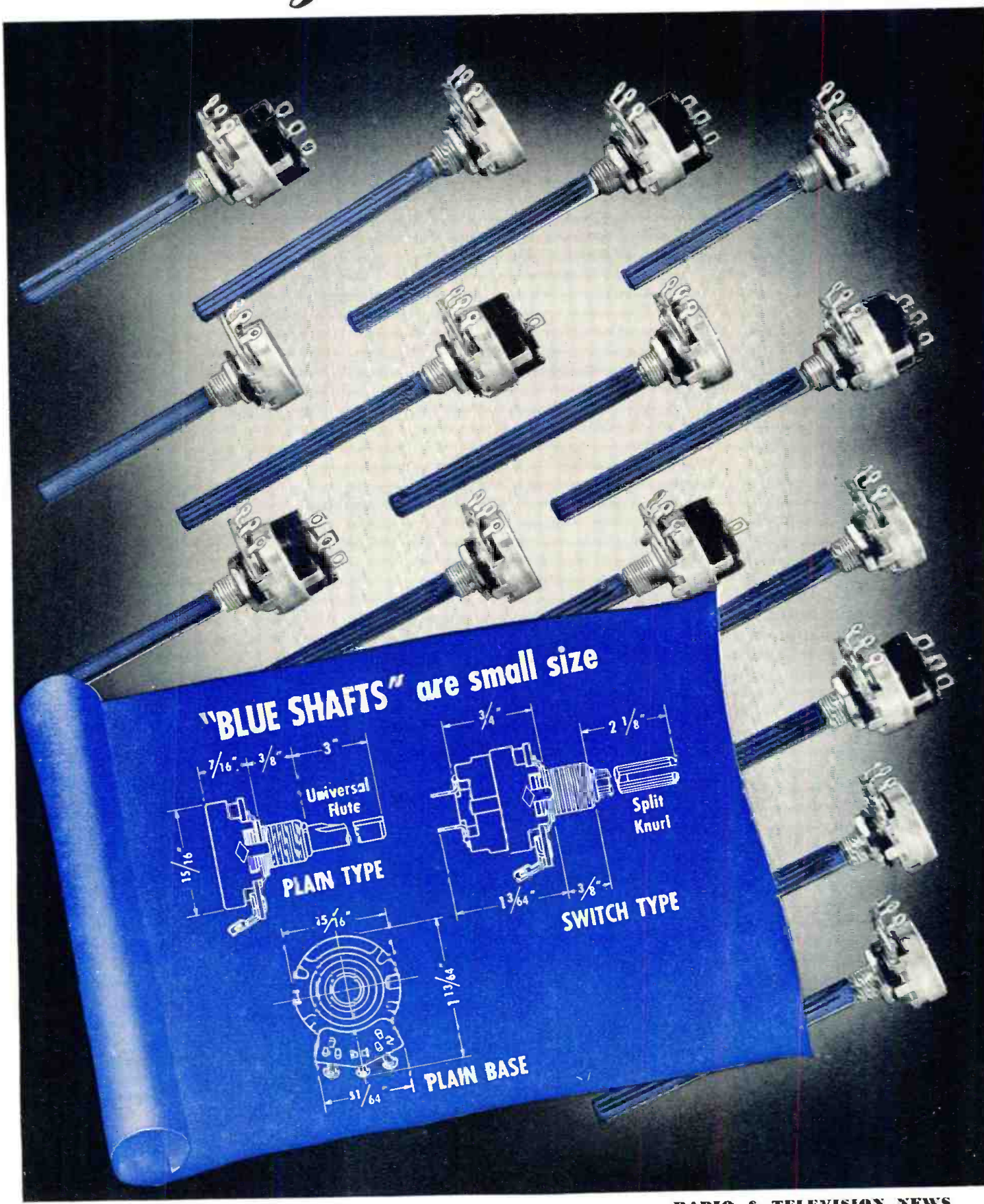

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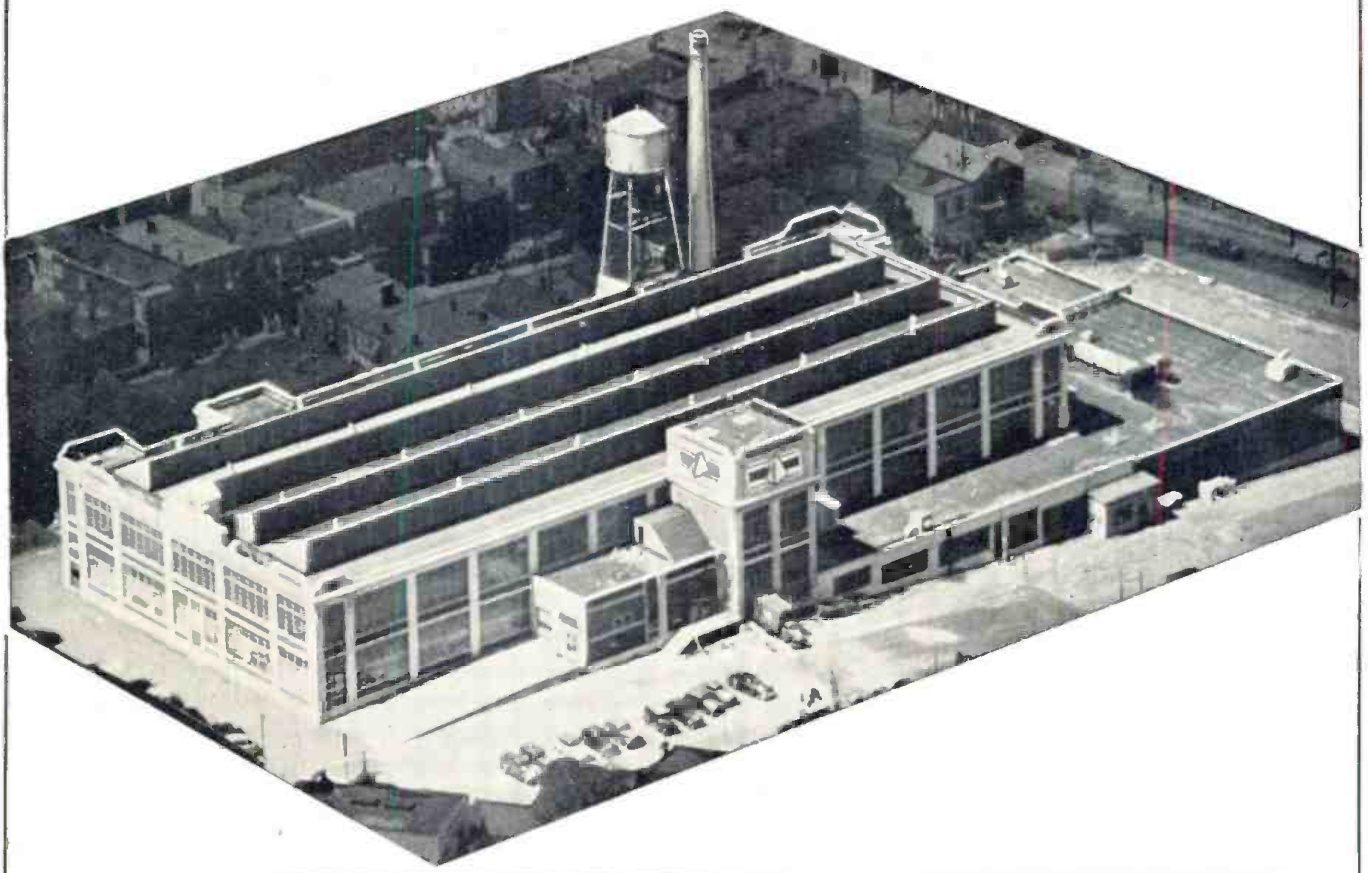

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★ *Presenting latest information on the Radio Industry.*

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

THE CHANNEL ISSUE, the original reason for the call of the allocation hearings, which was pigeon-holed for nearly a year by the vexing color debate, finally reached the discussion stage shortly before election day and appeared to be headed for a typical Washington festival of invectives. In the wrangling mill have been dropped such sizzling questions as . . . shall the present bands be continued and on what basis, or shall we rearrange and mix the channels with stations on the higher frequencies, or shall we extend the present bands to the, let us say, 300-megacycle region, now held in part by the military and simply forget the ultra-highs, or shall we add more stations to the present setup, allow less spacing between some stations in some territories and delay the ultra-high program indefinitely, or shall we use the program proposed by the Commission and add 42 channels to the higher bands, allow a specified intermixing of high and low bands in some areas, and insist on more separation between stations on the present bands. After several rounds of heated testimony, with ayes and nays bouncing from all sides, confusion in the hearing halls was quite rampant. Oddly enough, the replies offered appeared to have considerable merit. For instance, when Paul Raibourn, prexy of *Paramount Television Productions,* concluded his commentary, even the government's experts stared and appeared to wonder if an answer could be found. Seems as if Raibourn remembered his legal history very well and recalled that in the early days of AM development, an effort had been made through law by the so-called Davis amendment to freeze the frequencies and classification of stations, including power and hours of operation, into a rigid geographical formula by a system of zoning. Economic support could not be obtained in many of the less populous areas, while the demand for frequencies in the larger markets developed with increasing intensity. Accordingly, on the Commission's recommendations, Congress abandoned this statutory straitjacket, according to Raibourn, and placed upon the Commission the responsibility of insuring an equitable distribution of facilities, based primarily on demand. In the opinion of Raibourn, while it may have been that the pattern of nationwide broadcast coverage would ultimately have been enhanced in some areas if the AM frequencies had been withheld for a decade or more, it is doubtful whether there would have been the fullest development of competitive opportunities had not the more populous areas been permitted to make the fullest utilization of the AM frequencies. It was then pointed out that perhaps the important significance of the experience under the Davis amendment was the fact that the Commission found, in the early development stage of sound broadcasting, that geographical formulas were unduly restrictive. In the present stage of television development, disclosed Raibourn, *Paramount* felt that the assignment of the ultra-high frequencies would be even more restrictive.

Citing several interesting personal experiences in present band reception, the film executive said that he has been able to pick up signals from Washington, a distance of 245 miles away from his home, the pictures being equal to those from the Bridgeport ultra-high transmitter nine miles away. Pictures from Channel 3 in Philadelphia were also often found to be equal in enjoyment to the upper v.h.f. channels in New York. Adjacent channel interference didn't seem to bother the receivers in his home, Raibourn reported. He felt that existing standards of separation, developed in '45, were still proper and could continue to be used if receivers were made with higher tuning discrimination. The receiver design criteria needed to permit the existing channel allocation to continue were not extreme or difficult, the *Paramount* official declared.

Describing his views on the higher-band problem, Raibourn said: "As regards the proposed ultra-high allocation plan, and particularly the fact that major economic and population centers were not assigned channels, it is my fear that the u.h.f. as a broadcasting medium will not develop rapidly to the degree of which it is capable. Even when it does, the u.h.f. stations will stand in relation to the entire scheme as the clear-channel stations do now in the AM broadcasting structure."

Somewhat of a contrary view appeared in the testimony of Albert F. Murray, appearing on behalf of *Philco,* who reported that the residents of

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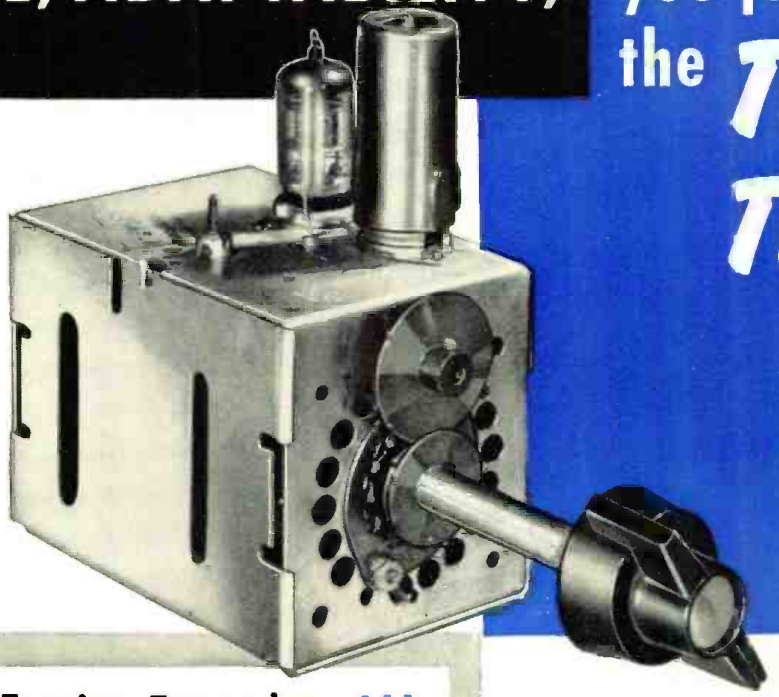

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Bridgeport and vicinity could receive excellent television service a greater percentage of the time from the present ultra-high station than they could from any New York City station and that, in addition, they could enjoy the advantages of much less ignition interference, practically no diathermy interference, lower and less-costly antenna structures, and smaller high-gain antennas. However, there were some u.h.f. disadvantages which must be considered, too, he said. For instance, the receiving antenna position is much more critical; swaying due to wind can cause signal variation. The shadow effect is also more noticeable, and the absorption of buildings and trees is greater, too.

Murray disclosed that he used a *Philco* 48-1001 table model set, equipped with a fixed, cavity-tuned converter and three types of receiving antennas; the usual dipole, a Yagi, and an eight-element stacked array with a reflector. To connect the antenna with the receiver either of two lengths of 50-ohm RG-9/U coax cable were applicable, one having a 2 db. loss and another a 3 db. loss. A motor-driven rotator served to select the proper pickup point. The directional higher-gain antennas were found to provide the best results.

Still another opinion on the ultra-high situation was offered by the industry's official association, the TBA, which asked that the Commission assign 70 channels for the higher bands in the entire 470 to 890 megacycle band, so that manufacturers could plan now in their design and production of receivers for the coming year.

Reviewing how they arrived at their proposal, the association declared that they felt that there should be at least four stations in each of the first 140 metropolitan districts, and at least as many stations in each metropolitan district and community as specified by the Commission. Spacing could be determined by considering where oscillator interference would be expected, using 58 and 75 mile separation as a basis of planning. The proposed RTMA intermediate frequencies of 41.25 mc. for the sound carrier and 45.75 mc. for the picture carrier served as a medium of reasoning for this approach. Explaining this point, the association said that with the considered intermediate frequencies, oscillator interference may be caused seven channels above the desired channels when the receiver is tuned to the desired channel; and two channels, the fourteenth and the fifteenth above the desired channel, are capable of creating image interference in the desired channel. The fifteenth channel image is the more damaging and with the receiver attenuations considered at this time to be feasible, geographical separation of stations assigned fifteen channels apart should be 75 miles or more. Signals, fourteen channels above the desired signal, will also cause image interference, but in this

(*Continued on page* 139)

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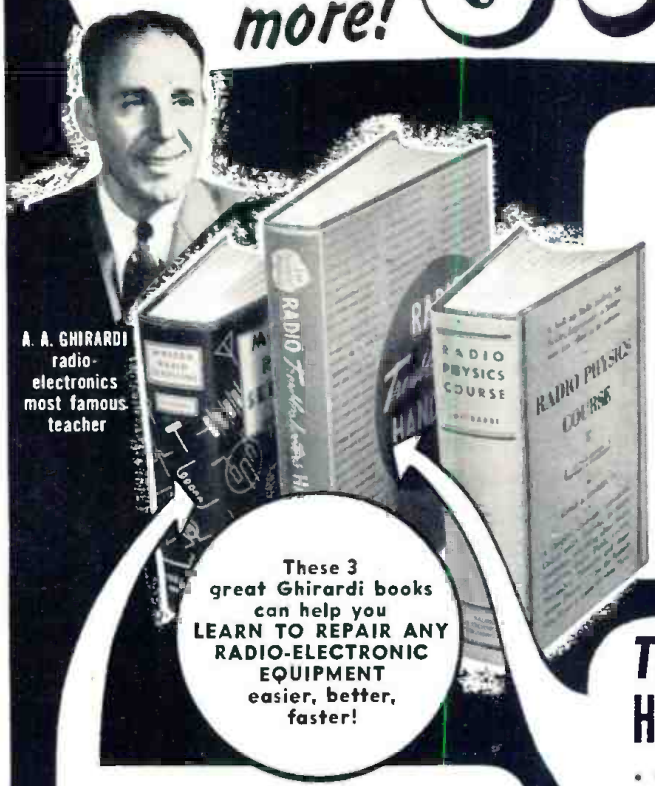

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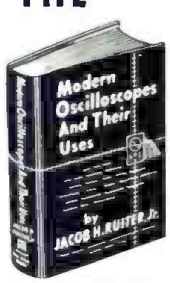

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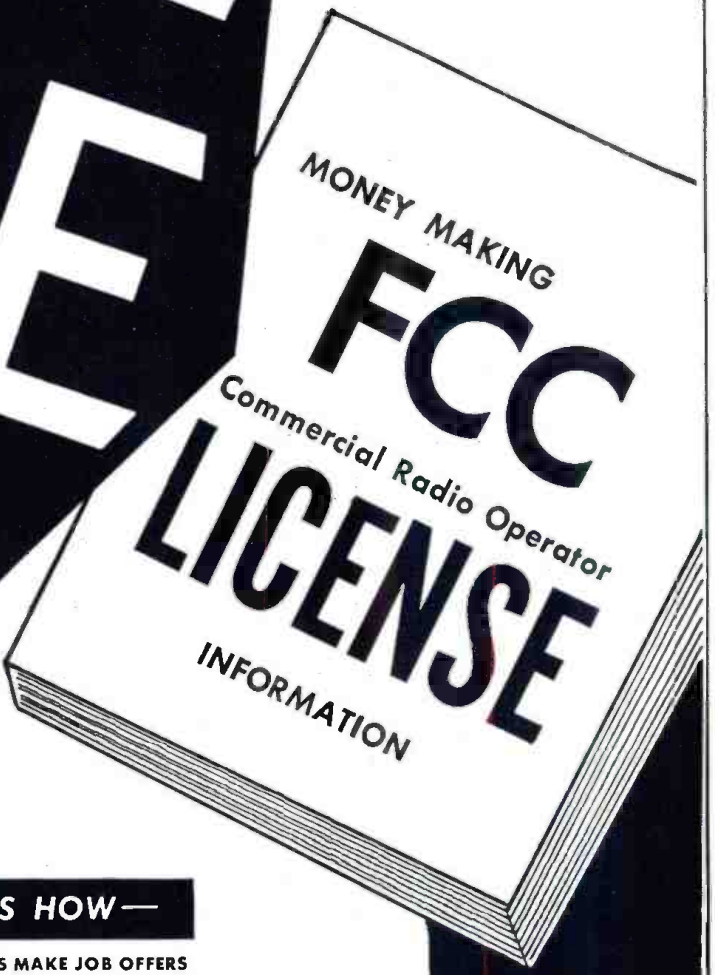

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S/Sgt. Ben H. Davis, 317 North Roosevelt, Lebanon, Ill.	1st Phone	28
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Letter, August 12, 1950, from Dir. Radio Div. State Highway Patrol. "We have two vacancies in our radio Communication division. Starting pay $200; $250 after six months' satisfactory service. Will you recommend graduates of your school?"
Letter, August 24, 1950, from radio-television sales and service company, Ohio. "We are in need of a good television man. The pay will be good, also good surroundings to work in. Please let us hear from you."
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Within the INDUSTRY

JOHN WILLIAM WALT, assistant advertising manager of *Admiral Corporation* since February 1949, has been promoted to the post of sales promotion manager for the company.

In his new position, Mr. Walt will have charge of the general promotional activities for the company including the handling of display advertising, national conventions, and printed matter.

Prior to joining *Admiral*, he was affiliated with *Webster-Chicago* as promotion manager for two years and served in a similar capacity with *Westinghouse* for one year.

During World War II, Mr. Walt served in the U. S. Navy for four years, entering service from the Chicago branch of *RCA Victor* where he was advertising manager from 1937 to 1941.

* * *

I. J. KAYLE AND ASSOCIATES, INC., has been recently formed in Chicago by I. J. Kaluzna and Sol Miller for the purpose of engineering and installing master television antenna systems for apartment buildings and commercial establishments. The company has offices at 1313 West Randolph Street in Chicago . . . **SIGHTMASTER CORP.** has announced its withdrawal from the television receiver manufacturing field to devote all of its facilities to the production of television glass . . . **THOMPSON PRODUCTS, INC.**, of Cleveland, Ohio, has entered the electronic field and will manufacture, sell, and service coaxial switches. The company has long been prominent in the automotive and aircraft parts field . . . **TRAD TELEVISION CORPORATION** has acquired control of the **WIL-RAY PRODUCTS COMPANY**, manufacturers of television cabinets. The new affiliate has been renamed the **TRAD CABINET CORPORATION** and will continue to produce cabinets at its Marlboro, New Jersey plant . . . **WHOLESALE ELECTRONIC SUPPLY** has recently opened its doors at 2800 Ross Avenue in Dallas, Texas to serve radio and television dealers, technicians, and industrial accounts in the northeast Texas area. John N. Leedom and M. B. "Pat" Patterson, both widely-known industry figures, are the principals in this new firm.

* * *

NEDA, through its president Arthur C. Stallman, has announced the establishment of an annual award to be bestowed on the person or persons in the electronic parts and equipment industry "whose work and/or activities in our industry directly improve and enhance manufacturer-representative-distributor relations."

Complete details on the award program will be announced following the next meeting of the organization's executive committee.

* * *

C. W. HIGBEE, manager of the electrical wire and cable department of *United States Rubber Company*, was recently elected president of the National Electrical Manufacturers Association.

Five vice-presidents were chosen in the same election and the following men will serve during 1951: Arthur A. Berard, president of *Ward Leonard Electric Co.*; J. H. Jewell, vice-president of *Westinghouse Electric Corporation*; J. F. Lincoln, president of *The Lincoln Electric Co.*; R. E. Murphy, vice-president in charge of sales for the *I-T-E Circuit Breaker Company*; and Alan F. Sheldon, vice-president and general manager of the *Kennecott Wire & Cable Company*.

L. G. Hall, president of *Stackpole Carbon Company*, was chosen treasurer.

* * *

JAMES M. TONEY, advertising manager of the *RCA Victor* Home Instruments Department, has been appointed director of public relations for the *RCA Victor Division*.

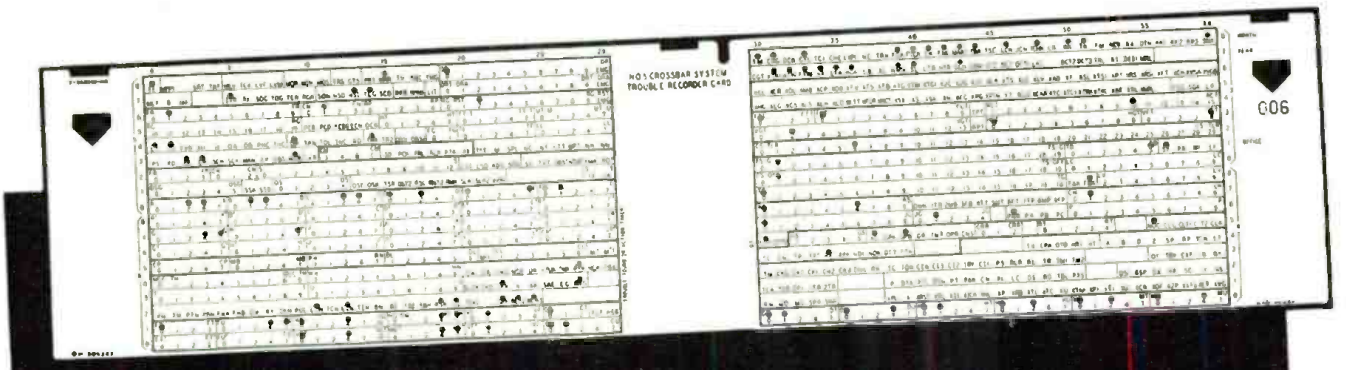
Mr. Toney succeeds John K. West who resigned to join the *National Broadcasting Company*, an *RCA* subsidiary, as vice-president in charge of its western division.

The new director of public relations brings to his new position a varied experience in the advertising, publicity, and public relations fields. He joined the company in 1943 as an expeditor in the Purchasing Department, working in the Chicago office. Since that time he has held diversified posts in the sales and advertising departments of the company.

* * *

IVAN S. COGGESHALL, general traffic manager of *Western Union Telegraph Company's* overseas communications, was named president of the Institute of Radio Engineers for 1951. He succeeds Raymond F. Guy, manager of radio and allocation engineering for the *National Broadcasting Company*.

Jorgen C. F. Rybner of Copenhagen was named vice-president succeeding Sir Robert Watson-Watt of London in



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Maintenance men examine the reports at intervals and learn what needs attention. Between times they go about their own duties in keeping service moving.

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this post. Directors elected by the Institute for 1951 include: William H. Doherty, director of electronic and television research for *Bell Laboratories;* George R. Town, associate director of the engineering experiment station at Iowa State College; Harry F. Dart, office manager of the electronics department of *Westinghouse Electric Corporation;* Paul L. Hoover, head of the department of electrical engineering, Case Institute of Technology; William M. Rust. Jr., head of geophysics research for *Humble Oil and Refining Company;* and Allan B. Oxley, chief engineer of *RCA Victor Company.* The following directors will continue to serve on the board during 1951: S. L. Bailey, R. F. Guy, W. L. Everitt, D. G. Fink, W. R. Hewlett, J. W. McRae, H. J. Reich, F. Hamburger, Jr., J. D. Reid, and A. V. Eastman.

* * *

AUSTIN ELLMORE, formerly director of sales and engineering for *Crescent Industries, Inc.* of Chicago, has been upped to the post of vice-president in charge of sales and engineering for the speaker, record player, and wire recorder firm.

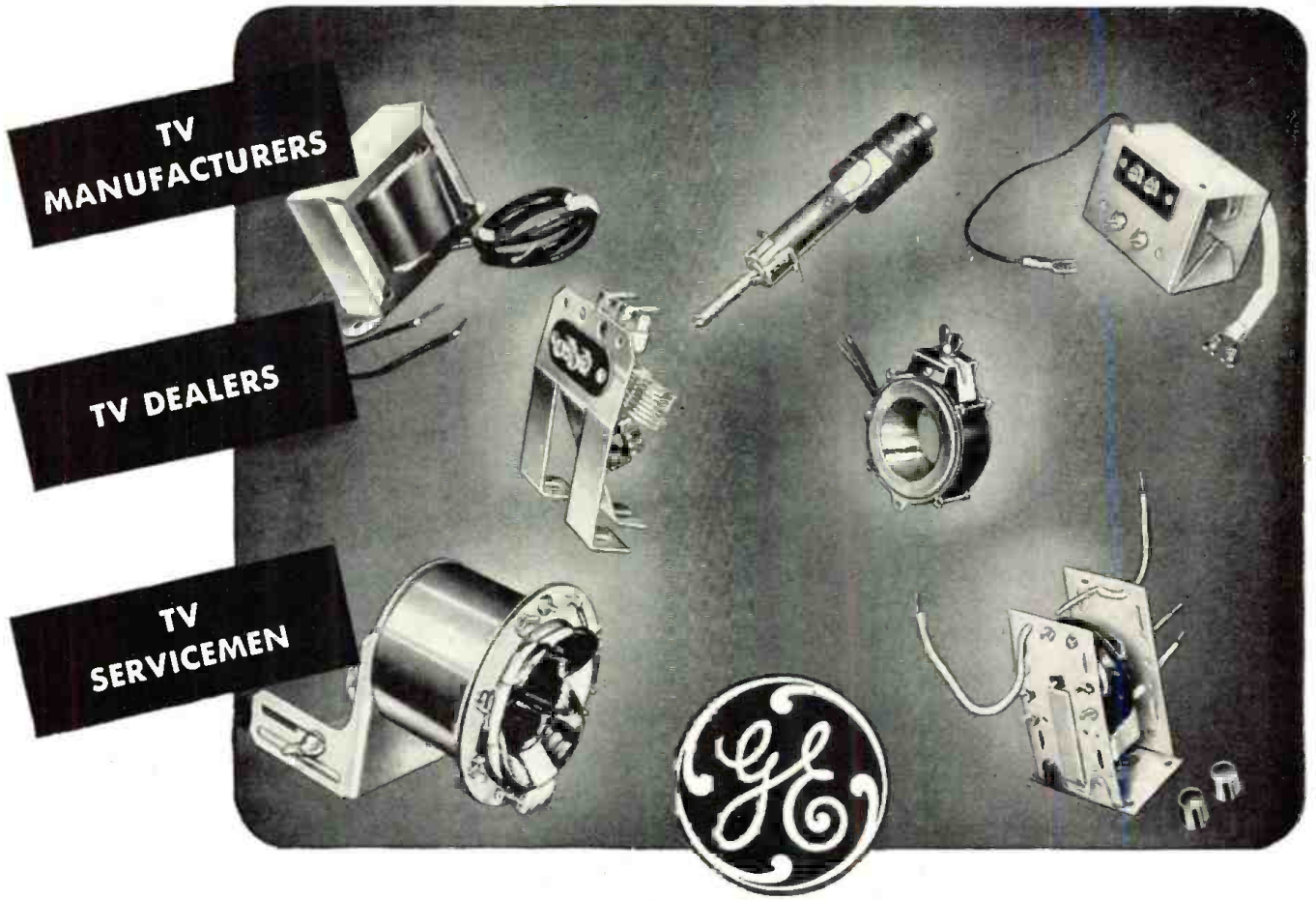
Mr. Ellmore, who joined *Crescent* three years ago, is well-known as an audio and acoustics engineer and for his work as chairman of the Committee on Acoustic Devices and the Committee on Speakers of the RTMA's Engineering Department.

Prior to his present association, Mr. Ellmore spent 18 years at *Utah Radio* where he was vice-president in charge of the *Utah Radio Products Division* of *International Detrola Corp.*

* * *

RADIO RECEPTOR CO., INC., has just purchased a 90,000 square foot factory structure at Wythe Avenue and North 3rd Street in Brooklyn. The company's sales offices will continue at 251 West 19th Street, New York . . . **PHOENIX ELECTRONICS, INC.,** recently took over enlarged quarters in Lawrence, Mass., to provide new production facilities to take care of the demand for its line of TV antennas and hardware . . . **RICHARDSON-ALLEN CORPORATION,** manufacturers of selenium rectifiers, battery chargers, etc., has moved to new quarters at 116-15 Fifteenth Avenue, College Point, Long Island, New York . . . **ARTHUR ANSLEY MANUFACTURING COMPANY** of Doylestown, Pa., has completed work on a new building adjoining its former plant. The company will manufacture cabinets for its line of phonographs in the new structure . . . **HUDSON WIRE COMPANY** has established a magnet wire plant in Cassopolis, Michigan, to handle the requirements of its midwestern and far western customers . . . **WESTINGHOUSE ELECTRIC CORPORATION** has opened negotiations for a tract of land near Baltimore's "Friendship Airport" on

(*Continued on page* 137)



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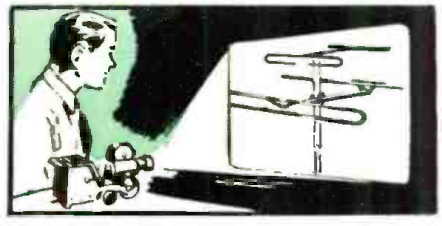

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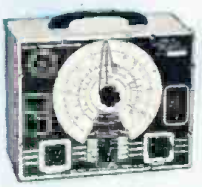

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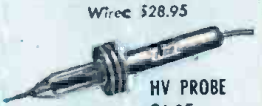

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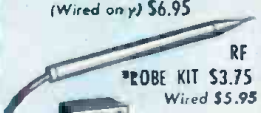

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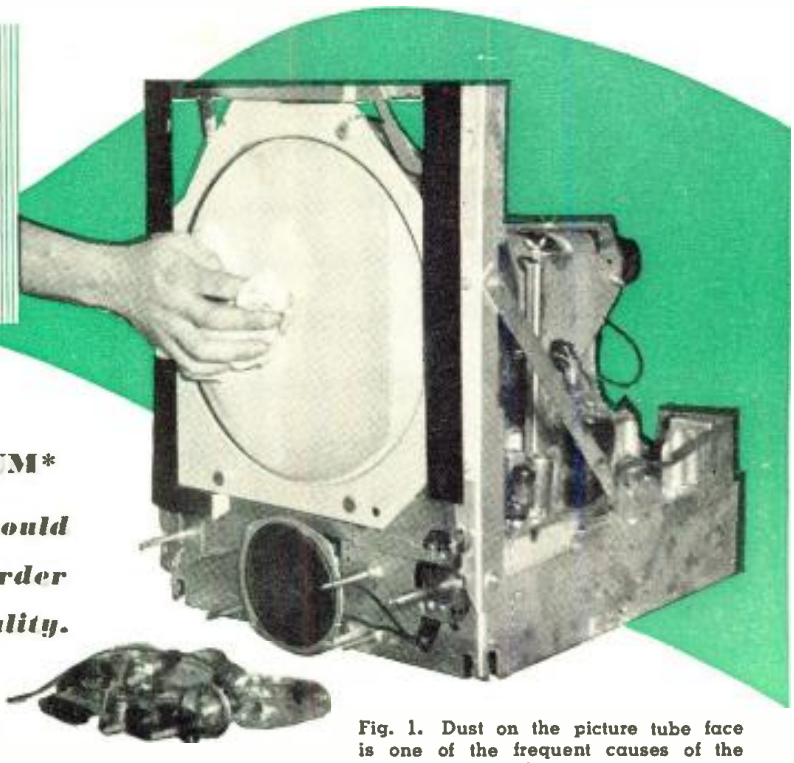


Fig. 1. Dust on the picture tube face is one of the frequent causes of the complaint that the pictures are dim.

By
WALTER H. BUCHSBAUM*

Unlike AM radios, video receivers should be checked at least once a year in order to restore their new-set picture quality.

IN 1948 over a million television receivers were sold, and an additional two million sets found their way into American homes in 1949. While the majority of these sets are performing satisfactorily, most of them will require some repairs after the first year of operation. Even if an actual failure does not occur, most viewers realize that their pictures are not as bright and clear as they were when the set was new. Many earlier models feature 10 or 12 inch screens which appear small in comparison with the new full-sweep, large screen models.

In overhauling and improving the performance of these television receivers the service technician will find a source of profit which will grow as more and more "old" sets come up for service. In many instances it will be profitable to include this overhaul and picture improvement in a second year service contract, a procedure already advertised by some enterprising service organizations.

The actual work required depends on the condition of the set and whether a new, large screen tube is to be used, or the sweep on the present tube merely expanded. In the following paragraphs the basic steps of such an overhaul are outlined and finally the problem of inserting a larger picture tube is taken up.

Dim Pictures

The most frequent complaint in the case of dim pictures is loss of brightness. This can be due to any or all of these causes:

1. Dust on face of picture tube.
2. Weak picture tube or weak ion trap.
3. Low high voltage.

The photograph in Fig. 1 is a good example of the dust problem. Because of the electrostatic charge on the face of the picture tube, dust not only collects easily but tends to stick to the glass. Some receivers have a dust-proof space between the picture tube screen and the safety glass but in the majority of the sets, a good coating of dust accumulates on the screen.

Cleaning the face of the picture tube is accomplished easiest by using window cleaning fluid or water and a very soft cloth.

Where a weak picture tube is suspected make sure that the picture tube is at fault by re-adjusting the ion trap magnet first. Permanent magnet types often lose some of their strength and it is therefore advisable to have an extra single and double magnet ion trap on hand. If the ion trap cannot produce a bright enough picture, the d.c. voltages on the picture tube cathode, grid, and first anode should be measured next. Most magnetically deflected tubes should give full brightness with about zero to 8 volts between cathode and grid. First anode voltages usually range from 500 to 250 volts.

If the second anode voltage of the picture tube is low, this will also result in a dim picture. The most dependable way of ascertaining this is to measure the high voltage directly at the picture tube with a high voltage probe and v.t.v.m. unless a special high voltage meter is available. Some service technicians can approximate the voltage by the length of the arc they can draw from a grounded screwdriver to the second anode terminal, but this is not an exact procedure.

Weak Tubes

If the high voltage is lower than about 7 kv. for a 10 or 12 inch tube, one of several components may be at fault. The tubes should be exchanged first. In 1948 and 1949 models the most frequently used horizontal output tube was the 6BG6, and this is a likely culprit. The 6W4 or 5V4 damping diodes are the next likely offenders and the 1B3 high voltage rectifier the least likely. Occasionally the horizontal oscillator tube may be weak and sometimes the trouble is due to low "B plus" voltages caused by an aging rectifier tube.

Weak Components

If tubes and operating voltages appear to be correct, the flyback transformer might have changed, due to a change in the powdered iron core. Since the circuits seem to function but are merely weak, a resistor or condenser failure is not likely, with one exception. In most receivers a 1 megohm resistor is used in series with the high voltage lead, and a high voltage condenser connects to one side of this resistor.

The high voltage condenser is rarely at fault, but the resistor may change in value or develop a very high resistance. This results in low second anode voltage and very poor regulation.

* Author of the recently published book "Television Servicing, Principles and Practice" (Prentice-Hall).

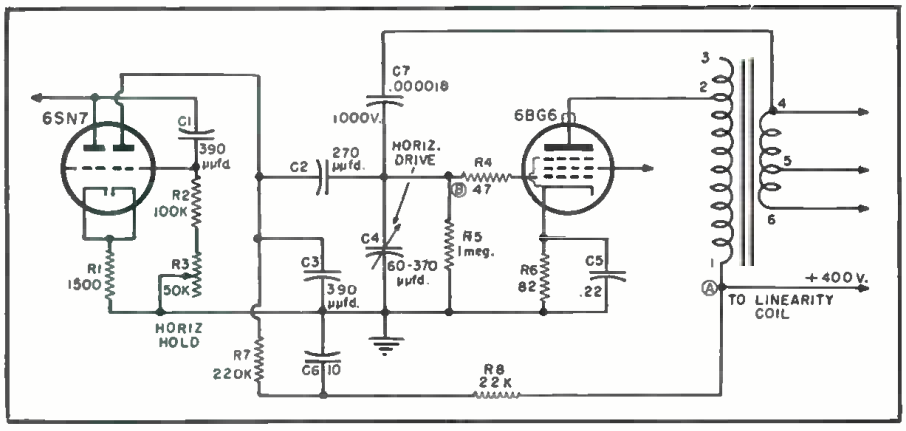


Fig. 2. Wiring diagram of a conventional phase detector drive circuit.

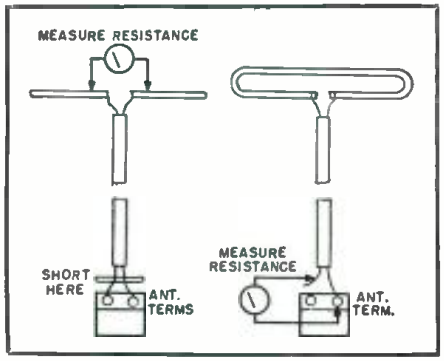


Fig. 3. Checking for bad antenna connections.

When the screen is dark, the high voltage may be sufficient but as soon as the brightness control is advanced the high voltage drops considerably. A defective 1 megohm resistor or a gassy 1B3 are almost invariably the cause of this defect.

Occasionally the customer is unwilling to purchase a new picture tube if his is only slightly dimmer and demands that something be done to increase the brightness of his old tube. By increasing the high voltage, a brighter picture can usually be obtained even on an old tube, but at the expense of tube life. A 10BP4, for example, will never last as long if operated at 13 kv. than if the prescribed 9.5 kv. is applied. Before attempting to increase the high voltage, check to make sure that sufficient width and height are obtained, because at higher second anode potential the picture will shrink somewhat.

Circuit Changes

To increase the high voltage several or all of the following steps may be required:

a. Return low side of high voltage condenser to plate of damper tube.

b. Reduce screen resistor of 6BG6 to 8000 ohms, 5 watts.

c. Remove all connections to the vertical sweep section from point *A* in Figs. 2, 4, and 5, and return them to the highest "B plus" point instead.

d. If a damping resistor is used, substitute a 10,000 ohm, 30 watt unit in its place.

e. Add a second 500 μμfd. high voltage condenser. This condenser is connected between the second anode terminal side of the 1 megohm resistor and the plate of the damper tube.

Poor Contrast and Sensitivity

Many complaints state that the pick-up from distant stations is poor after the first year of service or that the picture does not have the contrast and crispness it used to show. Most of these defects are due to aging of tubes, although some other factors can also be responsible.

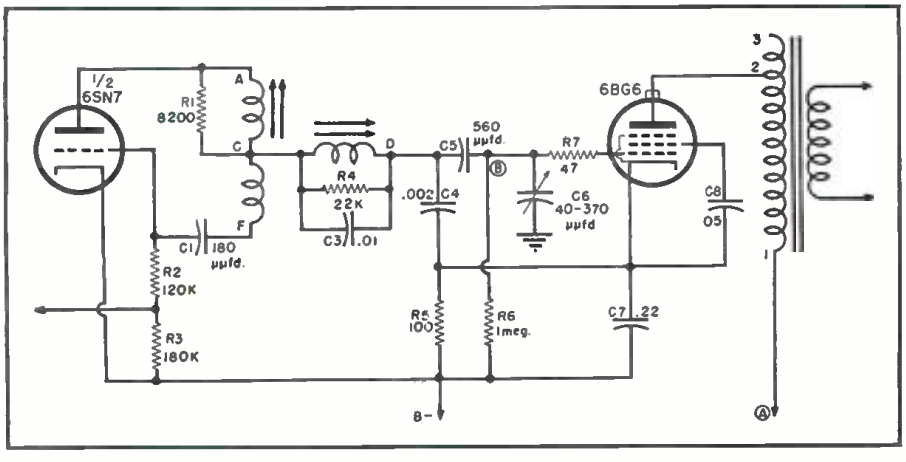
The i.f. amplifier tubes are usually good for only one year. After that time their transconductance drops considerably and while not completely bad they may register as slightly weak on the tube tester. Since the tube tester does not show their performance at the i.f. frequency, the best method is to check them by substituting new ones. If the same tube type is used for substitution it is rarely necessary to realign the i.f. coils. In some instances, however, a complete realignment will greatly improve the performance of the set. A complete alignment should be done only with the manufacturer's alignment instructions and the proper instruments, including a sweep generator, marker, and oscilloscope. The improvement in performance of a properly aligned set is well worth the extra time and work.

When pick-up from distant stations appears good, but the crispness of the black and white portions is lacking, the video amplifier tube may be weak. Occasionally a video peaking coil opens up, which results in smearing of the image from left to right.

The tubes in the front end tuner are also likely to deteriorate after a year or so of service. While replacement of the r.f. amplifier and mixer tube rarely causes any trouble, the oscillator tube is often very critical. In the *RCA* Model KRK-2 tuner, for example, the 6J6 oscillator tubes were hand-picked for each unit and not every 6J6 will work as an oscillator on all channels. In any event, when the oscillator tube is replaced it usually means that the oscillator coils must be realigned for all channels. Tuning the local oscillator can be done on a station signal from the air, provided the sound and picture i.f. sections are aligned correctly. Adjust the oscillator coil's slug for each channel, starting with Channel 13. To make sure that the fine tuning control will compensate for any slight frequency drift, set this control to a halfway point when adjusting the oscillator. Check and recheck all available stations for good sound and picture, in each case making certain that the fine tuning knob is in a center position.

Poor reception from distant stations and intermittent reception on any channel are often due to corroded antenna connections. These connections of the lead-in to the antenna elements are subject to all kinds of weather conditions and naturally tend to corrode and oxidize even if all parts are aluminum or brass. It is very difficult to judge the connections by their appearance. Measuring d.c. resistance as shown in Fig. 3 is often the quickest way. If the terminals appear badly corroded they should be replaced.

Fig. 4. Diagram of the most commonly used synchroguide circuit.



Changes For Increased Sensitivity

If it is desired to increase the sensitivity of a particular receiver, several different steps are possible:

a. Substituting higher gain tubes. If the receiver uses 6AU6 tubes as i.f. amplifiers, 6BC5's or 6CB6's may be used. It should be noted, however, that these tubes have different tube capacities and their use will mean realigning of the i.f. section. The 6BC5

is different from the 6AU6 in that the suppressor grid is connected to the cathode internally. This means that pin #2 on the 6AU6 must be disconnected from ground and remain unconnected if a 6BC5 is to be used. The 6CB6 is a higher gain tube than the 6AG5 or 6BC5 and its suppressor grid is not internally connected to the cathode. By using higher gain tubes as outlined above, the increase in sensitivity may be as much as two times.

b. For the reception of Channels 7 to 13 it may be advisable to use a 6AK5 r.f. amplifier in place of the 6AG5 used in the *Standard Coil* and similar tuners. If a 6J6 or other triode is used in the r.f. stage it cannot be replaced by a higher gain tube.

c. In some receivers it is possible to increase the i.f. and r.f. gain by connecting these tubes to a higher "B plus" point. Usually the "B plus" voltage is about 135 to 150 volts. If the plate and screen resistors are returned to a 200 or 250 volt point instead, additional amplification will result.

d. As a last resort the i.f. response curve may be changed so as to bring the picture i.f. carrier to the top of the slope and narrow the over-all curve down to obtain more gain. This should only be attempted if a sweep generator, marker, and oscilloscope are available and the technician is thoroughly familiar with i.f. alignment procedure.

Increased Width

Occasionally the customer complains of insufficient width or else the width problem comes up when the second anode voltage is raised. In some instances the technician wants to improve the picture size by substituting a new, full sweep screen cut-out in place of the old rectangular mask, or a new picture tube is used which might require more sweep. Barring weak tubes or a deteriorated flyback transformer or deflection yoke, it will be necessary to change the circuit to obtain more width. Two different approaches are possible, either the drive on the horizontal output tube can be increased or else the high voltage can be lowered.

Lowering High Voltage

a. Shunt the width coil with a .05 to .1 μfd condenser.

b. Connect a 100 to 500 μμfd. mica. 1000 volt condenser from the plate of the damper tube to ground.

Increasing Drive

This depends on the type of horizontal oscillator used. Steps *a.* and *b.* will help with all types of oscillators.

a. Increase screen voltage of the 6BG6 up to 300 volts above cathode by changing the screen resistor. Do not exceed the screen current of 15 ma. at 300 volts.

b. If the vertical oscillator and output tube obtain their "B plus" voltage from the horizontal boost voltage (point *A* in Figs. 2, 4, and 5) connect them to the next highest "B plus" point instead. This will cause the boost voltage to increase and produce more sweep as well as more high voltage.

c. The circuit in Fig. 5, is typical of receivers like the *RCA* 630 and many similar models. To increase the drive on the 6BG6 change R_1 to 1 megohm, R_3 to 470,000 ohms, and C_2 to 2000 μμfd. Changing C_1 to 330 μμfd. and R_2 to 10,000 ohms may also improve the width.

d. The circuit shown in Fig. 4, is used in later models and is today probably the most widely used horizontal oscillator. To obtain more width change C_5 to 2000 μμfd., C_4 to 1500 μμfd., and R_1 to 10,000 ohms.

e. The phase detector type of horizontal oscillator shown in Fig. 2, is used in such receivers as the *Admiral* 20A1 series and many other recent, low cost models. To increase the width, C_7 can be either increased to 30 μμfd. or reduced to 10 μμfd., depending on the individual receiver. C_2 can be changed to 390 μμfd., C_3 reduced to 220 μμfd. and R_8 can be made 10,000 ohms, 2 watts, with the electrolytic C_6 replaced by a paper, .25 μfd., 600 volt condenser. This provides a higher voltage for the oscillator and reduces the loading at point *A* at the same time.

Increasing Height

As in the preceding discussion on insufficient width, tubes and the transformer are the most likely reasons for insufficient vertical sweep. In some receivers additional sweep can be obtained by returning the red, or "B plus," lead of the vertical output transformer directly to the highest available "B plus" point. When sufficient high voltage and width are present the red lead from the output transformer may be connected to the boost voltage (point *A* in Figs. 2, 4, and 5) through a 3300 ohm decoupling resistor. An 8 to 30 μfd. electrolytic condenser should be connected from the transformer "B plus" to "B minus" or ground. To increase the height further, the resistor in series with the vertical linearity control, usually about 560 ohms, can be reduced to 100 ohms. The 1 megohm series resistor in the height control circuit can be reduced to about 220,000 ohms, permitting a wider range of height adjustment.

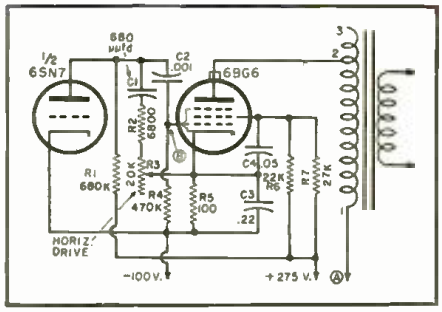


Fig. 5. Diagram of synchrolock drive circuit.

Tube Size (in inches)	Deflection Angle (in degrees)	2nd Anode (in kv.)	Focus Coil (type)
10	50	9.5	RMA #106
12	54	9.5	RMA #106
15	54	9.5	RMA #106 or 109
16 (16AP4)	54	12	RMA #109
16 (16GP4, round)	70	12	RMA #109
All other 16 round	63	12	RMA #109
All 16 rectangular	68	12	RMA #109
19	68	12	RMA #109

Table 1. Important variations in some of the most commonly used cathode-ray tubes.

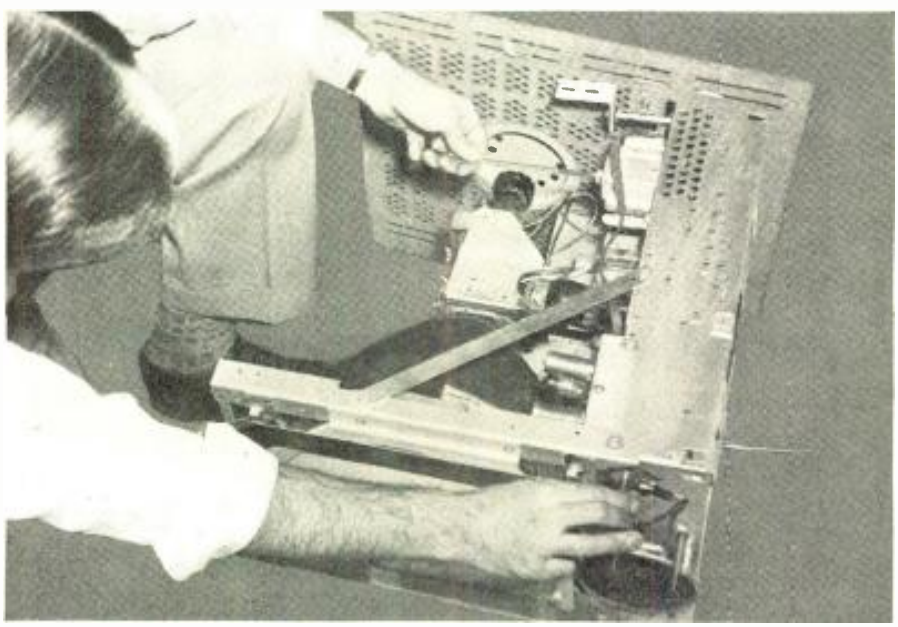
Improving Sound

If the set has been completely realigned, the sound i.f. and discriminator will have been checked and tuned for best sound quality. The sound amplifier stages rarely require attention other than replacement of weak tubes. In the event that the set has not been realigned it is often advisable to retouch the sound i.f. and discriminator transformers.

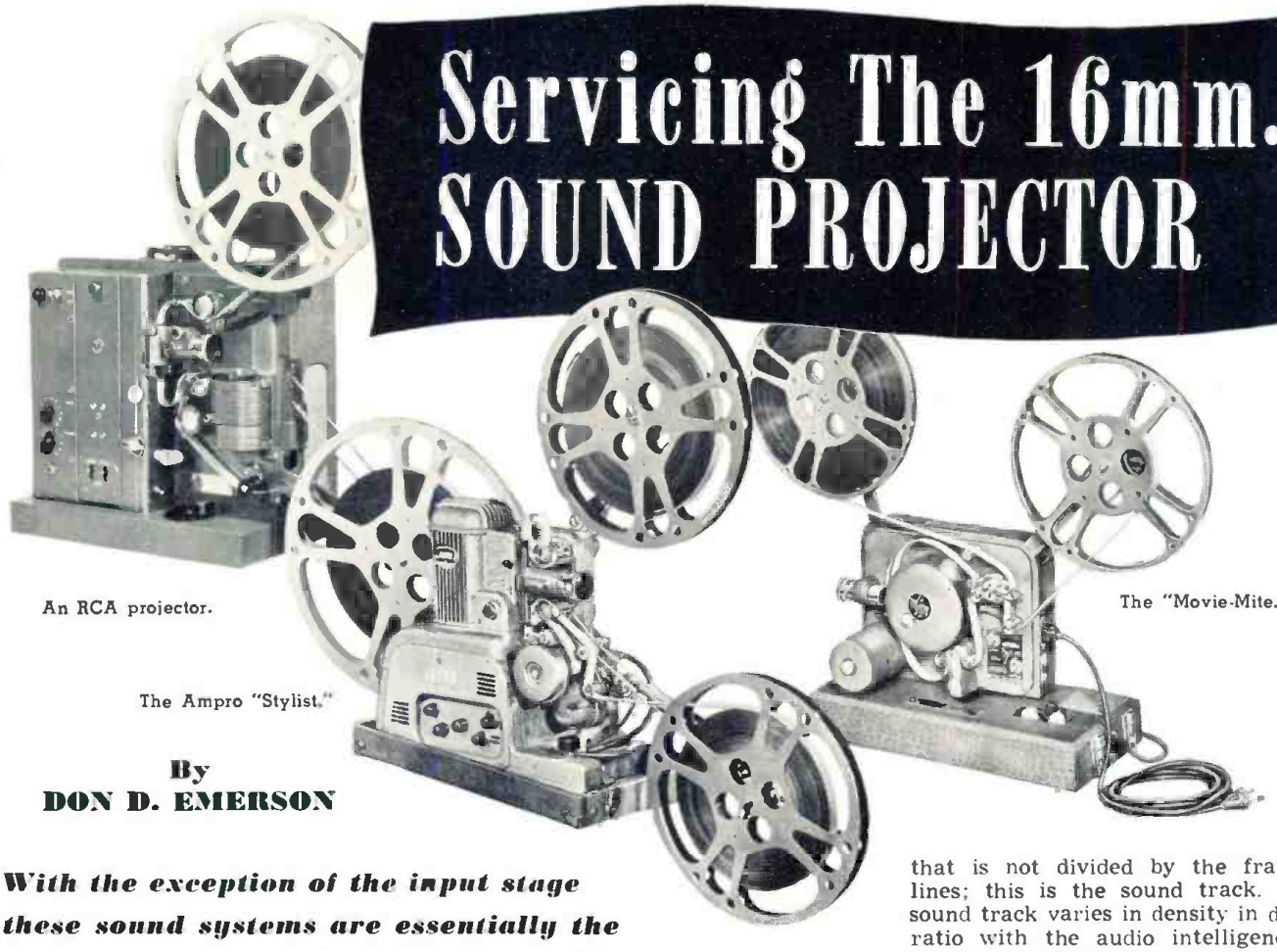
In the photograph in Fig. 6, the retouching of the ratio detector transformer in a *Westinghouse* 12 inch table model is illustrated. The receiver is

(*Continued on page* 96)

Fig. 6. Checking alignment of ratio detector transformer in a Westinghouse receiver.



Servicing The 16mm. SOUND PROJECTOR



An RCA projector.

The Ampro "Stylist."

The "Movie-Mite."

By
DON D. EMERSON

With the exception of the input stage these sound systems are essentially the same as any conventional audio amplifier.

WITH the tremendous strides taken in the audio-visual education field in the past few years a new service that can be rendered by the radio technician has developed. Servicing the 16mm. sound projector is a field of its own; but the servicing of the sound and minor mechanical adjustments can be handled by the average technician. Fortunately most of the 16mm. machines are equipped with instruction manuals, complete with schematics of the amplifier, etc. You will also find that many manufacturers are very cooperative when it comes to supplying service information as well as up-to-date service bulletins at a very moderate cost. You will also find that a few companies prefer to service their own equipment and these few will be reluctant, if they do not flatly refuse, to cooperate when you indicate your intention of servicing their machines.

With the exception of the input stage, there is essentially no difference between the sound system of a projector and that of any conventional audio amplifier. This input stage has a tendency to throw the old "seat of the pants" technician off his balance though for this first stage is capable of giving a remarkable imitation of many common amplifier troubles; such as open or shorted coupling and bypass condensers or even motorboating filters. Learning to spot these ailments can save the technician many hours of tedious labor.

This input stage is more mechanical than electronic in its operation and it is very important that everything in this stage be working properly. Before we go into the operation of this stage in detail, first let us examine its function.

Although there are several methods of achieving sound-on-film, the 16mm. field has narrowed itself down to either a variable density or variable area system of recording that is very satisfactory. On the edge of the film, opposite the sprocket holes (see Fig. 1) there is a continuous strip on the film

Fig. 1. (Left) Variable area sound track, and (Right) the variable density sound track.

that is not divided by the framing lines; this is the sound track. This sound track varies in density in direct ratio with the audio intelligence it represents. A bright light is focused on this film in the form of a very narrow rectangle at right angles to the edge of this film. As the film passes in front of this light, a photoelectric cell on the opposite side of the film from the light source picks up the resultant variations in light intensity. These variations are translated into minute electrical currents by the photoelectric cell. This cell is coupled to the amplifier and from there on, the problems usually encountered are no different from those developing in any normal audio amplifier.

Simple as all this sounds, there is plenty that can go wrong at this point without looking any further and right here is the stumbling block for most uninitiated technicians.

In Fig. 3, we see a typical input stage. This stage is made up of film guides, a flywheel and drum, exciter lamp, optical system, and photoelectric cell. These components function as follows: The film guides control the lateral positioning of the film over the stabilizer drum. These guides, in most machines, can be adjusted and do occasionally go out of adjustment. This can be recognized as a motorboat effect in which the framing lines of the picture interrupt the exciter light as it passes to the photoelectric cell. This is easily spotted by the fact that this thumping will be in step with the flow of film over the drum and only exists while the film is in motion. Another effect will be a "hissy" type of distor-

tion and very low volume as the bulk of the light bypasses the sound track on its way to the photoelectric cell with only a small portion picking up the sound track.

The flywheel and drum form a stabilizer which insures that the film is kept taut and moving at a constant rate as it passes in front of the exciter light. Trash on this drum will produce a thumping noise that is easily recognizable because this noise is produced only while the drum is in motion and is not dependent on the film being threaded up. This trash can be so minute that it is difficult to see, even so small an object as a bit of hair will upset the entire operation. It is very essential that this drum be perfectly balanced and moving very freely. The slightest touch should set it in motion. If this drum is not rotating freely, the film will not ride smoothly, instead, it will have a tendency to ride in and out causing a distortion, not unlike that of an open screen bypass condenser in extreme cases, or more usually a flutter or wow.

The exciter lamp is the heart of the entire system since it supplies the light that actuates the photoelectric cell. This lamp is usually a low voltage, high current device and in most cases this supply is furnished by a high frequency oscillator. If the customer's complaint is "no sound" and an ohmmeter check proves the lamp to be OK, investigate the oscillator circuit. A word of caution; the fact that the lamp is not burning while the amplifier is working does not necessarily mean this circuit or the lamp is defective. Many machines have the circuit so arranged that the exciter supply is not fully operational until the projection lamp, motor, and amplifier are on! Be sure the machine is in full operation before you decide this is the trouble. If the bulb is burned out, make certain that you replace it with exactly the same type of lamp. The placement of the filament of the exciter lamp is very critical and the base of the bulb is so arranged that no mistake can be made here. It is necessary that the filament of the exciter lamp line up perfectly with the tiny slot in the optical system to get proper operation. Be sure the lamp is secure in its base. A loose base that can shake with motor vibration will cause plenty of grief. The varying intensity of the light on the photoelectric cell will create some peculiar noises! Question your customer closely to insure that he hasn't replaced the burned out lamp with the wrong kind. Remember this, only the proper lamp will work in a given machine. It might light up all right, but the filament may be lateral instead of vertical or *vice versa*. Another thing to remember; if the complaint is "low volume" and the exciter lamp does not produce a good, full brilliance, you have probably discovered the trouble.

In many cases the volume of the projector sound is controlled by varying the intensity of the exciter lamp. Don't fly into the exciter circuit without making certain the volume control is well advanced and you still have no light. In one model, the *Movie-Mite*, there is no exciter lamp! A small amount of the light produced by the projection lamp is utilized for this purpose. Some exciter lamps are lighted by a special winding on the power transformer or a separate transformer; although the latter two are seldom seen in the more modern 16mm. machines. I hate to be repetitious, but be sure you have the machine in full operation before you decide that the exciter lamp or its circuit is inoperative!

The optical system is the critical baby and the most unlikely to become out of adjustment. Again question your customer carefully as to the machine's history and whether or not he or anyone else has tampered with this assembly. As shown in Fig. 2, the light from the exciter lamp is condensed and focused across the film track in a thin line at right angles to the edge of the film. Unless you are certain the trouble is here, do not tamper with the lens assembly or the tiny slot through which the light is beamed.

If the audio amplifier has passed a good proof-of-performance test and the sound still isn't right, here are a few clues: Severe garbled sound exists if the slot of light is not at right angles to the edge of the film as shown in Fig. 2. A very "bass-y" effect will appear if this light strip is too wide, generally caused by the optical system being out of focus and not the slot being out of adjustment. A crisp absence of lows and low volume exists if this band of light is too narrow. Whether the band is at one extreme or the other, the machine will demonstrate distortion of some sort if it isn't properly adjusted. If it should be necessary to readjust the slot, the type of machine you are working on will be the clue as to the next step. Some optical systems have

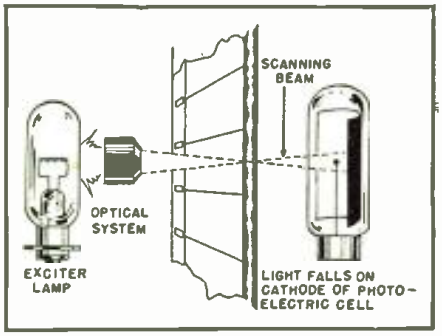
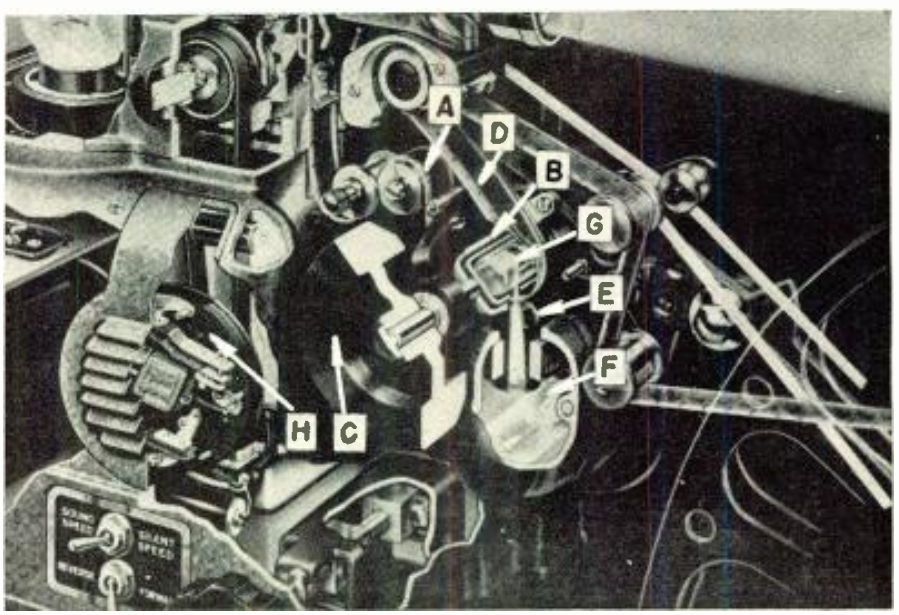


Fig. 2. Mechanical details of input stage.

to be dismantled before you can get to the slot. In others, this adjustment is made by a setscrew on the side of the lens holder. You will also find that many slots cannot be adjusted at all; since it is unusual to ever have to tamper with this after it is once properly set at the factory. Do *not tamper with the slot unless you know it is out of adjustment.* The next step is to focus this light *on the film.* This focusing is done by sliding the entire optical assembly back and forth in its holder until the light beam is at right angles to the edge of the film and in a thin line about the size of this dash—. The best way to adjust this is to have a film in the machine when the adjustment is made. You can easily tell when the system is focused properly by the quality of the sound when the optical system passes in and out of focus. Another thing; if there is a minute piece of trash on one of the lenses or the reflecting mirror, if one is used, you will have poor sound, if any at all!

The photoelectric cell is mounted so that the only light reaching it is a light from the exciter lamp; this light having passed through the sound track before reaching the photoelectric cell. It is very seldom that you will have to replace this cell unless it becomes shorted or broken. Caution!! If you

Fig. 3. Cutaway view of a section of the Ampro "Premier-20" 16mm. sound-on-film projector. (A) Curved film guide, (B) sound drum, (C) flywheel, (D) curved film guide, (E) optical system, (F) exciter lamp, (G) photoelectric cell, and (H) motor speed governor.



are servicing the amplifier, always remove the photoelectric cell and wrap it carefully in cloth or tissue to protect it from bright light. This is, of course, assuming you are servicing a set which has the photoelectric cell mounted right on the amplifier chassis. The photoelectric cell operates with a plate supply that varies from about 45 to 90 volts. This is a very stable d.c. If the customer's complaint is low volume, insufficient photoelectric cell voltage may be the reason. In some machines, this cell supply is lowered in conjunction with other volume controlling devices; so make sure you have the volume control well advanced when measuring this voltage. If the volume control has two decks, it is usually a good clue that one of them is controlling the photoelectric cell voltage and the other is controlling the current to the exciter lamp. Sometimes this cell pot is located elsewhere on the chassis and can be adjusted with a screwdriver. Be careful when advancing this control that you do not have too much voltage applied to the cell. This will be apparent if the photoelectric cell takes off in a high pitched squeal or a motorboating sound. Many models of machines don't have this pot and the photoelectric cell supply is a fixed voltage.

For perfect reproduction, the film should pass the optical system at a uniform rate of 24 frames-per-second. For perfect synchronization with the picture, the sound track should lead the picture by 26 frames. Many projectors are equipped with a "Sound-Silent" switch and many times this switch is accidentally left in the "Silent" position while the operator attempts to run a sound movie. In this case, one of two things will occur; either very low indistinguishable sound (caused by the film moving past the exciter light at too slow a speed) or no sound at all. The latter is caused by a special circuit arrangement to prevent the former. Always make certain that this switch, if the machine has it, is in the "Sound" position before attempting to service the sound.

As I have attempted to point out, the servicing of the sound in these machines is not at all difficult if you fully understand what is supposed to happen when the machine is operating correctly. Fortunately, most of the components are readily available and unless something serious, such as a broken lens, worn film guides or a burned out oscillator coil is the trouble, you should find all the parts you need at your local wholesale house.

If you have a projector that is mechanically defective, it is best to return it to the factory. The majority of cam and shuttle arrangements used in the operation of the claw are matched movements and expensive; so there is no advantage in tackling the replacement of this type of unit when the factory or an authorized service depot can do a much better job. However, there is still plenty that you can do to these machines to keep them in operation; providing the trouble isn't too serious.

Briefly, let's discuss how motion pictures work. The fact that the human eye is lazy and has a persistence of vision, is the only reason that movies work at all. Movies as they appear on the screen are nothing but a series of still pictures flashed on the screen in rapid succession. Each of these still pictures is called a frame. The secret of the entire operation lies in the action of the claw and shutter. These two work together in such a way as to insure that no light will get from the lamphouse to the film while the film is in motion. As soon as the claw starts to pull the film past the aperture, the shutter closes off the light until the film is at rest again and the next frame is ready to be flashed on the screen. Shutters vary in different machines but their effect is the same. Some models have the shutter interrupt the film more than once during the time the film is at rest in the aperture. These unnecessary interruptions actually help to smooth out the operation and greatly reduce flicker.

If the shutter should get out of adjustment, the figures on the screen will streak either upward or downward depending on whether or not the shutter is leading or lagging the actual movement of the film. There are usually one or more screws that may be loosened to allow you to slide the shutter either forward or backward a few degrees, giving you enough leeway to stop the streaking.

Another adjustment along the mechanical lines that can be done in the shop is the setting of the motor speed. In many machines, this is held to a definite rate by a governor that has either a single or double set of contacts. These contacts are controlled by a setscrew which opens or closes the gap *versus* spring tension. If the governor has a pair of contacts, one set will furnish the speed control for the sound speed and the other set for the silent speed. If the sound speed is not proper it will be apparent in the sound reproduction. The silent speed should be as close to 16 frames-per-second as you can get it. Caution! Before adjusting the motor governor, make certain there isn't something wrong elsewhere to cause the change in speed. You may save your customer the cost of a new motor.

As a protection against fire, there is a device installed in most machines which is called a fire shutter. This shutter is usually a wafer shaped disc of metal which has been perforated one or many times with tiny holes. Should the motor speed slow to a rate that might permit the intense light from the lamphouse to harm the film, the fire shutter will drop down cutting off a large percentage of the light. If you have a machine which puts out a very small amount of light, leaving the picture on the screen difficult to see, you will probably find that the fire shutter is stuck in the down position. Most fire shutters work on a centrifugal basis; that is, they will fall down across the aperture should the speed of the mechanism slow to a dangerous rate. Some machines depend on the rush of air that cools the lamp for this function and if there is a leak anywhere, it will cause the fire shutter to fall. One other safety device that has been installed on some machines is an automatic trip to disengage the mechanism from the motor should the film get stuck somewhere. The mechanism is again placed in motion by raising a lever which reengages it with the motor drive.

There are other adjustments that can be made on the machines to prevent unnecessary noise as the film passes through the gate or to prevent loss of the upper or lower film loop. Unfortunately, these adjustments vary with different models of machines and it would take a text of many pages to give the details for adjusting the lateral and vertical cut of the claw and

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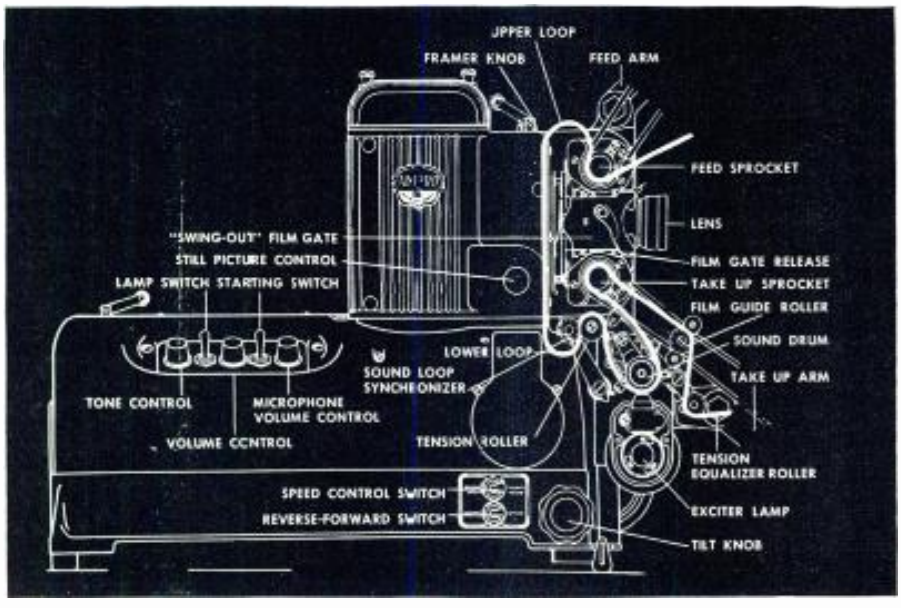
Fig. 4. Threading diagram for the 16mm. Ampro "Premier 20" sound-on-film projector.



DIELECTRIC HEATING

By
ED BUKSTEIN

Fig. 1. By means of dielectric heating, a plywood panel is formed and the glue set in 120 seconds. Each panel, when sawed, will yield four curved fronts for radio cabinets.

Some interesting facts you should know about this popular and widely used industrial process.

IN THE induction heating system, the metal to be heated acts as a secondary of a transformer, and the currents induced in the metal produce the heat. When the material to be heated is a nonconductor of electricity, dielectric heating is employed. In this system, the material to be heated is used as the dielectric of a condenser.

The principle of dielectric heating is illustrated in Fig. 2. An r.f. voltage is applied to the condenser so that its plates are driven alternately positive and negative. The positive plate of the condenser exerts an attracting influence on the electrons in the dielectric, and the negative plate repels these electrons. As a result, the electron orbits in the dielectric are distorted first in one direction and then in the other, millions of times per second. The power consumed in the process of altering the electron orbits manifests itself as heat in the dielectric.

One advantage of dielectric heating is that the work heats uniformly throughout its mass. When other heating methods are employed, the outside of the work heats first, and the heat slowly penetrates to the interior. Not only does this produce nonuniform heating and distortion of the material, but also causes the surface to become overheated or even charred before the temperature of the interior is raised sufficiently. Actually, when dielectric heating is employed, the interior of the work heats slightly faster than the outside due to heat radiation from the surface. This, of course, can be easily controlled, but when desired, the material can actually be heated from the inside out.

Dielectric heating time is measured in minutes instead of the hours required by older heating methods. Consequently, production time and cost are considerably reduced.

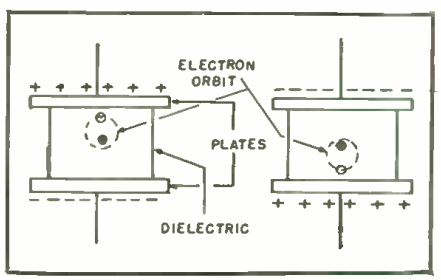
Dielectric Equipment

The equipment used for dielectric heating is similar in design to that used for induction heating. The dielectric heating unit consists essentially of a self-excited oscillator, its associated power supply circuits, and an automatic process-timing device. Colpitts, Hartley and other conventional oscillator circuits are common in this application.

In many cases, the same unit is usable for either induction or dielectric heating. The r.f. output is fed to a heating coil for the former application, or to a pair of plates for the latter.

In dielectric heating, the amount of heat developed in the work is in proportion to the number of times per second the electron orbits are distorted. Dielectric heaters therefore normally operate at higher frequencies than induction heaters. Frequencies ranging from 1 mc. to 100 mc. have been used, but the 5 mc. to 30 mc. range is most common. In some cases, frequencies extending up into the microwave region have been employed. Dielectric heaters normally generate powers ranging from 2 kw. to 100 kw.

Fig. 2. The electron orbits of the dielectric are distorted first in one direction and then in the other, millions of times per second. The power consumed in altering the orbits causes the dielectric to heat.



Applications

The medical profession has for many years employed dielectric heating (diathermy) to warm the tissues of the body and to produce artificial fever.

The woodworking industry has long been harassed by the time delay produced while waiting for glue to set. Dielectric heating has attacked this problem with the result that glue setting can now be accomplished in seconds instead of hours. This high speed glue setting also obviates the necessity of providing the additional storage space formerly occupied during glue setting.

Fig. 4 illustrates the bonding of plywood by dielectric heating. Laminations of plywood are glued, stacked and placed between the plates. Former methods of glue setting involved the use of steam heating or hot platens and often damaged the surface of the wood. In addition, the heat dehydrated the wood and caused it to become excessively dry. Dielectric heating overcomes both of these disadvantages. In the first place, the heating is uniform and charring of

(*Continued on page 92*)

SPEECH COMPRESSOR and MODULATION MONITOR

By
L. C. WATKINS, JR.,
W5JXO

Fig. 1. Front view of unit. Modulation peak percentages up to 100% can be measured.

The compressor is of the logarithmic type and features a meter calibrated directly in decibels of compression. The monitor indicates negative peaks by means of flasher lamp and a dial calibrated in terms of modulation percentage.

THE average phone operator is usually in a receptive frame of mind when he hears about a gadget that will help him increase the communication effectiveness of his rig, or add to the operating convenience of his station.

Described here are two such gadgets combined in one small package. One of them is a low-distortion (relatively speaking) logarithmic type speech compressor and its companion-in-arms is a peak-indicating modulation monitor of considerable accuracy.

If conditions at the receiving end of the conversation are unfavorable to your transmitted signal the compressor, when used intelligently, may give you a very decided boost in readability. Be sure your audio system is clean in its present state and then limit the decibels of compression to the amount your present modulator can handle. Better still, if your rig is shy on audio, consider rebuilding the modulator so that you can at least modulate your carrier 100% with a sine wave and with negligible distortion. Then with voice modulation you may approach the happy compromise of about 10 db. of compression (10 to 1 in power) with an all-around acceptable distortion content.

In the unit described here, a compression-level meter, calibrated directly in decibels, has been provided for its invaluable assistance in obtaining optimum performance from the system.

A filter network effectively reduces the amplitude of frequencies above about 3000 cycles, eliminating the compressor high-order distortion products and keeping the radiated signal narrow. Low frequency attenuation, below about 300 cycles, has been provided to maintain a good frequency balance with regard to maximum intelligibility, and to remove the power consuming bass frequencies.

The modulation monitor will give a positive indication of negative peaks that are too short in duration to be easily seen on an oscilloscope under usual viewing conditions. These short peaks may still cause overmodulation if they are allowed to exceed their proper amplitude for 100% modulation.

The Compressor

The basic circuit of the compressor has been ably presented in an earlier article[1], to which the reader should refer for important background information. The major difference between the original circuit and the circuit presented here is the addition of the calibrated compression level meter. A parallel-T, 60-cycle hum filter has also been included for an additional 20 db. of attenuation at the a.c. supply frequency. Many operators prefer dynamic microphones and with the extra gain of the compressor in use stray magnetic fields around the operating position frequently induce annoying hum voltages into the microphone. A small unavoidable amount of hum is also introduced in the first stage of amplification since the tube heater is supplied with alternating current.

T_1 (secondary winding unused) may be nearly any small replacement type, push-pull plates-to-voice coil output transformer. It should not be mounted near the power transformer or filter choke. The actual limiting circuit consists of R_8 and $Rect._1$, connected as a voltage divider from the center tap of T_1 to ground. The back-to-back copper oxide instrument rectifier acts as the non-linear element of the voltage divider, producing an approximate logarithmic shaped transfer characteristic.

With sine wave input, the compressed waveform from the output jack of the unit very closely resembles the original waveshape. Under the same conditions a conventional clipper would have produced almost a square wave output with its much higher percentage of distortion and high frequency cross modulation products. The sharp cut-off *LC* filter necessary to satisfactorily eliminate these high frequency components introduces serious distortion of its own from the shock excitation and resulting "ringing" effect from the square wave input signal. The copper oxide rectifier,

[1] Floyd, George H.; "Logarithmic Compressor," G-E Ham News, May-June, 1950.

being a non-linear device, also introduces distortion but of a much lower magnitude. In fact it is so much lower that a simple *RC* filter does an excellent job of removing the higher frequency distortion products. No "ringing" effect in the filter is possible and the phase shift characteristics within its passband are excellent.

Tube V_2 is an isolation amplifier and provided in its plate circuit is the output level control and a voltage divider proportioned so that a normal level voltage may be fed to the input jack of the regular speech amplifier. Although one section of V_2 is not in use, the circuit application is conveniently served by the characteristics of the type 12AT7 tube.

The lead connected between J_1 and J_2 is the microphone push-to-talk relay circuit, wired through the compressor.

The compression level meter is simply an audio frequency vacuum tube voltmeter connected from the center tap of T_1 to ground. It is a simplified version of a circuit previously described[2] by the writer and is well suited for use in this application.

The Modulation Monitor

The basic circuit of the modulation monitor has also been previously described in detail[3] and again the reader's attention is directed to that article for the basic theory of operation. Several changes have been made in the circuit for use in the present instrument.

Modulated r.f. to operate the unit is taken from a two or three turn link placed near the final tank coil in the transmitter. The coupling should be no closer than necessary for about half-scale indication of M_2 when the "Set Carrier" control, C_{20}, is tuned through resonance. A length of coaxial cable connects the link to the input binding posts at the rear of the monitor. Another short piece of coax is run from the binding posts to the 3-turn link, L_1, on the *Millen* Type 74002 shielded plug-in coil. L_2 consists of 57 turns of No. 18 enameled wire closewound on the coil form immediately above L_1. Taps are brought out at 6 and 13 turns from the ground end of the coil to permit bandswitching the monitor for the 75, 20, and 10 meter phone bands.

Demodulation is provided by a 1N34 rectifier. It is important that r.f. not be allowed to get into the grid circuits of V_4 or V_5 as serious inaccuracies would result. The a.f. monitor jack permits listening to the detected signal. The carrier-shift meter, M_2, has been "red-lined" at half scale to serve as a convenient reference point for adjusting the input r.f. voltage level, although proper operation of the monitor does not depend on a critical reference setting. Around 2½ ma. of current through the meter gives about the right volume level in the monitoring headsets. Plugging in the headset does not affect the calibration of the monitor.

As stated in the original article, the monitor operates on a bias cancellation scheme by comparison of the a.c. and d.c. voltage components that result from diode detection of a modulated carrier. The a.c. component is proportional to the modulation percentage and is equal to the d.c. component when the carrier is modulated 100%, the relationship being independent of carrier strength.

By use of a resistance bridge, or accurate ohmmeter, R_{30} and its dial may be calibrated directly in percentage of modulation. Reference to Fig. 1 will show the dial calibrated in 5% steps, with the 10% steps lettered in. The dial is marked according to the percentage of resistance between ground and the moving contact. The actual resistance of the stock "50,000 ohm" linear potentiometer used in our unit was 51,500 ohms. The 90% calibration point was then 46,350 ohms, etc. The potentiometer should be of the wirewound type if it is to hold calibration satisfactorily.

Potentiometer R_{34} adjusts the resting bias of V_4 to the proper operating point. Potentiometer R_{36} performs an identical function for V_5.

The energy stored in condenser C_{29}, which has been charged through a high resistance, R_{38}, furnishes operating plate voltage for V_5. When the tube is triggered C_{29} discharges rapidly through R_{39}, the flasher light RL_1, and of course the tube itself. The time constant of the discharge circuit has been made such that the filament of the 115-volt flasher lamp has time to reach full brilliance and produce a bright red flash through the one-inch diameter smooth jewel. The flasher is able to operate two or three times per second, and if V_5 is triggered before C_{29} has reached full charge the flash will still occur but will be of shorter duration.

The power supply makes use of gaseous voltage regulator tubes to provide the degree of voltage stability necessary for maintaining calibration of the modulation monitor. The dual filter condenser, C_{30}-C_{31}, should be mounted on an insulating plate so that its negative terminal (the can) may be connected to the power transformer high voltage center-tap and filament center-tap leads with insulated wire and grounded at one common point on the chassis. This prevents the circulating condenser current from flowing through the chassis and introducing hum voltages into the low level audio circuits.

Construction and Adjustment

The entire unit is constructed on a 7 x 9 x 2 inch chassis and housed in an 8 x 10 x 10 inch utility box. As a further aid in reducing hum and r.f. pickup a bottom plate is used on the chassis. The r.f. section of the modulation monitor is built on a sub-chassis placed at the left end of the main chassis (viewed facing the panel). The remainder of the monitor components are on another sub-chassis mounted

2 Watkins, Loren C., Jr.: "An Audio Oscillator and V.T.V.M.." Radio & Television News, June, 1950.

3 Denham, John S.: "A Peak-Indicating Modulation Monitor," QST, May, 1948.

Fig. 2. Top view of the completed unit showing parts layout.

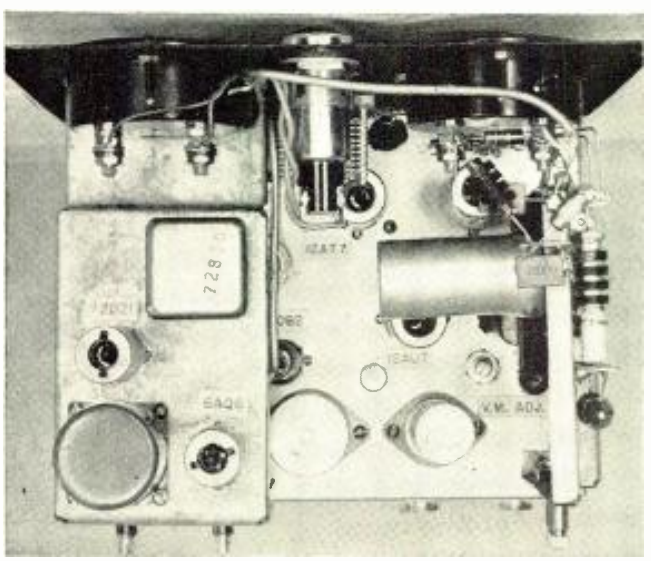
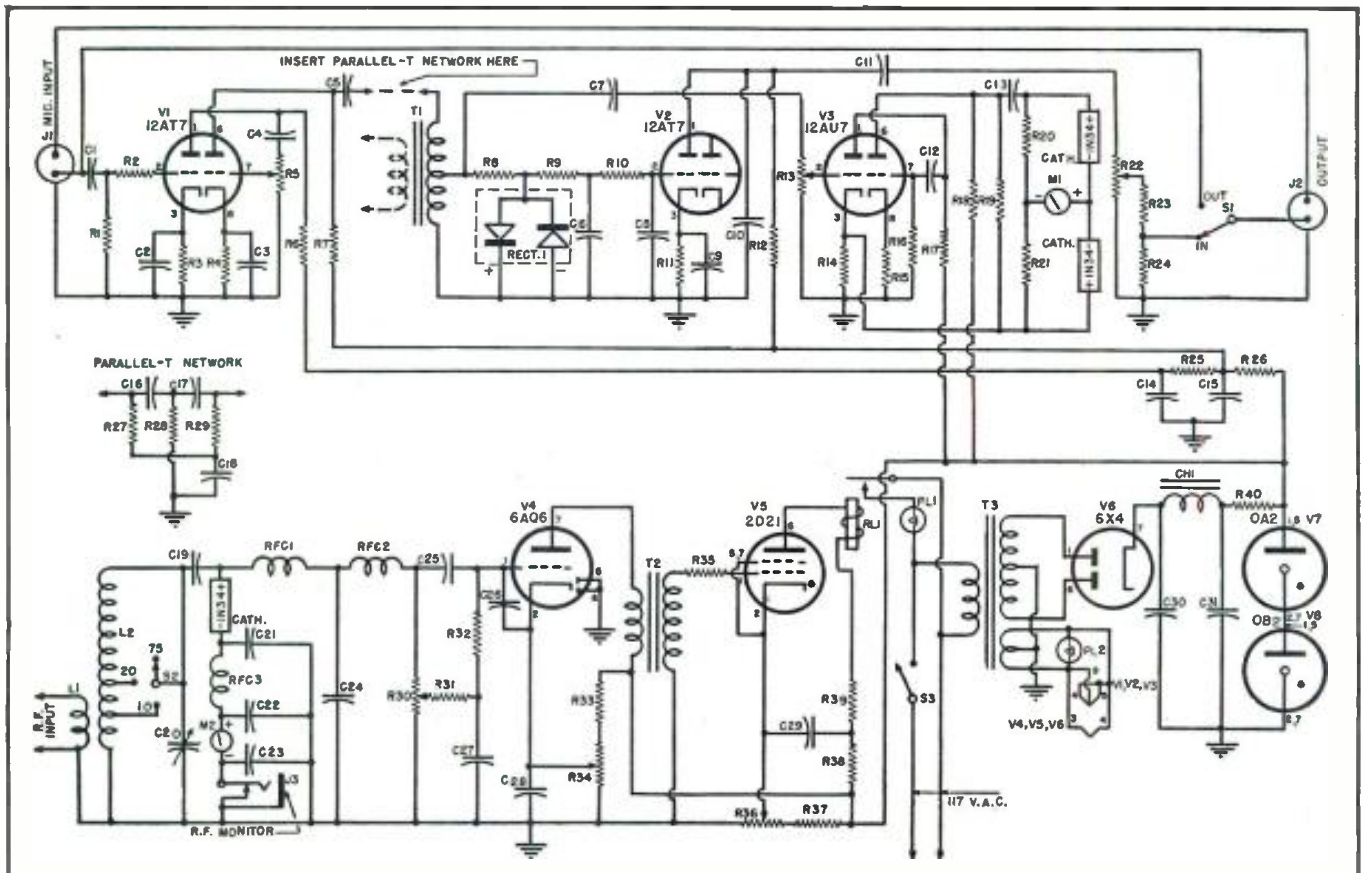


Fig. 3. Rear view showing location of the various sub-chassis.



R_1, R_{23}, R_{35}—470,000 ohm, ½ w. res.
R_2—47,000 ohm, ½ w. res.
R_3, R_4, R_{11}—470 ohm, ½ w. res.
R_5, R_{13}—500,000 ohm pot. (linear taper)
R_6, R_{37}—100,000 ohm, 1 w. res.
R_7, R_{12}—47,000 ohm, 1 w. res.
R_8—47,000 ohm, ½ w. res. ± 10%
R_9—56,000 ohm, ½ w. res. ± 10%
R_{10}—560,000 ohm, ½ w. res. ± 10%
R_{14}—2200 ohm, 1 w. res.
R_{15}, R_{26}—1000 ohm, 1 w. res.
R_{16}, R_{31}, R_{32}—1 megohm, ½ w. res.
R_{17}—270,000 ohm, 1 w. res.
R_{18}—33,000 ohm, 1 w. res.
R_{19}—150,000 ohm, 1 w. res.
R_{20}, R_{21}—10,000 ohm, 1 w. res.
R_{22}—100,000 ohm pot. (linear taper)
R_{24}—20,000 ohm, ½ w. res.
R_{25}—4700 ohm, 1 w. res.
R_{27}, R_{29}—530,000 ohm, ½ w. res. ± 10%
R_{28}—265,000 ohm, ½ w. res. ± 10%
R_{30}—50,000 ohm wirewound pot. (linear taper) (Mallory Type M50MP)
R_{34}, R_{36}—10,000 ohm wirewound pot. (linear taper) (Mallory Type M10MP)
R_{35}—10,000 ohm, ½ w. res.
R_{39}—27,000 ohm, 1 w. res.
R_{40}—5000 ohm, 25 w. wirewound res. (with slider set to 3800 ohms)
C_1, C_4—.001 µfd., 500 v. mica cond.
C_2—25 µfd., 25 v. elec. cond.
C_3, C_9—1 µfd., 200 v. cond.
C_5, C_7, C_{12}—.05 µfd., 600 v. cond.
C_6—.001 µfd., 500 v. mica cond. ± 10%
C_8—100 µµfd., 500 v. mica cond. ± 10%
C_{10}—.005 µfd., 500 v. mica cond. ± 10%
C_{11}, C_{25}—.01 µfd., 600 v. cond.
C_{13}—2 µfd., 400 v. bathtub cond.
C_{14}-C_{15}—Dual 40 µfd., 450 v. elec. cond.
C_{16}, C_{17}—.005 µfd., 500 v. mica cond. ± 10%
C_{18}—.01 µfd., 500 v. mica cond. ± 10%
C_{19}, C_{24}, C_{26}—100 µµfd., 500 v. mica cond.
C_{20}—140 µµfd., midget var. cond.
C_{21}, C_{22}, C_{23}—250 µµfd., 500 v. mica cond.
C_{27}—.1 µfd., 600 v. cond.
C_{28}—10 µfd., 50 v. elec. cond.
C_{29}—1 µfd., 400 v. cond.
C_{30}-C_{31}—Dual 20 µfd., 450 v. elec. cond.
S_1—S.p.d.t. toggle sw.
S_2—S.p. 3-pos. ceramic rotary sw.
S_3—S.p.s.t. toggle sw.
PL_1—115 v. pilot lamp (type S6)
PL_2—6.3 v. pilot lamp
T_1—Output trans. p.p. plates-to-v.c. (secondary not used)
T_2—Audio interstage trans. 1:3 ratio
T_3—Power trans. 325-0-325 v. @ 40 ma.: 6.3 v. c.t. @ 2 amps.
CH_1—Filter choke, 10 hy. @ 40 ma. (approx. 530 ohms res.)
RL_1—5000 ohm plate relay (Potter & Brumfield Type LM1 or equiv.)
RFC_1, RFC_2, RFC_3—2½ mh. r.f. choke
J_1—Microphone jack
J_2—Output jack
J_3—Midget closed circuit phone jack
L_1, L_2—See text
M_1—0-1 ma. d.c. meter
M_2—0-5 ma. d.c. meter
Rect.$_1$—Copper oxide instrument rectifier (Conant Type BHS-160)
3—1N34 crystal rectifiers
V_1, V_2—12AT7 tube
V_3—12AU7 tube
V_4—6AQ6 tube
V_5—2D21 tube
V_6—6X4 tube
V_7—0A2 tube
V_8—0B2 tube

Fig. 4. Complete circuit diagram and parts list for the speech compressor and modulation monitor unit.

over the power supply components. Each sub-chassis is formed from thin sheet metal, with the seams and corners soldered. Their shape and location on the main chassis can be seen in Figs. 2, 3, and 7. A shielded lead is run from RFC_2 on the r.f. sub-chassis to C_{25} and R_{30} on the other sub-chassis. A shielded lead is also used from M_2 to J_3, as this wire must pass near the "Set Carrier" control, C_{20}. About the only shielding required in the compressor wiring is the leads from "In-Out" switch, S_1. All tubes in the unit, except the rectifier and voltage regulator tubes, should be shielded.

The relay, pictured behind M_1 in Fig. 2, is of the surplus sealed variety but almost any 5000 ohm plate relay will function properly. Several different relays were tested in the unit and a representative type is noted in the parts list. Potentiometers R_{13}, R_{34}, and R_{36} are slotted for screwdriver adjustment. R_{13} is located on the main chassis beneath the plug-in coil. R_{31} and R_{36} are located behind their associated tubes on the sub-chassis.

Millen Type 10009 dials are used for the S_2 and R_{30} controls. Discs of white Bristol board were cemented to the metal dial plates to take the calibration lettering.

After the wiring is completed and voltage checks made, the compression meter is ready for calibration. Connect a constant sine wave input signal to J_1 of about microphone level, say 30 millivolts, and set R_{22} for maximum output. Set R_5 fully closed. Connect an external a.f. v.t.v.m. from T_1 center-tap to ground and advance R_5 until one-tenth volt is indicated. Now measure the output signal voltage from upper pin of J_2 (Fig. 4) to ground (S_1 at "In" position). Note the voltage measurements and repeat the procedure, continuing to advance R_5 each time so that the voltage from T_1 center-tap to ground increases in 50 millivolt steps until 1 volt has been reached. From this point the voltage is allowed to increase in half-volt steps until about 5 or 6 volts has been reached. We should now be well beyond the 10 db. point. Some normal variation in characteristics should be expected between copper oxide instrument rectifier units, however in our case 4.5 volts from T_1 center-tap to ground provided the desired 10 db. of compression.

The voltage readings obtained are now plotted on regular graph paper, the T_1 center-tap voltage horizontally and the output voltage vertically. Fig.

5 shows the actual results from our compressor. Since $N_{db.} = 20 \log_{10} (E_1/E_2)$, we have at hand the information necessary to calculate the decibels of compression. We simply obtain the decibels of increase in voltage along each axis of the graph and take the difference between the two to learn the number of decibels of compression. If we solve the formula, always setting E_2 equal to the minimum voltage on one axis and letting E_1 equal any other voltage on the same axis, we will have the number of decibels of voltage increase for those particular voltage values. The same thing holds true for the other axis. Now if we select a point on the x-axis, say 4.5 volts, we may read the corresponding y-axis voltage by use of the curve. We then figure separately the db. increase in voltage for each axis and take the difference between the two values. This figure is the number of decibels of compression for an input voltage of 4.5; in our case it was 10 db.

Since it is convenient to have the meter calibrated in even steps from 1 through 10 db., we select by the trial and error method other voltages on the x-axis less than 4.5 volts so that the final calculated result is a desired calibration point, 1, 2, 3, 4, etc.

Potentiometer R_{13} is now set so that the value of x-axis voltage, as monitored by the external v.t.v.m. from T_1 center-tap to ground (which represents 10 db. of compression), produces full scale deflection on M_1. Continue to monitor voltage with the external v.t.v.m. and adjust the compression control, R_8, so that the proper voltage is applied to produce 9 db. of compression. Mark this point on the scale of M_1, and proceed in this manner until all desired points from 1 to 10 db. have been marked on the M_1 scale. These may now be inked in and the calibration is complete.

After connection of the unit into the transmitter, and with the compressor switched out of the circuit, adjust the regular speech amplifier gain control for 100% modulation. Then,

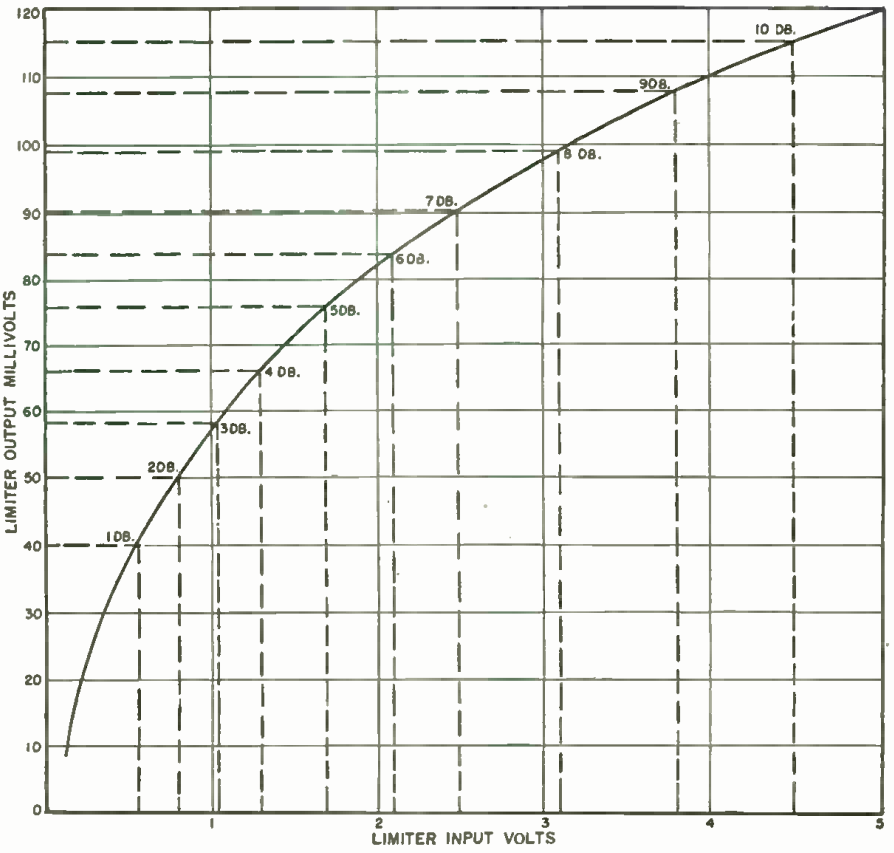


Fig. 5. Compression curve showing the decibel meter calibration points.

with the compression control set for the desired decibels of compression as indicated on the meter, the compressor may be switched in and the output level control advanced until 100% modulation is again obtained. The compressor may now be cut in or out at will with no further juggling of controls necessary.

The modulation monitor is best calibrated with the aid of a sine wave signal source and an oscilloscope. With no r.f. signal present at the input of the monitor, adjust the 2D21 bias control, R_{34}, so that the flasher light will operate when the grid of the 2D21 is touched with a screwdriver. If the bias is left at too low a setting the gas tube will not de-ionize, preventing C_{29} from receiving a new charge after a discharge cycle.

Now with 100% sine wave modulation of the transmitter, as indicated by the scope, adjust the 6AQ6 bias control, R_{34}, so that the flasher light just does operate. If the flasher refuses to operate, T_2 is probably connected so that a negative pulse is being sent to the V_8 grid, driving the tube further beyond cut-off. To correct this, reverse the primary or secondary winding of T_2 (not both). —30—

Fig. 6. Under chassis view. The a.c. wiring should be twisted and kept away from low level audio circuits used in the unit.

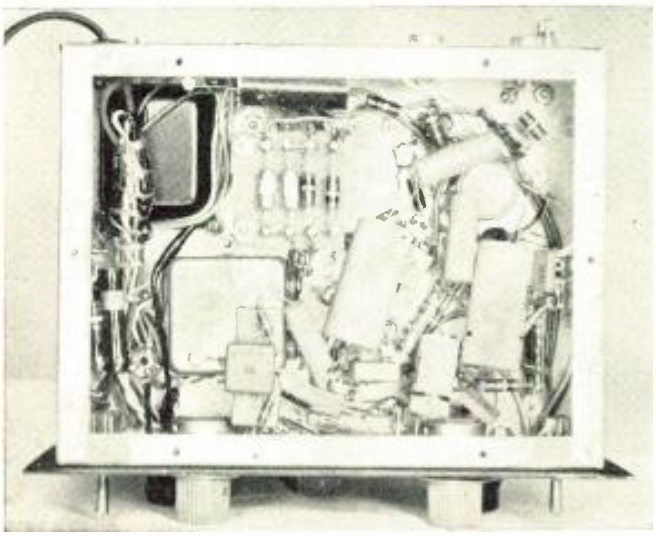
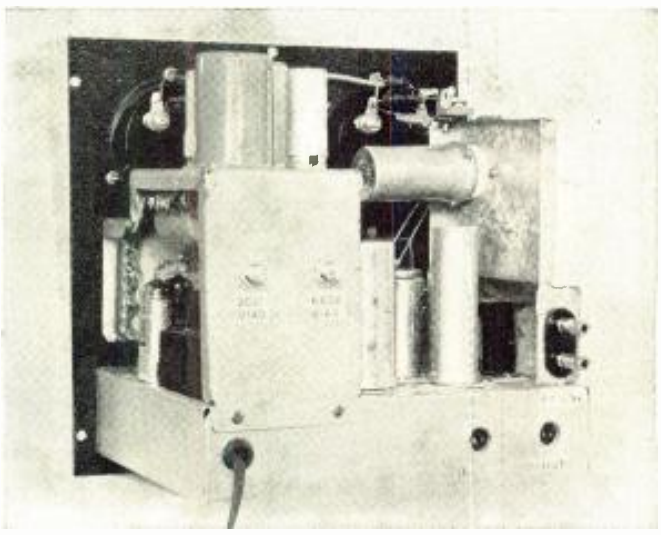
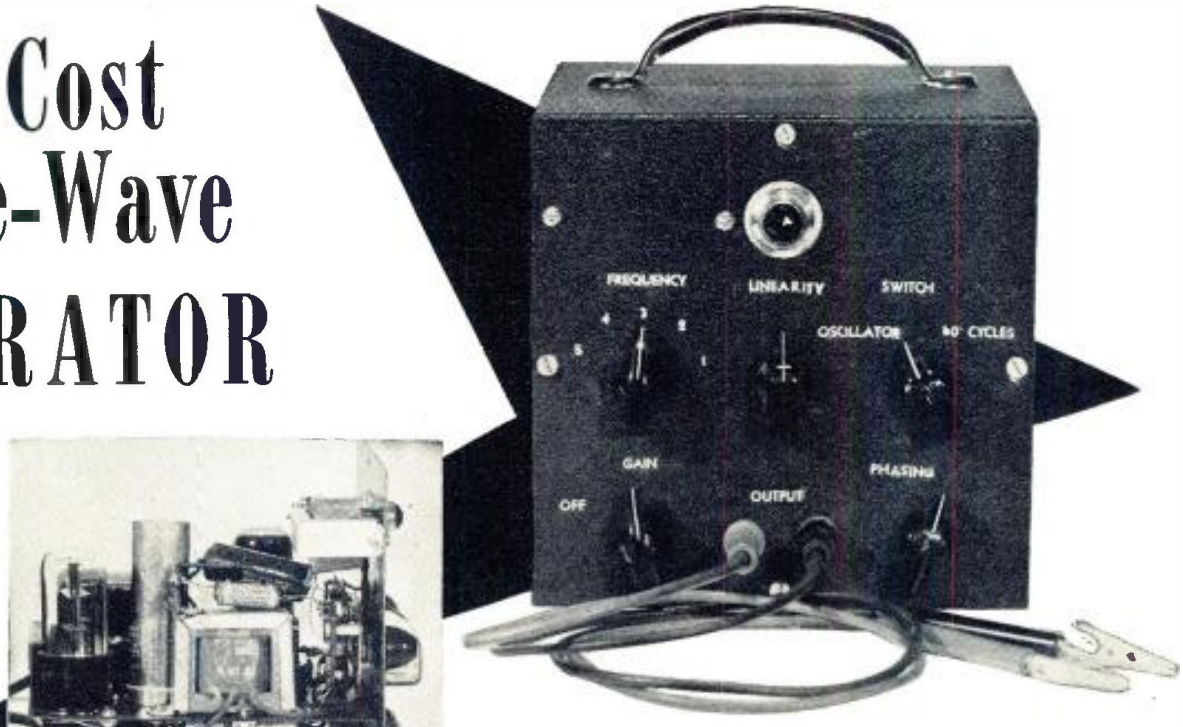


Fig. 7. View of the modulation monitor sub-chassis. Note T_1 behind the r.f. link terminals in "well" of the r.f. sub-chassis.



A Low Cost Square-Wave GENERATOR



Two views of the home-built square-wave generator. The front panel view shows correct location of controls. The shunting choke, mentioned in the text, is mounted on the front panel just above oscillator transformer and is visible in the side view. If enclosed cabinet is used vent holes must be provided.

By
SMITH HARRIS

This test instrument can be used to check frequency response of audio amplifiers from 60 to 20,000 c.p.s.

THE utility of a square-wave generator for checking audio amplifiers is too well known to require comment. Unfortunately, commercial generators cost more than many audio enthusiasts, technicians, and experimenters care to invest. The generator described in this article, however, can be built at a very nominal cost largely from junk box components and is entirely adequate for checking the frequency response and characteristics of an amplifier from 60 to 20,000 cycles. It consists essentially of a simple audio oscillator and amplifier followed by the clipper developed by Louis E. Garner, Jr. (March and July, 1950, issues of RADIO & TELEVISION NEWS.)

The entire unit can be housed in a standard 6"x6"x6" utility cabinet, such as the *Bud* C-1798.

The power supply is conventional. Current and voltage requirements are: 3 ma. at approximately 350 volts, 1.05 amperes at 6.3 volts, and 2 amperes at 5 volts. Any power transformer with a secondary producing from 250 to 350 volts a.c. can be used.

The audio oscillator employs a 3:1 interstage transformer and half of a 6SN7. While the transformer used by the author was a *Stancor* A-63C, any similar transformer may be used. In wiring up the *Stancor* transformer, either of the grid leads may go to pin 1 of the 6SN7 while the other lead is not used. The lead marked "CT" goes to ground. Temporarily connect one of the primary leads to pin 2 and the other to R_5 and after the generator is completed, reverse them should oscillation fail to occur. R_1 is a linearity control and is used to correct any slight differences in width that may exist between positive and negative halves of the final square wave and to disable the oscillator as explained later. The oscillator frequency is varied by shunting the primary of the transformer with various values of condensers by means of a rotary switch, S_1.

Only three frequencies are normally needed to cover the entire audible range, namely 20, 200, and 2000 cycles-per-second, as a square wave contains strong harmonics through at least the tenth. Thus these three basic frequencies could be used to check the response of an amplifier from 20 through 20,000 cycles-per-second. It is convenient, however, to employ five or six frequencies within this range in order to more easily determine the exact point at which some change may take place in the response. The lowest frequency at which the transformer used by the author could be made to oscillate was approximately 150 cycles-per-second. Sixty cycles is obtained from the power line, therefore, and fed directly to the clipper through S_2 and C_8 to obtain a low frequency test wave. Although the response of an amplifier may extend below this frequency, a good, clean response at 60 cycles will give adequate low-frequency reproduction for normal listening.

The other half of the 6SN7 is used as a voltage amplifier. In order to obtain a good square wave, the amplitude of a *sine* wave applied to the clipper should be at least 75 volts. As it is impractical to obtain this value in a single-stage amplifier, the values of R_3 and R_4, as well as the excitation voltage, were determined experimentally so that the amplifier is overdriven to produce a wave that is already partially squared off. While the amplitude of this wave is considerably below 75 volts, the sides are so steep that the clipper has no difficulty in producing a good square wave from it.

A 6H6 is used as a clipper in the circuit developed by Mr. Garner as previously mentioned. The theory of its operation is fully covered by Mr. Garner in his two articles and will not be repeated here. The values of R_8, R_9, and R_{10} are different from those recommended by him, but were chosen to give the best results in this particular application. S_2 allows either 60 cycles obtained from the power line or any frequency generated by the oscillator to be fed to the clipper.

The phasing control following the clipper was added to correct a severe phase shift of the lower frequencies (low frequencies leading) occurring in the author's oscilloscope. It should not be necessary if the oscilloscope used with the generator has a good low frequency response.

Selection of the proper values of the

condensers shunting the primary of T_1 is easily made. Turn on the generator and feed its output into an oscilloscope. Throw switch S_2 to obtain a 60 cycle figure and adjust the controls of the oscilloscope to obtain one complete square wave on the screen. Turn off the generator, as the primary of T_1 is "hot," and temporarily connect a condenser across the primary with one position of switch S_1. Then turn the generator back on, set switch S_2 to the oscillator position, and without changing the setting of the oscilloscope controls, observe the number of complete cycles appearing on the screen. If, for example, three complete cycles are seen, the frequency of the generator is three times 60 or 180 cycles; if six are seen, the generator frequency is 360 cycles and so on. The size of the test condenser is varied until the approximate frequency desired is produced. The other condensers are selected in the same manner. It will probably not be possible to arrive at the exact frequency desired except by using odd values of capacitance obtained by tedious paralleling, but this is not necessary. If one of the frequencies desired is 500 cycles, a frequency of 480 or 540 will do just as well. The frequencies used by the author were 60, 180, 480, 720, 900, and 2000 cycles-per-second obtained as follows:

60 cycles: obtained from power line
180 cycles: $C_3 = .05$ μfd.
480 cycles: $C_2 = .005$ μfd.
720 cycles: $C_1 = .001$ μfd.
900 cycles: no condenser used, see below
2000 cycles: no condenser used, see below.

The values of C_1, C_2, C_3 will be different if a transformer other than the one specified is used or if other frequencies are selected.

The distributed capacity of the audio transformer together with its inductance will result in its having a natural resonant frequency above which it will not oscillate. Should this frequency lie below the highest frequency desired, it will be necessary to shunt the primary on one position of switch S_1 with an added inductance to reduce its inductance and hence raise its resonant frequency. The resonant frequency of the *Stancor* transformer specified is approximately 900 cycles. To obtain a top frequency of 2000 cycles, it was shunted with a 10 henry, 25 ma. choke. This choke is visible in the photographs mounted against the rear of the front panel just above the rotary switch. If the frequency obtained in this manner is too high, it may be lowered by paralleling the choke with a condenser of suitable value.

Unless S_2 possesses a very low capacity, the oscillator frequency may jump it when the switch is set to the 60 cycle position and be superimposed on the latter frequency. Should this condition occur, disable the oscillator by turning the linearity control (R_1) until there is zero resistance between the grid of the oscillator tube (V_1) and ground.

To use the generator to check the response of an audio amplifier, feed its output into the amplifier while observing the resulting pattern on an oscilloscope connected to the amplifier's output. Interpretation of various patterns is beyond the scope of this article. This matter has been covered in previous articles in this magazine, most recently by Mr. Garner in the two articles cited. It is advisable to become familiar with the response of your oscilloscope before condemning the generator or the amplifier if results are below expectations. That loss of highs, as indicated by the rounding of the leading edge of the square wave, can very well be due to poor high frequency response of the vertical amplifier of the oscilloscope.

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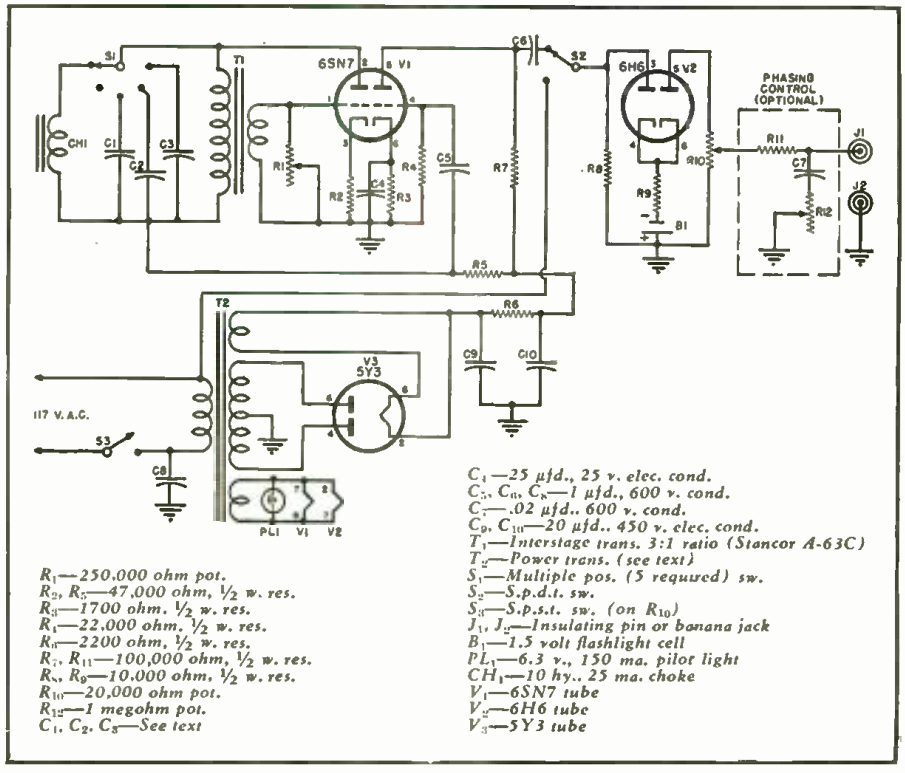
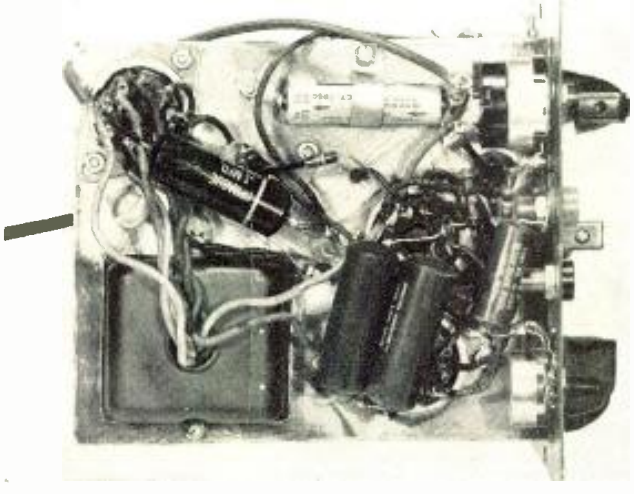
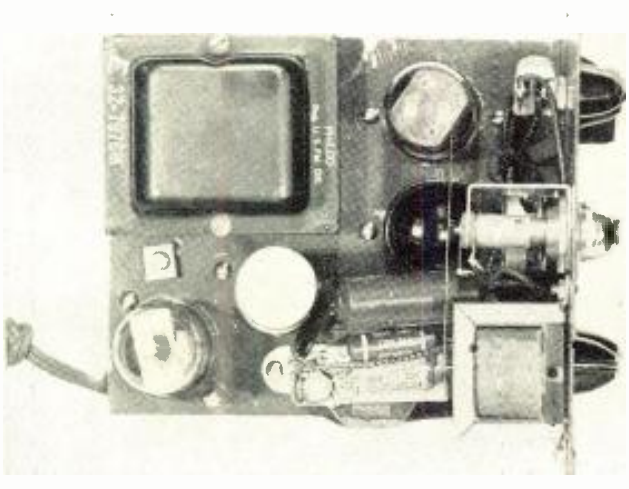


R_1—250,000 ohm pot.
R_2, R_5—47,000 ohm, ½ w. res.
R_3—1700 ohm. ½ w. res.
R_4—22,000 ohm. ½ w. res.
R_6—2200 ohm, ½ w. res.
R_7, R_{11}—100,000 ohm, ½ w. res.
R_8, R_9—10,000 ohm, ½ w. res.
R_{10}—20,000 ohm pot.
R_{12}—1 megohm pot.
C_1, C_2, C_3—See text
C_4—25 μfd., 25 v. elec. cond.
C_5, C_6, C_8—1 μfd., 600 v. cond.
C_7—.02 μfd., 600 v. cond.
C_9, C_{10}—20 μfd., 450 v. elec. cond.
T_1—Interstage trans. 3:1 ratio (Stancor A-63C)
T_2—Power trans. (see text)
S_1—Multiple pos. (5 required) sw.
S_2—S.p.d.t. sw.
S_3—S.p.s.t. sw. (on R_{10})
J_1, J_2—Insulating pin or banana jack
B_1—1.5 volt flashlight cell
PL_1—6.3 v., 150 ma. pilot light
CH_1—10 hy., 25 ma. choke
V_1—6SN7 tube
V_2—6H6 tube
V_3—5Y3 tube

Complete schematic diagram and parts list covering the square-wave generator.

Under chassis (left) and top chassis views of generator. The 5Y3 is at lower left while the 6SN7 appears at the upper right.





CUSTOM-BUILT for PROFIT

By DALE ELLIS
Electronics Information Bureau

Complete home entertainment center housed in Jensen "Customode" cabinets. From the left are the Jensen speaker cabinet, Radio Craftsmen Model RC 101 16" TV set, and, in the enclosed cabinet, a Radio Craftsmen Model R-10 AM-FM radio, and a Milwaukee Stamping Co. record player. The bottom drawer may be used for storage or a tape recorder. A Talk-A-Phone "Chief" intercom tops the extra cabinet unit.

An abundance of custom radio and TV equipment now makes custom work easy and very profitable.

CUSTOM installation, once considered a novelty confined to a select few persons in the upper income brackets, is rapidly becoming an important factor in the radio, television, sound, and home intercommunications market.

And this is deservedly so, for service technicians and home owners alike find in this relatively new field an outlet for their originality in installation, in design, and in home decoration which gives electronics a new place in modern living.

Some enthusiasts in this new medium compare custom installation's progress with that of home heating—which began with open fireplaces, then changed to bulky living room stoves, to fancy baseburners, and eventually to the furnace and the heating unit hidden away in the basement or utility room. They claim that radio-television and other home units will undergo the same development, and ultimately will be recessed and built in.

Whatever may be its ultimate development, however, custom installations have caught the public's fancy, and the manufacture of chassis designed to be built into cabinets, bookcases, and paneled walls has grown five-fold in the past three years, it is estimated.

One advantage of the custom installation is the fact that the sound units can be placed anywhere in the room to achieve maximum acoustical benefit. With remote control devices, the units themselves may be built into any advantageous spot, regardless of accessibility for dialing or operating.

This new field has found instant favor with an increasing number of radio technicians, partly because it offers almost unlimited scope for originality and technical skill, and in addition presents a lush market, not only for single installations, but for multiple unit sales, ranging all the way from a single TV set to combination radio-TV-intercom, wire or tape recorders, record changers and in many instances built-in boosters, antenna rotators, and all the other "plus" equipment which attracts the built-in electronics enthusiast.

Paradoxically, the more competitive the conventional television set business becomes, the larger the custom-built market grows. The case of a large Eastern department store which has discontinued all stock TV lines is a typical example. This store, faced with the necessity of stocking a dozen different brands, with several models of each line, announced that it would offer only a custom-built chassis, with choice of specially built cabinets. While this is not likely to start a trend, it indicates that at least one merchant saw an opportunity for merchandising custom chassis and fine cabinets together.

The number of ways that custom radio-television can be combined with deluxe cabinets, bookshelves, and panels is limited only by the imagination of the buyer or installer. One collector of period furniture had a TV set built into an oversize grandfather's clock. Many have utilized desks, breakfronts, and other favorite pieces of furniture.

Many installers claim that once the home installation bug bites a customer he will stay up nights figuring out new and more novel ways to build in electronic devices. One of the biggest attractions at the recent Chicago Furniture Mart was a multiple section cabinet which housed a 16 inch TV set, an AM-FM-short wave radio, a record player, a tape recorder, special speaker, and a twelve station intercommunications unit which connected all the bedrooms, living room, dining room, kitchen, basement, garage, and front and back doors to a single master control — the ease-loving housewife's dream, since it did away with the necessity for half the trips that make up a woman's day in the home.

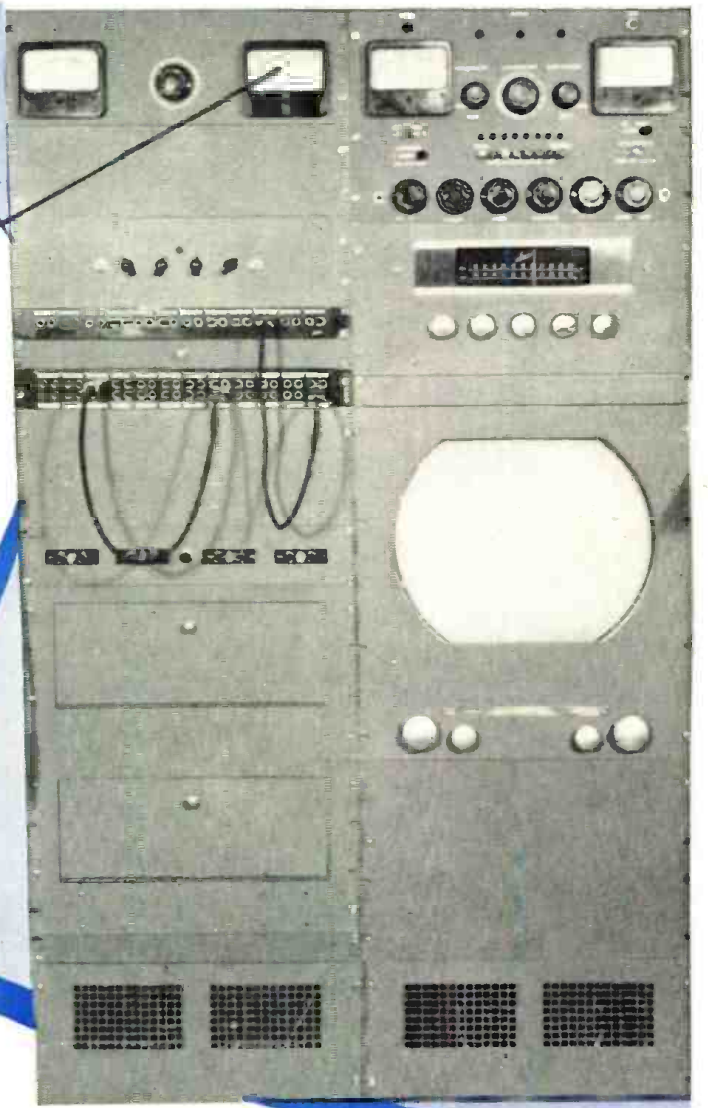
And of course interior decorators and home designers are having a field day with the new custom-built electronics idea. By the simple addition of wall cable and lead-in wiring, the new homes are being equipped to carry an ambitious allotment of electronic devices. One new home on Chicago's North Shore is being designed to do away with all cords for toasters, mixers and other kitchen aids, by the simple device of a plug panel, table-high along one entire wall of the kitchen. A toaster, mixer, or waffle iron can be literally plugged into the wall at any place on the kitchen work table, a plug having been substituted for the cord on each kitchen device.

An ingenious architect has come up with the idea of an open wall between living and dining room, so that a built-in television set can be swiveled into viewing range for the youngsters whose meal time coincides with their most popular TV program. Another parent has placed a television set in his children's room, with remote control to the living room, so that he enforces a TV curfew each night by simply shutting off the set.

But aside from the novelty aspect of custom-installation, the idea of integrating TV and radio into the decor and design of a home is growing rapidly, with its accompanying opportunity for service technicians and installers to find new markets, and for householders to utilize these new media of entertainment in the home. —30—

A Flexible RECORD-REPRODUCE SYSTEM

By
OLIVER READ
Editor, RADIO & TELEVISION NEWS



The symmetrical layou of this two-bay assembly is also practical electrically.

Part 2. Continuing the discussion on a record and playback system as used by the author for studying performance of audio equipment and accessory items.

IN PART 1 of this present series (November, 1950 RADIO & TELEVISION NEWS, page 42) we listed and described briefly the basic equipment used in this system. The discussion pointed out why certain components were selected in order to meet our own requirements.

Our first requirement was a combined preamplifier and equalizer, in order that a choice of program circuits could be made by means of a selector switch and this program material amplified and equalized before being passed to the line amplifier. Fig. 2 shows the block diagram of the combined preamp-equalizer. Note that the volume control is a tandem-connected unit which affords smooth control of gain over two stages rather than the conventional single stage control.

The circuit arrangement (Fig. 3) provides complete freedom from impulse types of distortion and a stable feedback circuit permits full adjustment of either the treble or bass controls without amplifier instability.

Bass boost of approximately 20 db. and bass attenuation of approximately 13 db. is available and is independent of the treble control. Likewise the treble boost of approximately 15 db. and a treble cut of approximately 20 db. is independent of the bass control.

A switch is provided which makes possible the selection of either 300 or 600 cycle turnovers at a 6 db. per octave rate for channels 3 and 4. In addition, separate adjustable gain controls are provided for the tuner and crystal pickup inputs so that the program level may be preset for these two channels.

Typical curves for the preamplifier are shown on the graph of Fig. 6. These provide more than adequate equalization for nearly every listening condition, and are also highly useful in the recording of sound on disc where treble frequencies must be accentuated during the recording process at slow speeds and at inner diameters.

The output of the preamplifier connects to a plate-to-line transformer as mentioned in Part 1 of this series. The output, therefore, becomes 600 ohms, unbalanced. The 600 ohm line from the preamplifier output matching transformer connects to the jack field. This line feeds through two pairs of double jacks and is "normalled" to the input of the line amplifier, as shown in Fig. 5.

The Line Amplifier

The circuit for this amplifier is entirely conventional and is used in several manufactured units. It was home-built with components on hand and meets the requirement for approximately 40 db. gain at extremely low distortion. The 600 ohm input terminates in a triode (½ of a 12AY7) voltage amplifier with a gain control in the grid circuit. The 100,000 ohms shunted across the secondary of the transformer provides sufficient loading to reflect an impedance of 600 ohms back into the primary. The triode output employs the other section of the 12AY7 and is coupled with a plate-to-line output transformer. The primary is 15,000 ohms when so connected. The secondary is 600 ohms which is standard for all lines used in this system.

In order to reduce heat and to make the line amplifier more compact the

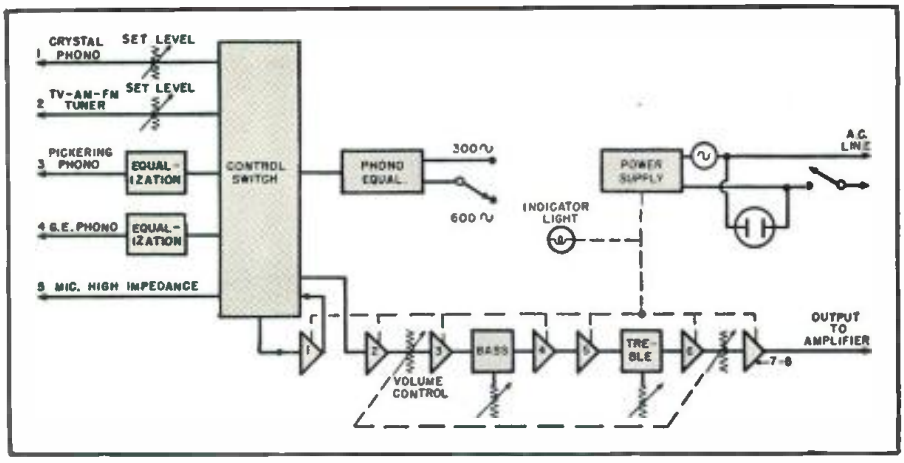


Fig. 2. Block diagram of a preamp-equalizer designed for five input channels.

usual rectifier tube was eliminated and instead a full-wave, bridge-type selenium rectifier employed. The 100 ohm potentiometer shunted across the filament secondary of the transformer is used to balance out hum in the filament circuit. The entire unit is mounted on the 8¾" relay rack panel which is shown directly below the jack field. The schematic diagram of the line amplifier is shown in Fig. 7 (see page 134).

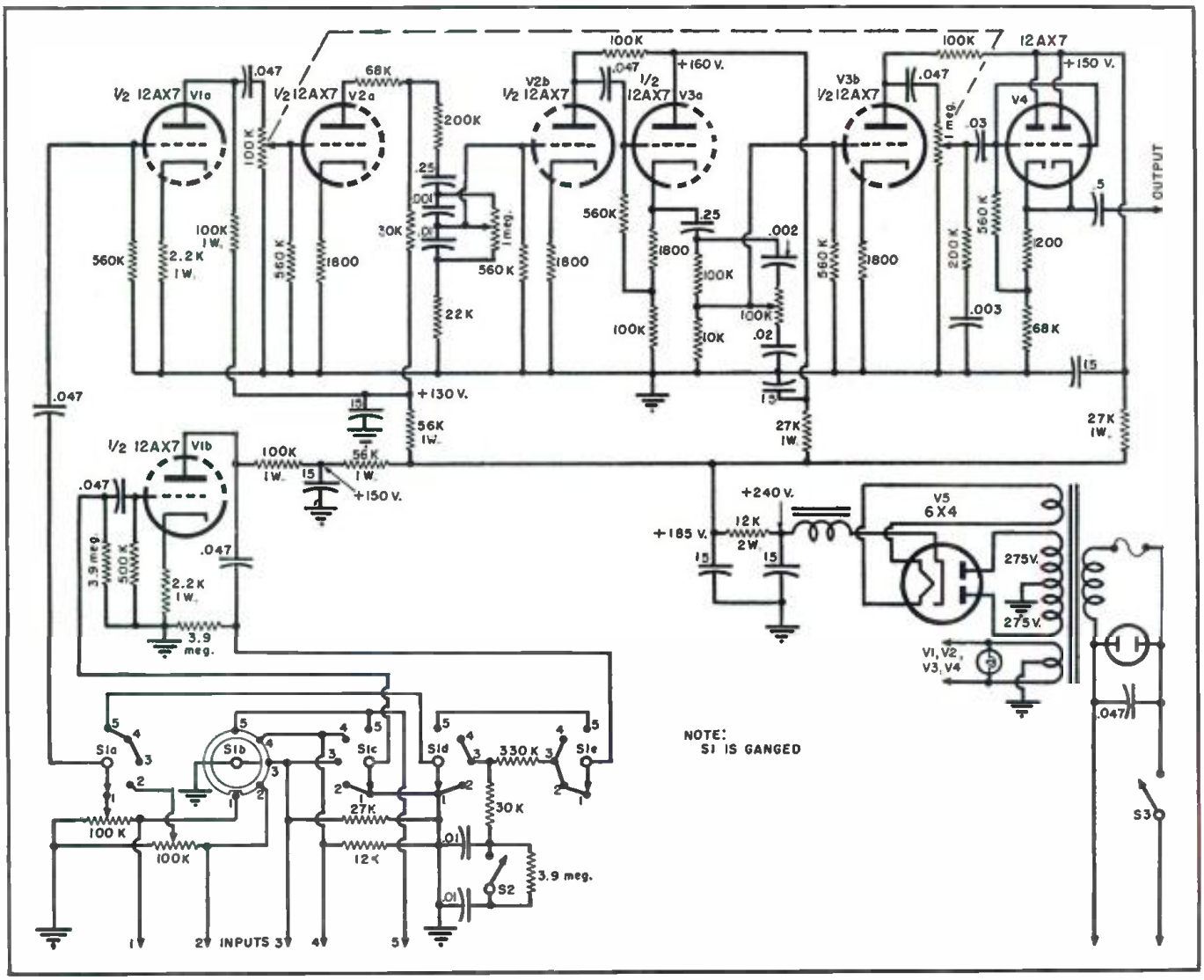
The Jack Field

All program circuits terminate in the jack field as described in Part 1 of this series. For those who do not understand the functioning of the patch system, the following will serve to illustrate the advantages to be gained by such a system. Fig. 8 shows how the jacks would appear when connected between the preamplifier output transformer and the input transformer of the line amplifier.

In audio circuitry it is common practice to eliminate return or ground circuits from diagrams (except the program circuit). To simplify the understanding of the workings of the jack system, reference to Figs. 7, 8, and 9 will show how a pair of double jacks is "normalled" to the following circuit. The jack (Fig. 10) consists of the "swinger" which is the long spring actually making contact with the tip of the plug, the frame of the jack (which is grounded), and the normal spring which, in this case, is normally in contact with the swinger. When a plug is inserted into the jack, contact is made with the swinger which raises it away from the normal spring and breaks the circuit; hence, when the plug is removed the swinger returns to place in contact with the normal spring and the circuit is completed as shown.

The system commonly employed in the jack field makes use of what is known as a "double jack." Here both

Fig. 3. Schematic of the AE-2 preamp-equalizer. Output is coupled to the 600 ohm line with an externally mounted transformer.



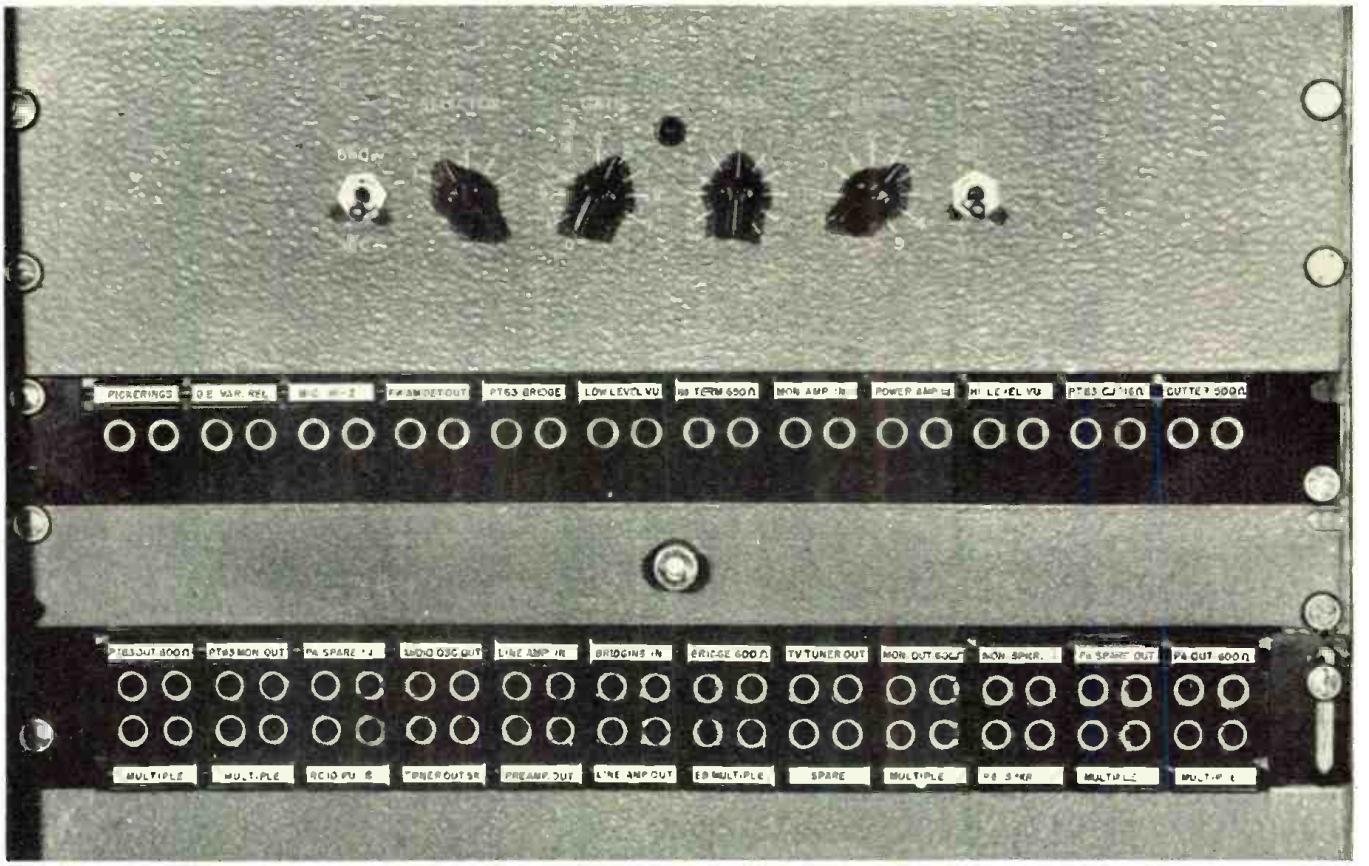


Fig. 4. The jack field comprises one single and one double jack strip. Note separation of low and high level circuits. Connector on center panel is for the high-impedance microphone.

sides of the circuits are connected to the swingers of the jacks and the normal springs connect to other circuits where connection of that sort is indicated. The construction of a typical double plug is illustrated in Fig. 11. It is good engineering practice in audio work to ground only one end of the shield of the connecting cable. This is necessary to prevent ground loops. Inasmuch as all of the jack frames are at ground potential there will be proper grounding of the plug when it is inserted into any of the jacks, but

(*Continued on page* 134)

Fig. 5. Simplified block diagram of complete system described in this series. Many combinations can be made with patch cords. Separate leads to a grounding bus prevent "ground loops."

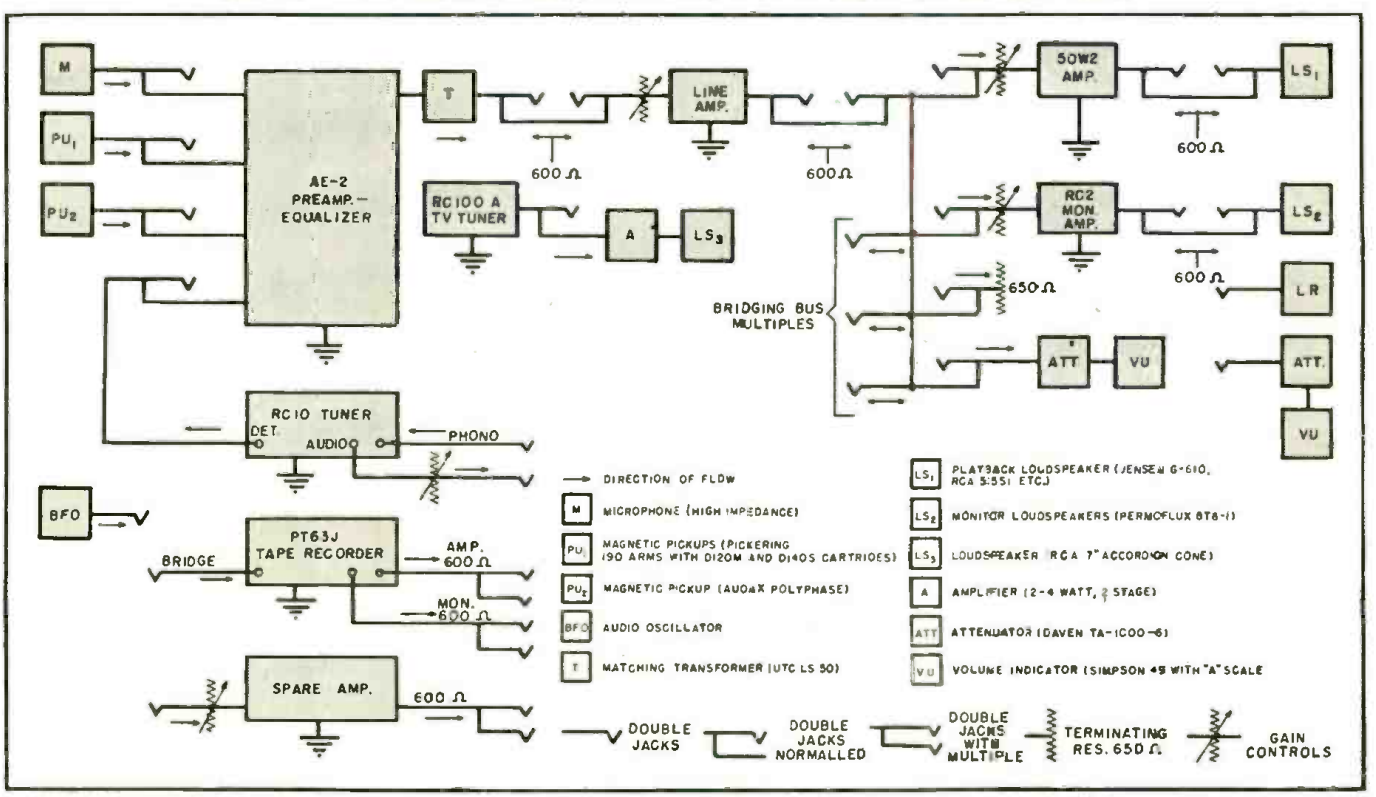


Fig. 1. Two of the small-sized, non-linear Thyrite resistors. The disc type is approximately ½-inch in diameter while the rod is slightly more than 1 inch long and approximately ¼-inch in diameter.

By
RUFUS P. TURNER, K6AI

Applications for THYRITE RESISTORS

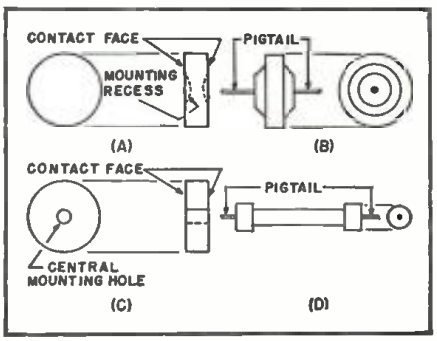
A non-linear component that can be used to perform special functions, alone or in conjunction with tubes.

IN THE growing list of non-linear resistance materials, *Thyrite* is both interesting and important. However, the practical applications of this material undoubtedly are better known to power engineers than to the electronic engineer. The distinguishing features of *Thyrite* resistors indicate the suitability of the latter for performing special functions, alone and in conjunction with tubes, in electronic circuits. For this reason, it appears appropriate to direct the attention of electronic personnel to *Thyrite* characteristics and applications.

Thyrite is a *General Electric Company* product. It is made from silicon carbide pressed with a ceramic binder and fired at approximately 1200 degrees Centigrade. Commercial *Thyrite* resistors are made in several sizes and shapes including flat discs whose two faces form the contact surfaces, flat discs with pigtail wire leads, washers whose two faces form the contacts and whose central holes may be used for mounting or stacking, and rods with pigtail leads. For contact purposes, a metallic coating is sprayed on each surface of the *Thyrite* disc and washer, and on each end of the rod. An impregnating compound provides protection against humidity.

Disc-type *Thyrite* resistors are supplied in diameters ranging from ¼ inch to 6 inches and thicknesses of 0.03 to 0.25 inch, depending upon power rating. Further discussion of *Thyrite* resistor specifications appears near the end of this article. Fig. 2 shows four shapes in which *Thyrite* resistors are supplied.

Fig. 2. Some of the Thyrite resistor shapes.



Electrical Characteristics

In common with other non-linear resistance materials, *Thyrite* is not "ohmic." When a voltage is applied to a *Thyrite* resistor, the current flow does not obey Ohm's Law but is proportional to some *power* of the applied voltage. This effect is more pronounced in some *Thyrite* resistors than in any other simple 2-terminal non-linear resistance. Thus, for the *Thyrite* resistor:

$$I = kE^n \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

where: I = the instantaneous alternating or direct current through the *Thyrite*

E = the instantaneous a.c. or d.c. applied voltage

k = amperes at 1 volt (a constant)

n = an exponent between 3.5 and 7 governed by the manufacturing process

From this relationship, it is seen that an exceedingly large current change is obtained by doubling the applied voltage, when the exponent n is high. Conversely, this means also that the change in voltage drop across a *Thyrite* resistor of high n value is low when current flowing through the resistor undergoes a large change in value. This latter feature is the basis of a simple *Thyrite*-type voltage regulator.

Unlike several other familiar 2-terminal non-linear resistance devices, the *Thyrite* resistor is not a rectifier. Any rectification effects are said by *General Electric* to be less than 1 percent. *Thyrite* accordingly may be used in a.c. as well as d.c. circuits. The positive and negative portions of the volt-ampere characteristic curve for *Thyrite* are symmetrical (See Fig. 3). The non-linear characteristic of the *Thyrite* resistor extends over a wide current range. The curves in Fig. 4 show the extent of current and voltage ranges for seven *Thyrite* resistor types.

When a sine-wave voltage is applied to a *Thyrite* resistor, the current flowing through the resistor is in phase with the voltage and is symmetrical but is distorted by the shape of the conduction curve. From Fig. 5, it is apparent that the current wave contains considerable odd-harmonic components. This ability of the *Thyrite*

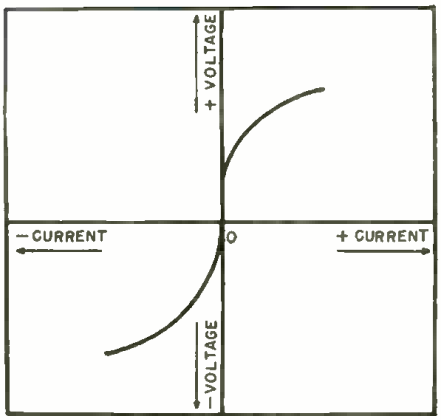


Fig. 3. Conventional volt-ampere characteristic curve of the Thyrite resistor.

resistor to generate harmonics is the basis of a simple frequency multiplier circuit used principally for tripling or quintupling the frequency of the applied voltage. This distorting characteristic should be considered when planning use of *Thyrite* resistors in a.c. circuits. The power factor of this resistor is less than 1 because of the difference in current and voltage waveforms. For this reason, the average a.c. power loss in the resistor is expressed as $E \times I \times p.f.$; where the loss is in watts, E is the applied voltage in r.m.s. volts, I the current in r.m.s. amperes, and *p.f.* the power factor expressed as a decimal.

The electrical characteristics of *Thyrite* are stated to be the same for impulses of a few microseconds as for d.c. It appears, however, that the maximum practical operating frequency will be governed appreciably by the self-capacitance of the resistor. The dielectric constant of *Thyrite* is given as 30 to 100 or more and is dependent to some extent upon applied voltage. This results in a rather high capacitance in the larger discs having parallel metallized faces.

Thyrite resistors are employed in power circuits as simple 2-terminal voltage regulators, protectors against voltage surges, lightning arrestors, as the sensitive elements in voltage-selective circuits, and in potentiometers giving constant voltage output under varying load conditions. The electrical characteristics of these resistors make them suitable for use in portions of electronic circuits where a non-linear current flow or voltage drop is desired.

Thyrite Circuits

Fig. 6 shows nine simple circuits incorporating *Thyrite* resistors. These circuits have been selected as typical of those in which the non-linear resistance characteristic of *Thyrite* might be utilized. Elaborations and modifications of these circuits, as well as entirely new applications, will suggest themselves to the circuit designer.

In Fig. 6A, the conventional linear cathode resistor in an electronic tube circuit has been replaced with a single *Thyrite* resistor (or several such resistors connected in series to obtain the desired resistance). As the applied signal voltage, E_o, increases, the tube plate current also increases. This fluctuating plate current flows through the *Thyrite* cathode resistor. The voltage drop across the latter is applied to the grid, in the conventional manner, as negative bias. The cathode voltage drop cannot alter to the same extent as the plate current, because of the non-linearity of the *Thyrite*. The result is a more nearly constant grid bias voltage under varying input-signal conditions. Use of the *Thyrite* cathode resistor may introduce complications in a.c. amplifier stages because of the harmonic content of the *Thyrite* current.

In Fig. 6B, signal output is taken across the *Thyrite* cathode resistor in a cathode follower type amplifier circuit. This circuit can be used when a fairly constant output is desired from a varying grid signal voltage. As in 6A, the voltage drop across the cathode resistor will contain relatively high odd-harmonic distortion. Means must be provided for suppression of the harmonics when they are not desired in the output voltage.

The harmonic-generating property of *Thyrite* is utilized in the simple frequency multiplier circuit shown in Fig. 6C. Because of the predominance of odd-numbered harmonics in the *Thyrite* current, this circuit is most effective for multiplying the input frequency by 3 or 5. Condenser C and the transformer primary inductance must resonate at the desired multiple frequency. It should be noted that a frequency multiplier of this type is not an amplifier, but on the other hand consumes power. The output power always is less than the input. In spite of this disadvantage, there are many applications in which such a simple frequency multiplier will be desirable.

The 4-arm bridge circuit in Fig. 6D contains both linear resistors and *Thyrite* resistors. Since the resistance of the *Thyrite* units varies with voltage, the bridge will be balanced only at one value of applied voltage. At this point, the output voltage accordingly will be zero. As the applied voltage is increased beyond the value required for null, the output voltage will increase,

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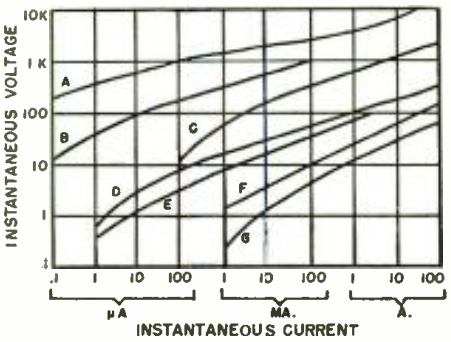


Fig. 4. Typical characteristic curves for several Thyrite resistors. (A) 3" diam., .78" thick. (B) 1" diam., .75" thick. (C) 6" diam., .75" thick. (D) 3" diam., .13" thick. (E) 2" diam., .13" thick. (F) 3" diam., .095" thick, and (G) 3" diam., .062" thick. The scale is logarithmic.

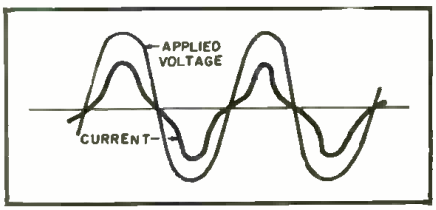
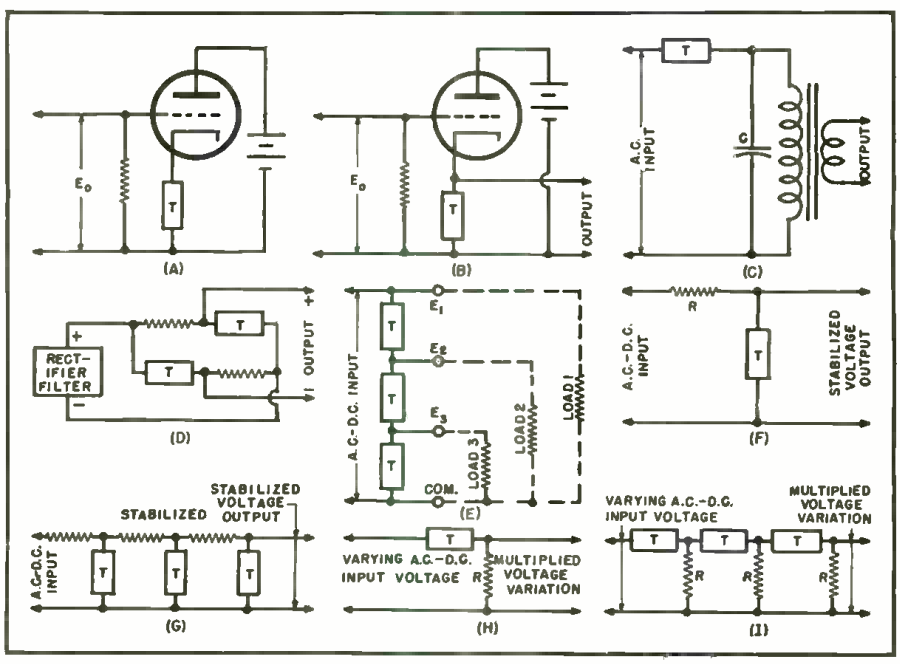


Fig. 5. Thyrite a.c. voltage-current waves. The presence of odd harmonics in the current wave is clearly visible in diagram.

Fig. 6. Thyrite circuits. (A) constant self-bias, (B) constant output, (C) frequency multiplier, (D) voltage regulator and polarity reversing control circuit for fluctuating input voltage, (E) potentiometer, (F) output voltage regulator, (G) cascade output voltage regulator, (H) multiplier of voltage variations, and (I) cascaded multiplier of voltage variations.



CRYSTAL CONTROLLED TWO-METER CONVERTER

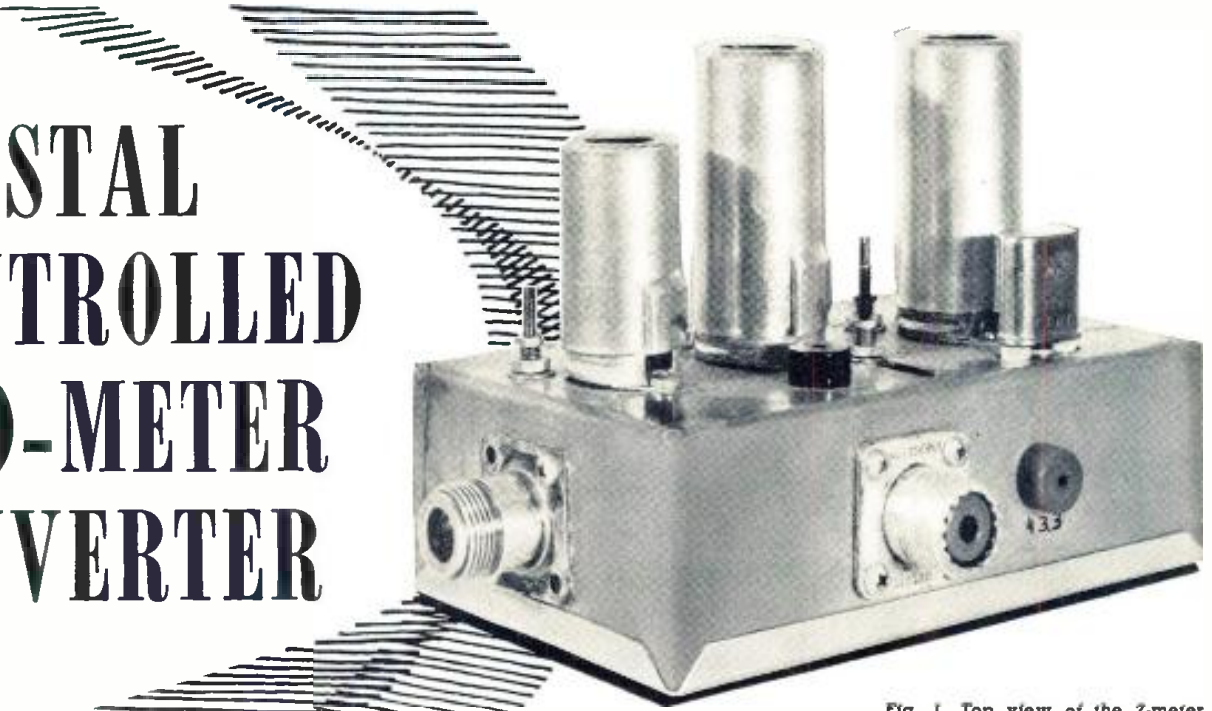


Fig. 1. Top view of the 2-meter converter which is built on a standard 3" x 5" x 1½" chassis.

By
HARRY G. PRATT,
W2SEA

Bandpass circuits for r.f. and detector stages simplifies design. It is easy to build.

MUCH interest has been shown in recent years in improved equipment for the higher frequency amateur bands. Crystal controlled transmitters have been accepted as standard equipment on 2 meters; however, little consideration has been given to increasing receiver stability. The converter described in this article has been designed to provide good sensitivity, stability, and at the same time, ease of operation.

As the design is a bit unconventional, the following explanation is given. Most 2 meter converters are built as shown in Fig. 3A, following the pattern of a conventional low frequency receiver front end. The r.f. and detector tuned circuits must track with the oscillator and produce a fixed output frequency, which is fed into the communications receiver.

Considerable simplification can be achieved by using bandpass circuits for r.f. and detector, as shown in Fig. 3B. Here no tracking problem is encountered as only the oscillator is tuned. With careful design the bandpass r.f. amplifier can be made to operate as well as the tuned r.f.

Both of the systems in Fig. 3 require the use of a communications receiver which is fed with a fixed frequency input. The front end of the receiver, which may be capable of tuning from 1 to 30 mc., is then used as a glorified i.f. amplifier, set at one predetermined frequency.

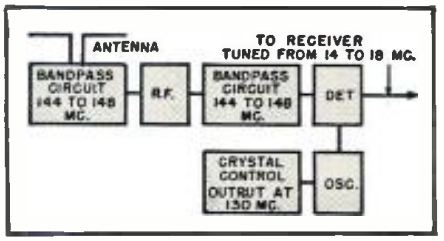
There is a popular misconception among many amateurs that a broadband amplifier is more noisy than the conventional tuned type. This is not true in the case of an application such as this since the i.f. in the receiver used actually determines the bandwidth and, consequently, the noise level is no greater than that of a tuned converter.

One disadvantage of a converter of this type lies in the possibility of signals from services in the tunable i.f. range getting directly into the front end of the receiver.

With modern, well-designed receivers this is not a serious problem if reasonable precautions are taken to shield the lead from the converter to the receiver and if a cabinet is used on the converter. The lead from the converter to the receiver should be kept as short as possible.

With the arrangement shown in Fig. 2, better use is made of the communications receiver, and at the same time the converter is greatly simplified. Bandpass circuits are used in the r.f. and detector, while the oscillator is operated at a fixed frequency. Using the 130 mc. oscillator as shown, incoming signals between 144 and 148 mc. are mixed in the detector to produce output signals in the range of 14 to 18 mc. The receiver may then be tuned over this range to select the desired 2 meter signal. Thus no tuning controls are needed within the converter and, in effect, it is connected into the antenna line and all operation carried on from the communications receiver.

Fig. 2. Block diagram of crystal controlled 2-meter converter. Advantages of this type of design are discussed in detail in text.



An oscillator frequency of 130 mc. was chosen so the converter could be used with a BC-348 receiver, which does not cover above 18 mc. Placing the oscillator below the signal frequency and using an even multiple of 10 for the oscillator frequency allows for easy interpolation of the receiver calibration. With the 130 mc. oscillator, 14 mc. at the receiver corresponds to 144 mc., 15 mc. tunes to 145 mc., etc. Other frequencies could be used to match a particular receiver. For example, with the oscillator at 120 mc., the receiver would be required to tune from 24 to 28 mc.

Use of a fixed frequency oscillator facilitates stabilization. A self-excited oscillator may be used; however, series mode crystals are available which allow operation in this frequency range without additional multiplier stages.

As shown in Fig. 4, an 8.66 mc. crystal is operated on the 5th mode in a cathode-coupled circuit using a

12AT7 twin triode. This gives output of 43.3 mc. at L_7, which is fed back to the cathode follower section to sustain oscillation. Now if an additional tank is connected in the plate circuit of the cathode follower, it may be used as a multiplier. In the circuit shown the tank, L_6, is tuned to 130 mc. or the third harmonic of the crystal output.

Crystals intended for harmonic operation are made with small electrodes plated at the center of the crystal. They are available on special order at a corresponding price. However several conventional AT cut crystals from surplus sources have been tried and found to operate well in this circuit. The cathode-coupled oscillator works well at the third or fifth mode, and the multiplier can be used to double, triple, or quadruple. Thus the crystal may be some frequency other than 8.66 mc. For example, a 6.5 mc. crystal-operated fifth mode, and multiplied four times in the cathode follower plate circuit will produce 130 mc. output.

Use of the harmonic mode crystal is not only desirable from the standpoint of attaining a high frequency output with a minimum of tubes, but almost a necessity to reduce spurious responses. If the 6 or 8 mc. crystal was operated at its fundamental and followed by several multiplier stages, spurious responses or "birdies" would be found every 6 or 8 mc. By operating the same crystal at 30 or 40 mc. the chances of birdies within the tuning range of the receiver and converter are greatly reduced.

R. F. Amplifier

The r.f. amplifier consists of a neutralized triode-connected 6AK5, and one-half of a 12AT7 connected in the now popular "cascode" circuit.[1] Bandpass of 144 to 148 mc. is required in all coupling circuits from antenna to detector grid.

Input coil, L_8, is loaded by close antenna coupling to provide optimum operation of the input stage. With the tap located as indicated in the coil data the bandpass is in excess of 4 mc. when fed from a 50 or 72 ohm cable. L_2 is broadbanded by virtue of the low input impedance of the grounded-grid stage and by shunting this coil with R_1.

Coupling between the grounded-grid amplifier and detector is through bandpass transformer L_3 and L_4. It is essential that this arrangement be used instead of a loaded single-tuned circuit, to actually limit the response to approximately 4 mc. Without inductive coupling, signals at the receiver frequency (14 to 18 mc.) may pass through the converter and cause interference.

Detector

One half of V_2 is used as a triode first detector. Oscillator output is coupled directly to the grid through the 2 $\mu\mu$fd. condenser C_{20} producing some grid-leak bias. This bias may be read at Test Point #2 (J_2), which is included as an aid in tuning the oscillator as described under "Initial Adjustments."

The detector plate circuit must also have a bandpass of 4 mc., in this case from 14 to 18 mc. Capacity coupling as shown was used to provide flexibility, so the converter could be used with different communications receivers. It is capable of matching a wide range of receiver input impedances and has been used successfully with the BC-348, SX-28, and HQ-129 receivers. The capacity of the connection cable from converter to receiver becomes part of the circuit, and should represent approximately 25 $\mu\mu$fd. To obtain this capacity, a two-foot length of RG-62-U low capacity cable was used. If another type of cable is used, the length should be cut down to maintain essentially the same capacity.

Power Supply

Power requirements are 6.3 volts at .775 amp. and 150 volts at 18 ma. which can be taken from the supply of most receivers, or a separate supply may be used if desired. In either

[1] Wallman, Macnee, & Gladden: "A Low-Noise Amplifier," Proc. IRE, June 1948.

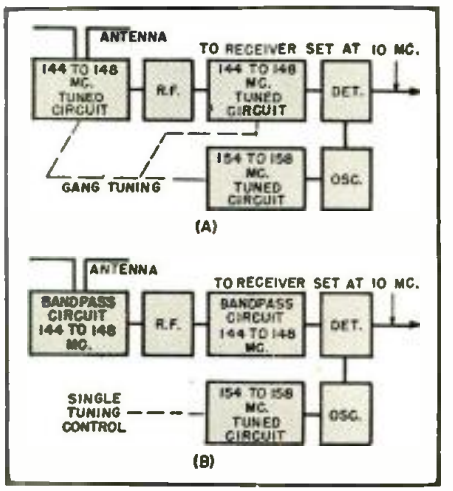
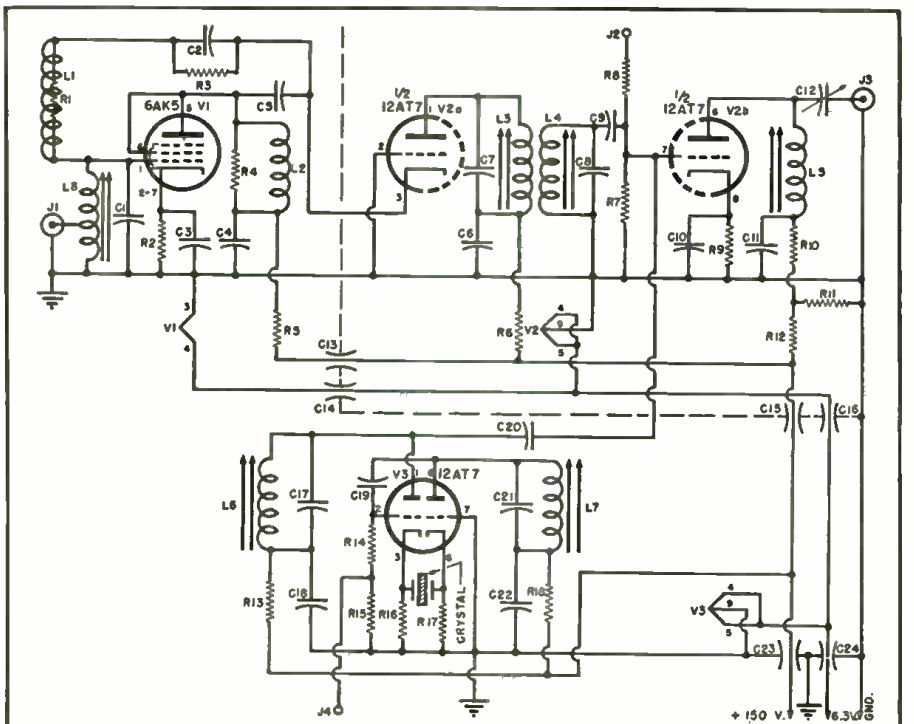


Fig. 3. Two of the most-commonly used two meter converters. See text for explanation.

Fig. 4. Complete circuit diagram covering the crystal controlled, 2-meter converter.



R_1—1 megohm, 1 w. res.
R_2—330 ohm, ½ w. res.
R_3—150 ohm, ½ w. res.
R_4—4700 ohm, ½ w. res.
R_5, R_6—10,000 ohm, ½ w. res.
R_7—100,000 ohm, ½ w. res.
R_8—150,000 ohm, ½ w. res.
R_9—1800 ohm, ½ w. res.
R_{10}—22,000 ohm, ½ w. res.
R_{11}, R_{12}—47,000 ohm, ½ w. res.
R_{13}—68,000 ohm, ½ w. res.
R_{14}—1000 ohm, ½ w. res.
R_{15}—2000 ohm, ½ w. res.
R_{16}, R_{17}—470 ohm, ½ w. res.
C_1, C_7, C_9—4 $\mu\mu$fd. Ceramicon (Erie Style K)
C_2—470 $\mu\mu$fd. postage-stamp mica cond.
C_3, C_4, C_8, C_{10}, C_{11}, C_{13}, C_{22}—470 $\mu\mu$fd. button mica cond. (Erie 370FA)
C_5—220 $\mu\mu$fd. postage-stamp mica cond.
C_6—50 $\mu\mu$fd. Ceramicon (Erie Style K)
C_{12}—8-50 $\mu\mu$fd. Ceramicon trimmer cond. (Erie Style 557)
C_{15}, C_{14}, C_{15}, C_{16}, C_{23}, C_{24}—500 $\mu\mu$fd. feed-through cond. (Erie 370 CB)
C_{17}—10 $\mu\mu$fd. Ceramicon (Erie Style K)
C_{19}, C_{21}—22 $\mu\mu$fd. Ceramicon (Erie Style K)
C_{20}—2 $\mu\mu$fd. Ceramicon (Erie Style K)

J_1—Antenna input jack
J_2—Tip jack (Test Point #2)
J_3—Receiver output jack
J_4—Tip jack (Test Point #1)
L_1—15 t. #28 en. closewound on Allen Bradley 1 w. res. (R_1)
L_2—4 t. #22 bare en., ¼" dia., ½" long, air-supported
L_3, L_4*—4 t. #22 bare en., double-spaced on ¼" form with slug
L_5*—28 t. #32 en. closewound on ¼" form with slug
L_6**—3 t. #22 bare, ⅜" dia., ¼" long, air-supported over tuning slug
L_7*—8 t. #28 en. closewound on ¼" form with slug
L_8*—5 t. #22 bare en., double-spaced on ¼" form with slug. Tap 2 t. from gnd. end
Crystal—AT cut crystal (see text)
V_1—6AK5 tube
V_2, V_3—12AT7 tube

*All ¼" forms with slugs are Cambridge Thermionic Corp. Type LSM
**Tuning slug assembly from Cambridge Thermionic Corp. Type LSM

case, the plate supply should preferably be regulated with a VR150.

The converter shown in Figs. 1 and 5 was built on a 3x5x1½ inch chassis. Brass was used in preference to aluminum so that the shields could be soldered in place. Good shielding and careful placement of parts is required, as in any 2 meter equipment.

Fig. 5 shows the under chassis layout. Shields were placed between each tube socket as shown, and feedthrough condensers used where power leads pass through shields. Incidentally, all necessary holes should be cut in these shields before they are soldered in place. The shield between V_1 and V_2 has an opening on the center line for C_2, C_5, and R_3, as well as holes at one end for feedthrough condensers C_{13} and C_{14}. The shield between V_2 and V_3 requires openings for C_{15}, C_{16}, and C_{20}.

It was also found necessary to install a shield between pins 1 and 3 of V_2, to shield the input from the output of the grounded-grid amplifier. This shield consists of a small plate approximately 1 inch square, which is soldered in place vertically, starting at the center post of the tube socket and passing through pin 2, which is grounded.

For purpose of alignment, it is desirable to provide means of decreasing coupling between L_3 and L_4. For this reason, L_4 was mounted in a slot, such that at maximum coupling the coils are spaced ⅜" between centers, while with L_4 at the far end of the slot, the coils are spaced approximately 1 inch.

Initial Alignment

With power applied, the oscillator should be tuned first. A high impedance voltmeter is connected from Test Point #1 (J_1) to ground and a small negative voltage will be observed. As L_7 is tuned through resonance, this voltage will increase. Proper adjustment is slightly higher in frequency than the crest of this peak, as in tuning a conventional crystal oscillator. The purpose of this slight detuning is to insure starting of the crystal which may be checked by turning plate voltage off and back on again and observing that the test meter returns to the same reading. Using a *Simpson* Model 260 meter on the 2.5 volt scale, off-resonance deflection was approximately .25 volt, which increased to .45 volt at resonance. Wide variation may be expected with different crystals; however, there should be a definite rise as L_7 is tuned through resonance.

The multiplier plate coil (L_6) may now be tuned. Connect the test meter from Test Point #2 (J_2) to ground, and a similar negative voltage will be observed. When L_6 is tuned through resonance, this voltage will rise. As this is a multiplier tuning adjustment, proper operation is at the crest of this rise.

The r.f. alignment can be made using a sweep generator and scope, in which case the over-all response is adjusted for a bandpass of 144 to 148 mc. Fortunately for most of us, alignment can also be made with only a signal generator, using the following procedure.

Set the receiver to the center of tuning range, in this case 16 mc., with receiver antenna trimmer at center of its range. C_{12} is also set at about one-half of maximum capacity. Now a good hefty 16 mc. signal is applied to Test Point #2 (J_2), and the generator frequency trimmed up to obtain maximum signal at receiver, as indicated on "S" meter, or by using a modulated signal and listening to the audio output of receiver. L_5, the detector plate coil may now be peaked.

After L_5 is peaked at 16 mc. the band ends should be checked by tuning both the receiver and signal generator to first 14 and then 18 mc. At each end frequency, rock the antenna trimmer on the receiver to determine if it may be peaked up. If not, increase C_{12}, return to 16 mc. and repeat the whole procedure.

When finished with the detector plate circuit, connect signal generator to converter input and apply 146 mc. Tune the receiver around 16 mc. to locate the signal and proceed to align L_2 and L_4. This is done by decoupling L_2 and L_4 until the space between coils is approximately 1 inch. Both coils may now be tuned and will peak quite sharply. Once they have been peaked, the slugs are locked, and the coupling increased by moving the coils closer together. With a spacing of ⅜" between centers the bandpass should be satisfactory.

This leaves only L_8, the input coil to be tuned, which is best done by disconnecting the generator from the converter, thus removing the loading from L_8. With the generator output lead near L_8, the signal is increased until heard in the receiver through the loose coupling. With 146 mc. signal, L_8 is tuned for maximum signal and the slug locked.

Over-all operation may be checked by connecting the signal generator to the input jack and comparing the relative sensitivity at 144 and 148 mc. (The generator should represent a 50 or 72 ohm source to load L_8 properly.) If any great difference is apparent, it can be flattened out by trimming L_2. As this is not a critical adjustment no slug has been provided, and trimming is done by spreading or squeezing turns.

Operation and Results

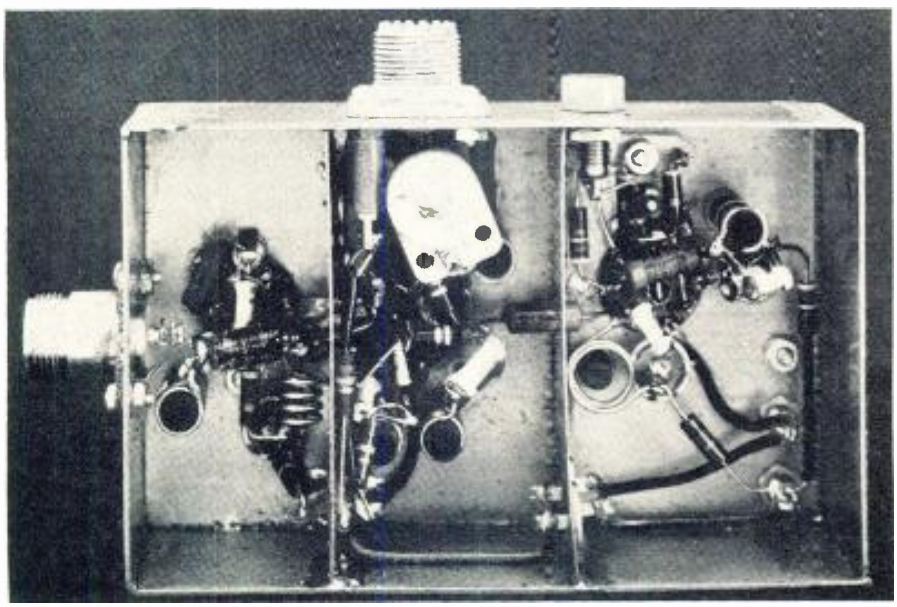
Once the converter has been aligned actual operation is pretty much determined by the receiver in use. Best sensitivity is normally obtained with a.v.c. turned off, audio gain near maximum, and r.f. gain advanced until noise is just noticeable. When tuning from one end of the band to the other it will be necessary to repeak the receiver "antenna trimmer" in the same manner as would be required when using the receiver without the converter.

Sensitivity tests of the converter show that the cascode front end performs as well as many enthusiastic users have claimed. With a 30% modulated signal of .1 μv. applied, the resulting output signal was some 12 db. above noise level. This would tend to indicate a sensitivity of about .05 μv. for a 3 db. signal-to-noise ratio, although no direct measurements could be made at this level due to test equipment limitations.

On-the-air checks also showed the crystal controlled cascode converter to be superior to the conventional pentode front end. This was in part due to the cascode performance and partially due to the fact that with stable first oscillator the receiver i.f. could be operated in a sharper position than would otherwise be possible. In general the results were very gratifying and felt to be well worth the time and effort involved in designing and building the converter.

-30-

Fig. 5. Under chassis view of the crystal controlled, 2-meter converter.



A Nondirectional CORNER SPEAKER

By DEAN POST

Complete details on a sound chamber that can be home-built at relatively low cost. Any speaker can be used.

Fig. 1. Over-all view of sound chamber. Speaker is mounted at top of column and reflector is used to direct sound into room.

THIS article deals with a satisfactory and, at the same time, economical answer to the problem of directional high-frequency sound radiation of loudspeakers. The solution also offers a saving in space requirements, plus a realistic physical placement of the sound aperture. Total cost of materials was less than $10.00.

The usual speaker baffle construction places the sound vent relatively close to the floor. This is an exceedingly unrealistic arrangement. Violinists, for example, do not usually play in a prone position. The realism afforded by sound radiating at ear level is well worth the effort required to obtain it.

The enclosure described here largely overcomes the above shortcomings. See Fig. 1. The speaker is mounted horizontally and at the top of the column, where it radiates into a 45 degree reflecting conic section. This device reflects sound over a 90 degree arc. Placement of the box in a corner thus insures that practically all listening positions in the room receive equal amounts of high-frequency radiation.

The totally enclosed portion is one foot square (outside dimensions) and 3 feet high; total height of the unit is about 4 feet. A 7 inch British speaker is used by the writer, but larger units can readily be employed. The size speaker used will determine the total height of the box. Volume is the critical dimension. A 7 inch diameter speaker requires about 3 cubic feet of enclosed space, while a twelve inch unit requires about twice that amount. A box suitable for a 12 inch speaker would thus be about 15 inches square and 4 feet high, with a correspondingly larger reflector.

The lower portion of the baffle is constructed of ¾ inch plywood with edges butted. Interior corner 1" x 1" strips are utilized for screw mounting, since wood screws do not enter plywood edges in a satisfactory manner. Glue would do as well.

Sound absorbent material—rug padding, Celotex, or the like—lines the entire box interior. Even though the box is of columnar construction, no resonance effects have been detected.

The exterior is finished by enclosing it with 1¼ yards of tapestry. This greatly simplifies construction and finishing problems, and the cost of the cloth is most reasonable.

The top portion is easily constructed. After the speaker cone is located in the center of a 1-foot square mounting board and a suitable hole is cut out, vertical ¾ inch pine boards are cut for mounting in the form of a corner as shown in Fig. 2. The boards are square when measured from the speaker side, and are placed tangent to the hole.

A diagonal cut on each board is made with a hack saw or other thin blade, to a depth of ⅜ inch, as indicated by the lines marked *D* in Fig. 2. This is to hold the edges of the conic section.

A piece of 0.025 inch aluminum should now be laid out and marked as shown in Fig. 3.

A compass centered at point *O* with *D* as a radius should then describe the arc *S*. *D* is the length of the slots, from Fig. 2, and *S* is equal to 1.57*H*. The distance *S* should be measured along the arc. This section should then be cut out and gently formed into a slight curve of a cone. The ⅜ inch strip on each side will serve as a retaining and mounting portion.

Now mount the side boards securely on the speaker mounting board, and slide the cone into the slots. A nice

(*Continued on page* 149)

Fig. 2. Mechanical details of reflector mounting. Cut slots to ⅜" deep along both diagonals "D."

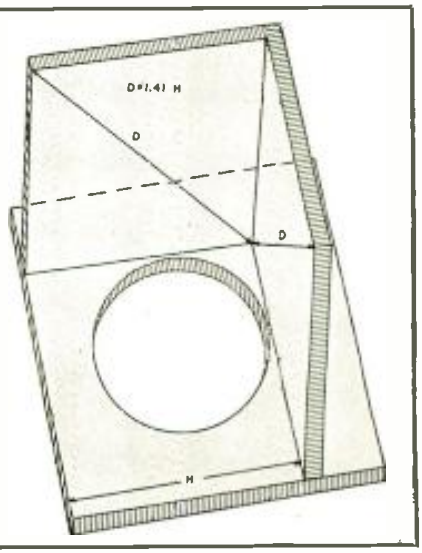
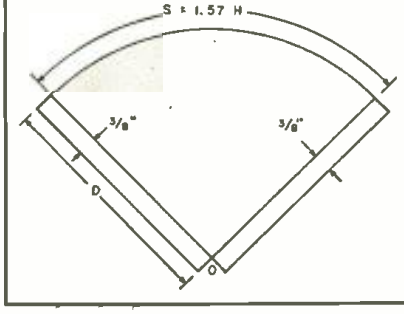
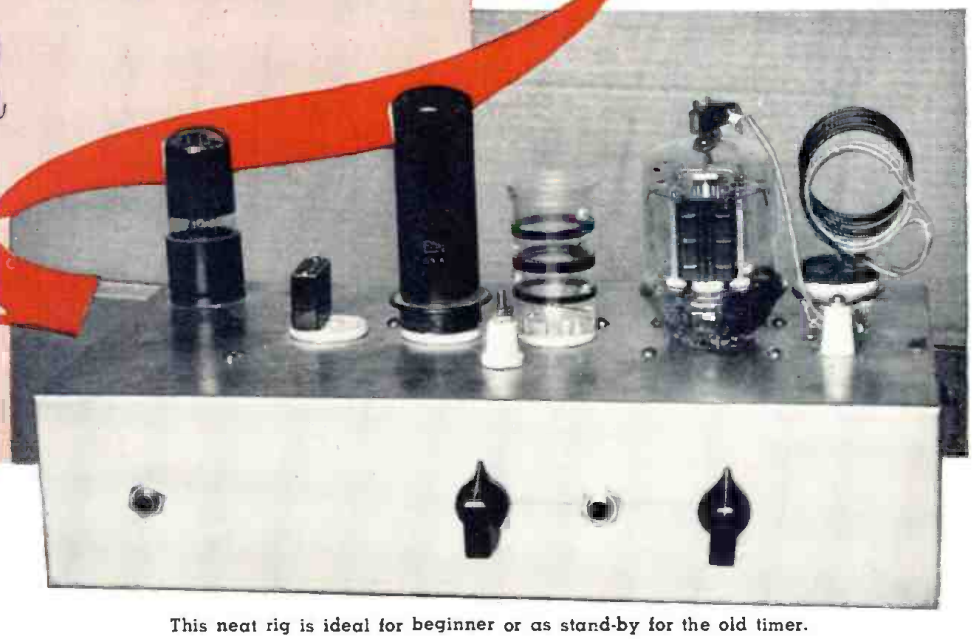


Fig. 3. Reflector dimensions. Aluminum .025" thick was employed.



An Easy-To-Build 10 METER RIG



This neat rig is ideal for beginner or as stand-by for the old timer.

By
STAN JOHNSON,
WØLBV

This unit uses three tubes, operates from single power supply, and has "clamper tube" modulation.

THIS 10 meter phone transmitter was designed with one thought in mind: to build a compact transmitter which would require an absolute minimum of parts and yet be capable of a reasonable amount of output and be easy to adjust and put on the air. The result is a transmitter which has but two tubes in the r.f. section and a single modulator.

Because the rig uses so few parts —and these parts are all standard values which can be used later in a more complicated rig—the transmitter is ideal for the beginner. And for the old timer the transmitter is an excellent standby unit for use when the big rig is being revamped—or for mobile, portable, or emergency use.

The r.f. section uses a 6L6 tritet oscillator with a fixed-tuned cathode circuit, thus eliminating one variable condenser. The 6L6 plate output circuit (which provides output at twice the crystal frequency) likewise is untuned, being tightly coupled to the grid circuit of the following stage. This stage, using an 829-B (or 3E29) is very efficient as a push-push doubler, and provides the 10 meter output. The tuning condensers in the grid and plate circuit of this stage are the only variable condensers in the set.

Modulation for the transmitter is provided by a 6V6 which is used as a "clamper tube" modulator. This is a now-familiar form of screen grid modulation. The arrangement illustrated is the last word in simplicity—not even needing a modulation transformer or choke. Actually, it is a form of series modulation, which the writer and many others used nearly 15 years ago.

The entire transmitter is built up on a standard 3" by 7" by 13" chassis. The modulator is placed at one end of the chassis to get it as far as possible from the r.f. output end. Down the center of the chassis in a row, starting from the left end, are: the sockets for the crystal; the 6L6 oscillator; the combination plate coil for the 6L6 and the grid coil for the 829-B; the 829-B socket; and the socket for the plate coil in the output circuit.

On the rear of the chassis is a 4-prong socket which is used to provide connection with the 6.3 volt heater voltage source and for the 45 volt "C" battery. A feedthrough insulator is used as a high voltage terminal for the 600 volt power supply. The latter can be any standard supply which will furnish 600 volts at 200 ma. plus 6.3 volts for the tube heaters.

The values chosen for the parts in the rig are all standard. However, some are rather critical so unless you are an old hand at modifying circuits it is urged that you use the parts specified. For example, the writer tried using a single-gang condenser for C_4. This resulted in a very unstable transmitter which would oscillate without rhyme or reason. Replacing the single gang condenser with the dual condenser whipped the trouble completely.

Another critical spot is the output plate coil. A standard manufactured coil was tried—but it would not work, apparently because paralleled tube plates add enough capacity so that the coil used must be smaller than normal. If you do use a manufactured coil you will have to peel off turns—and further, it is doubtful if the antenna pick-up coil will have enough inductance. For that reason, the writer urges that for this set the builder "roll his own" coils, following the coil specifications given in the parts list.

Getting the set into operation is no trick at all if everything has been wired properly. The first thing to do, of course, is to get the oscillator working, as indicated by r.f. on the grid coil when a standard pick-up loop and flashlight bulb is coupled to it. Then, with an 0-200 ma. or larger milliammeter plugged into the cathode jack, the plate circuit is tuned to resonance.

If the set is working properly so far —the next step is to put it on the air. *It is imperative that the antenna loading be heavy*— if *both* good efficiency and good modulation are to be obtained. This means first of all that the antenna should be one which "takes" r.f. readily—one which will overload a standard transmitter if the antenna coupling on it is turned all the way in.

Assuming that a good antenna is available, adjust the slider on R_4 until the screen voltage on the 829-B reads 150 volts. (If you do not have a voltmeter the setting is approximately the half-way point on the 1000 ohm cathode resistor.) Next, couple up for maximum antenna loading—which should be so "tight" that the resonance dip, as noted on the milliammeter, is very broad. Now, plug in

the microphone, and speak into the mike. When you really "hit" the mike there should be a very slight upward "kick" of the milliammeter, and total current indicated on the milliammeter should be about 135 ma.

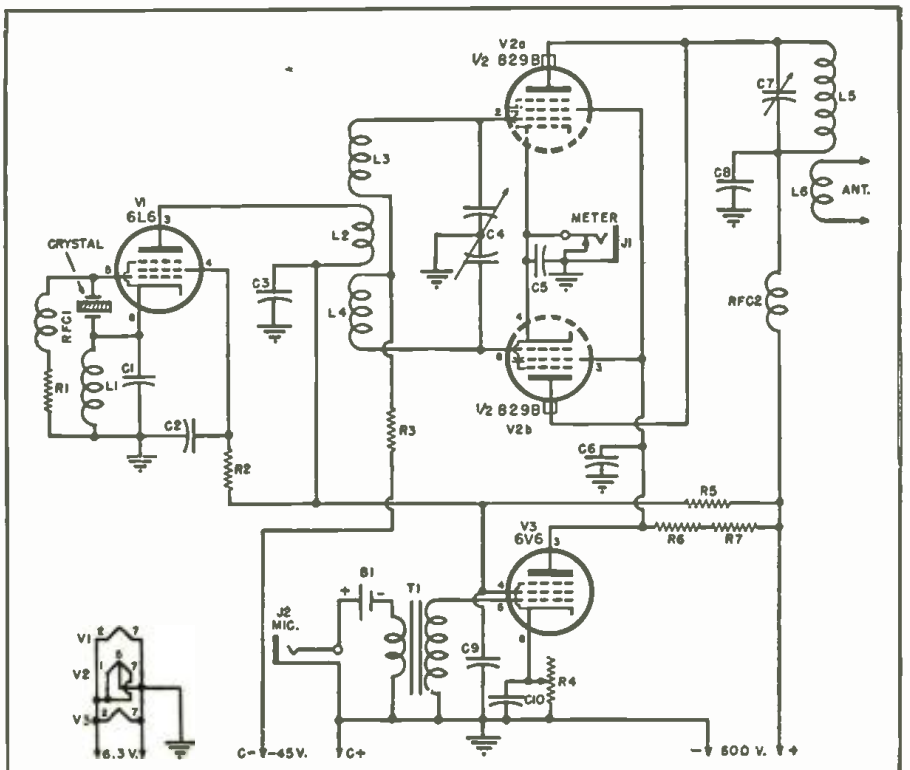
If the transmitter modulates "down" it is an indication that (1.) the antenna coupling is too loose, or (2.) the screen voltage is too high. The latter can be lowered by adjusting the slider on R_4. However, lowering screen voltage reduces efficiency, so if possible increase the antenna load. This may involve changing the number of turns on L_6, or modifying the antenna so that it loads better.

When adjusted, using the procedure outlined, the rig is capable of excellent quality—in fact, to the writer's consternation, a local ham reported that the little rig sounded as good as the regular transmitter, which has Class B modulation, a crystal mike, and all the trimmings. Subsequent checks proved that the local was a trifle optimistic, but quality reports have been uniformly good on both local and long haul contacts.

A gain control for the mike was regarded as an unnecessary luxury—simply "backing off" from the mike originally used kept the gain at the proper level. However, it would be a simple matter to put a 500,000 ohm variable resistor across the output side of T_1.

A word about microphones. The plentiful T-17 type mikes have relatively low output, so low that they will barely provide enough audio. with very close talking. Their output can be improved a good deal by prying them apart with care, and drilling some extra holes in the front for the sound to enter. Even so, the writer prefers the standard "F" type microphone from a telephone, because it has superior quality and output. Contrary to popular conception, it is not necessary to "scrounge" these—many local phone companies will sell them, providing they recover from the shock of somebody trying to acquire one honestly.

Like any low power transmitter this one will not consistently slug it out down in kilowatt alley at the low end of the band, and the user will probably have better luck with it if he operates 29,000 kilocycles and higher. Also, it is asking too much of any modest transmitter to expect it to perform miracles with a folded dipole or other simple antenna. In fact, the writer has always been a little amazed at the number of folded dipoles in use considering the fact that a simple beam (such as the two element, end-fire array described in the writer's article "No Space for an Antenna?" in April 1950 issue of RADIO & TELEVISION NEWS) costs practically nothing to build, takes up very little more space than a dipole, and will give infinitely better results. The beam mentioned, incidentally, has been found to work even better if spaced 6 feet instead of 4 feet as specified in the original article.



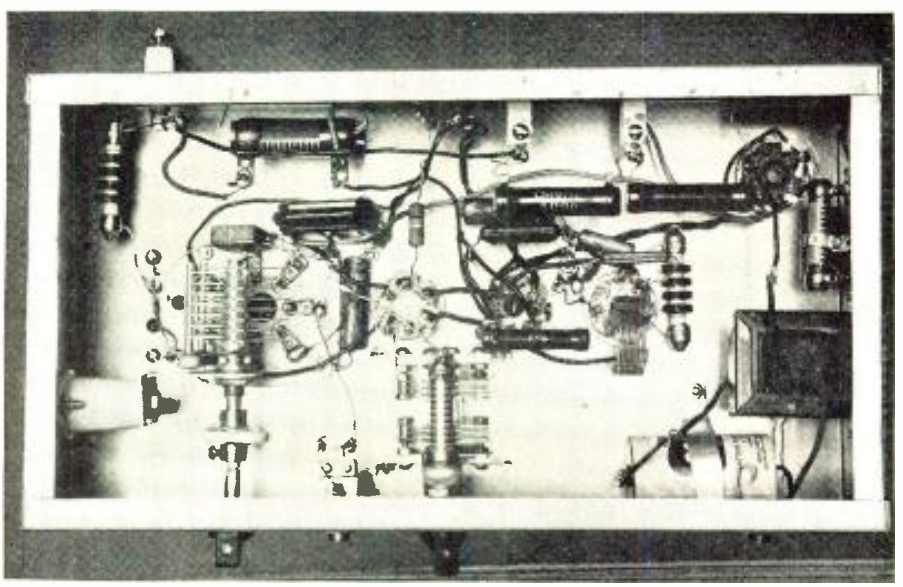
R_1—47,000 ohm, 1 w. res.
R_2—20,000 ohm, 10 w. wirewound res.
R_3—10,000 ohm, 1 w. res.
R_4—1000 ohm, 10 w. wirewound adj. res.
R_5, R_7—10,000 ohm, 25 w. (or larger) wirewound res.
R_6—5000 ohm, 25 w. (or larger) wirewound res.
C_1—100 μμfd., 500 v. mica cond.
C_2, C_9—.05 μfd., 600 v. cond.
C_3—.003 μfd., 500 v. mica cond.
C_4—50/50 μμfd. var. cond.
C_5—.05 μfd., 600 v. cond.
C_6—500 μμfd., 500 v. mica cond.
C_7—50 μμfd. double-spaced midget var. cond.
C_8—.002 μfd., 1000 v. (or higher) mica cond.
C_{10}—10 μfd., 50 v. elec. cond.
RFC_1, RFC_2—2½ mh., 125 ma. r.f. choke
J_1—Closed circuit jack
J_2—Microphone jack
B_1—1½ v. flashlight battery
T_1—Single-button microphone-to-grid transformer
Crystal—40 meter crystal
L_1—8 t., #22 en., 1½" in dia., spaced to occupy ⅜"
L_2—9 t. #24 en. closewound
L_3, L_4—7 t. #24 en. closewound either side L_2 and spaced ½" from it.
L_5—5 t. #14 en., 1¾" i.d., spaced to 2" length
L_6—3 t., 1¾" dia. (see text)
1—Single-button microphone
V_1—6L6 tube
V_2—829 tube
V_3—6V6 tube

Complete circuit diagram of a 10 meter transmitter which uses only three tubes.

One caution—in order to provide tight antenna coupling, the antenna coil is wound of flexible wire so that it can be "poked" into the plate coil. This means that it must have very good insulation—otherwise there is the grim possibility that high voltage will appear on the antenna feeders. The moral is obvious—use wire with a high voltage breakdown rating, such as auto ignition wire.

-30-

Under chassis view of transmitter shows how few components are required in unit.



A Preamp With TONE CONTROL

Front view of the home-built preamp and novel power supply.

By
GLEN SOUTHWORTH

This novel preamp features simplified power supply and combination "low-high" frequency boost control.

IN RECENT years an increasing amount of audio equipment has been offered to that part of the listening public which desires to assemble its own reproducing system. This trend has been reinforced by the recommendations of various consumer organizations and an increasing number of not too technically minded persons are joining the experienced constructor in the assembly of their own equipment.

In many instances the interactions between various sections of the audio setup may be largely ignored, even though careful attention is paid to the selection of highest quality components. Probably the most obvious example of this is the conventional radio phonograph wherein the close proximity of the loudspeaker to the pickup produces electromechanical feedback which, in turn, causes hangover, distorted reproduction, and limited low frequency response capabilities. This problem is often accentuated where microgroove recordings are concerned due to the lighter tracking pressures involved and the fact that some of the lightweight plastic arms have serious mid-frequency resonances, as may be tested by turning up the gain and tapping lightly on the arm.

Probably one of the best and simplest solutions to the above problem is to move the record playing mechanism to a distance from the loudspeaker system. As most listeners usually prefer to sit somewhat back from the speaker, it is often desirable to locate the player nearby, together with some means of tone and volume control. To do this almost always requires some form of preamplifier with a relatively low impedance output in order to prevent the capacitance of the connecting shielded cable from seriously attenuating the high frequencies.

A compact preamplifier incorporating cathode follower output as well as a novel power supply and tone arrangements is shown in the accompanying diagram and photographs. The power supply is unique in that only the six volt heater voltage is drawn from the power supply of the main amplifier. This is used for the tube filaments and is stepped up by a small filament transformer which is connected backwards to supply the plate voltage for the preamp tubes. This arrangement has several advantages, prominent of which is the fact that the only power connection required is a single pair of wires carrying low voltage, which is additionally desirable under certain wiring codes. Secondly, an arrangement of this kind provides excellent decoupling from the main amplifier power supply in the event that high gains or a large power output is desired.

With the exception of the tone circuit, the rest of the preamp is of conventional design, using a 6J5 as a stage of voltage amplification and one half of a 6SL7 as a cathode follower output stage. In the event that additional amplification is required, such as for a low level magnetic pickup, the other half of the 6SL7 may be connected for extra gain.

Upon examination it will be noted that the tone circuit used is somewhat similar to the increasingly popular compensation circuits for the *Fletcher-Munson* effect, in that it boosts both high and low frequencies simultaneously. In principle, its operation is considerably different in that it is intended to be used at high volume levels as well as low to create a form of "Distance Control."

The average living room does not have the acoustic characteristics of a concert hall and, as a result of a combination of factors, home reproduction may sound distinctly unnatural to the listener accustomed to live performances. This difference does not necessarily result from a longer reverberation time in the concert hall, as both acoustic design and the absorption of a large audience can reduce this to a fairly low value, but rather due to the characteristics of binaural hearing.

An interesting analogy is to assume two microphones, connected in parallel, spaced about six inches apart, and placed toward the rear of an auditorium. Under these conditions, sound generated on the stage will reach the microphones mostly in the form of reflections from various angles, except at the higher frequencies where directional effects start to occur. At low frequencies the wavelengths of the reflected sounds will be small in comparison to the distance between the mikes, and little effect will occur no matter from what angle the sound is received. In the region around one thousand cycles the distance between the two microphones will approximately equal one-half wavelength and a large degree of cancellation will result over a considerable angle of reflected sound. Above this point an increasing amount of direct radiation is received in relation to reflected energy due to directional effects and greater efficiency of sound absorbing materials. The resulting frequency response characteristic under these conditions may have an attenuation of six decibels or more in the mid-frequency region.

Although the foregoing analogy does not necessarily hold true for live lis-

tening, various experiments in listening and recording tend to indicate that it has considerable validity. Inasmuch as many commercial recordings are made with the microphone placed relatively close to the performer, due to limitations imposed by the equipment or acoustics, the resultant reproduction when played back over a flat system in a small room may sound harsh with excessive middle register. As a result, a device such as the distance control, which allows controlled attenuation of the mid-frequencies, may be definitely desirable in obtaining the illusion of concert hall presence.

In some cases the experimenter may succeed in putting together just the right combination of audio components which, together with the room acoustics, seem to give nearly perfect reproduction, yet after a period of days or months the quality may not seem to sound nearly as good as it did at first. This, again, is often the result of the interaction of a number of different factors. Usually electromechanical devices are the worst source of trouble. Speaker suspensions dry up and lose their elasticity, phono pickups become defective due to heat from adjacent tubes, and other sources cause crystals to go flat or rubber damping blocks to harden. Similarly, microphonic tubes, particularly in high gain preamps, can cause serious distortions if within range of loudspeaker radiations, often causing a serious transient peak somewhere in the high frequency range.

A number of other factors might be noted, both for the benefit of the novice constructor or the technician who may be called upon to fix a special system. One of these relates specifically to unwanted electrical feedback, especially in the case of audio amplifiers capable of supersonic bandpass. When a high gain system is used, such as is increasingly the case, sufficient energy may be fed back from the output of the system to a poorly shielded input to cause damped or continuous supersonic oscillations. This can cause splatter on high level musical passages and can cause a serious limitation on the undistorted power output available from the system.

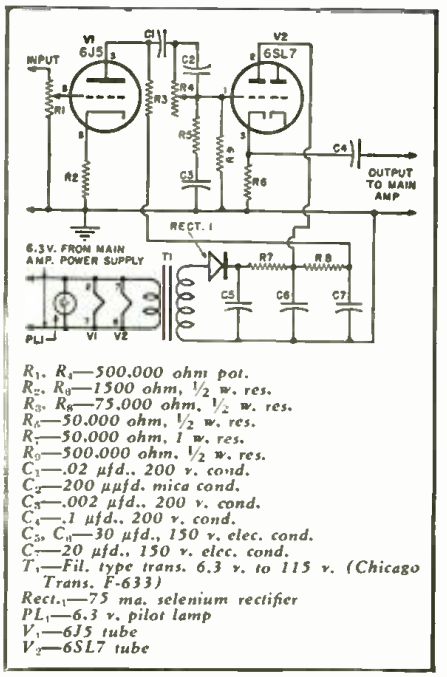
Another source of annoying distortion results from the earlier mentioned arm resonance problem in phono pickups. This appears to be especially serious where certain crystal cartridges are concerned due to the fact that these elements may be sensitive to vibration applied at any part of the cartridge case. As a result, ringing resonances in the arm, or motor board noise, is readily transmitted through the audio system. By isolating the cartridge case from the tone arm with foam rubber or similar material a notable improvement may be obtained, particularly in cases where the needle apparently distorts on certain passages. Although magnetic cartridges appear to be relatively insensitive compared to the crystal it may be beneficial in some instances to use a similar treatment. In either case, care should be taken that the compliance of the isolating material is not such as to cause or accentuate a serious low frequency resonance as an arm resonance of even a few cycles-per-second can cause fuzziness and modulation of high frequency components.

Loudspeaker Arrangements

Although the choice of a loudspeaker is of considerable importance in obtaining superior reproduction, in general, less specific information is available on this component than about the other links in the audio "chain." For the most part, the trend in recent years has been toward woofer-tweeter combinations for wide range reproduction. Although representing one of the simplest means of obtaining wide range sine wave reproduction, the high and low frequency speaker combination can result in some serious transient distortions. The transient reproducing ability of a direct radiator appears to be closely related to the primary resonant frequency of the diaphragm. Thus a woofer with a resonant frequency of forty cycles may exhibit poor transient reproduction throughout nearly all of its useful range. The tweeter, on the other hand, usually has a very light moving element with a relatively high resonant point. The result may be that the transient response is very uneven and distorted compared to the steady state measurements. The listening effects may be of harshness in the upper register, due to partial reproduction of transients in this area, and poorly reproduced low frequency tones which contain strong modulations.

A situation that more nearly seems to fit the requirements of good reproduction is to use a number of identical small radiators with relatively high resonance frequencies. An arrangement of this nature provides sufficient cone area to be effective at low frequencies but still maintains sufficiently low individual mass to provide good high frequency efficiency. Transient response of such a setup will tend to be equal to sine wave response below resonance and fall off smoothly above this point, a characteristic which tends to approximate the audible effects produced by a room in which the sound absorbency of the walls and furnishings increases with ascending frequency, a condition usually found in studios and concert halls.

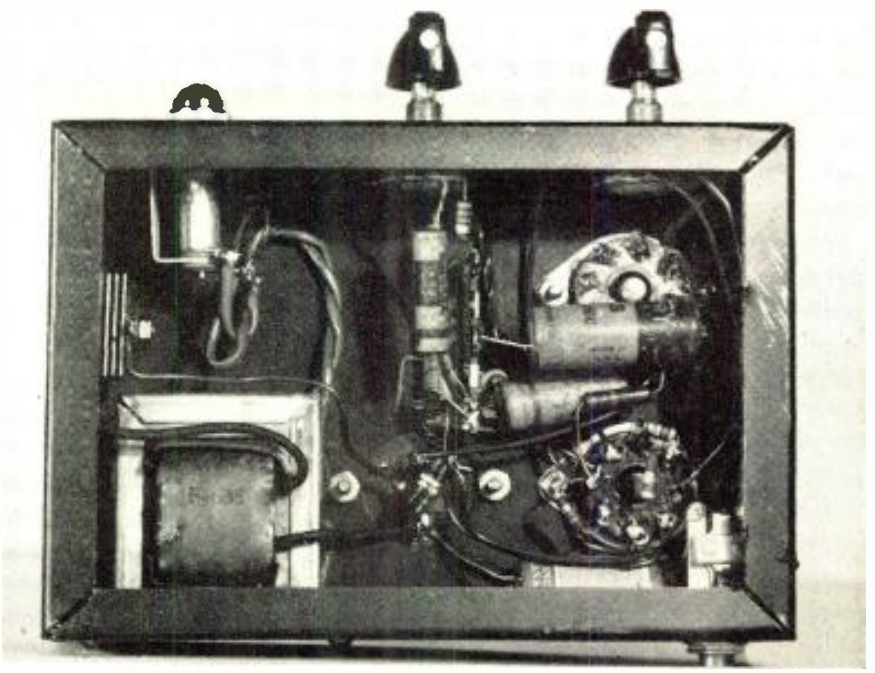
Several problems are to be considered in setting up a system using a number of small loudspeakers. Chief

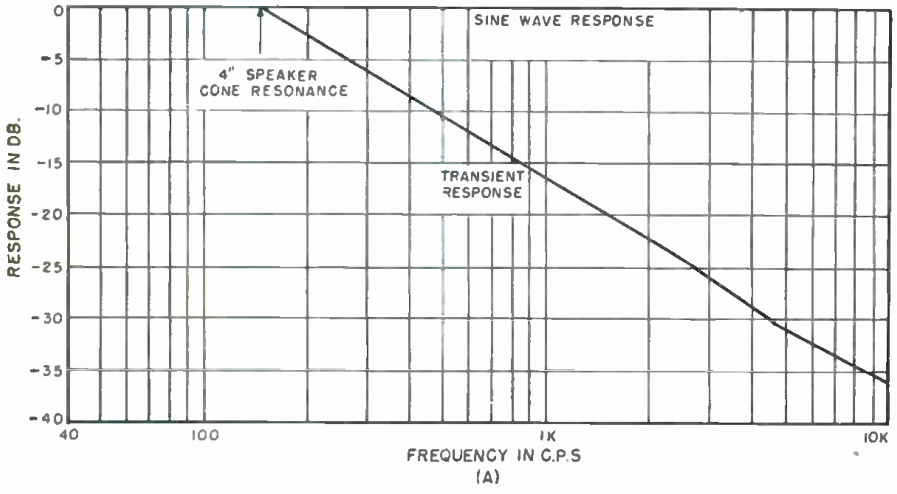


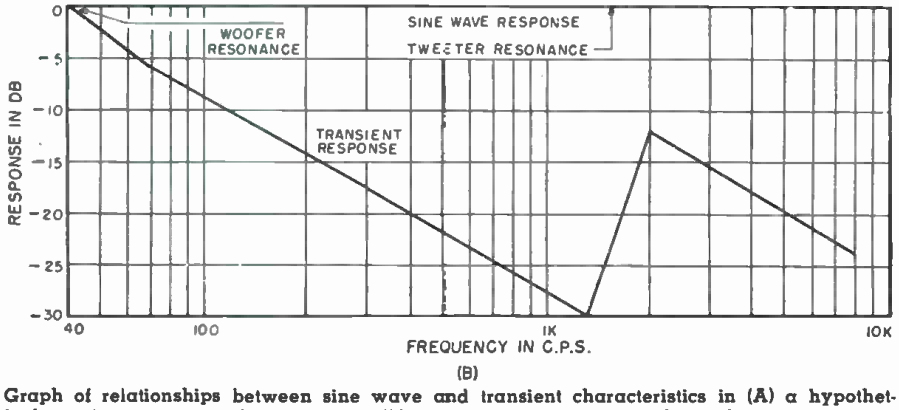
R_1, R_4—500,000 ohm pot.
R_2, R_9—1500 ohm, ½ w. res.
R_3, R_8—75,000 ohm, ½ w. res.
R_5—50,000 ohm, ½ w. res.
R_6—50,000 ohm, 1 w. res.
R_7—500,000 ohm, ½ w. res.
C_1—.02 μfd., 200 v. cond.
C_2—200 μμfd. mica cond.
C_3—.002 μfd., 200 v. cond.
C_4—.1 μfd., 200 v. cond.
C_5, C_6—30 μfd., 150 v. elec. cond.
C_7—20 μfd., 150 v. elec. cond.
T_1—Fil. type trans. 6.3 v. to 115 v. (Chicago Trans. F-633)
Rect.$_1$—75 ma. selenium rectifier
PL_1—6.3 v. pilot lamp
V_1—6J5 tube
V_2—6SL7 tube

Diagram of preamp which incorporates distance control and novel power supply unit.

Bottom view of the preamp. The entire unit is built on a single, compact chassis.







Graph of relationships between sine wave and transient characteristics in (A) a hypothetical woofer-tweeter combination, and (B) system using group of identical small speakers.

among these is the fact that the primary resonant frequency of a small five- or six-inch loudspeaker usually lies between one hundred and two hundred cycles, well within the audible range. To keep this from producing a peak in the frequency response it is preferable to use some means of speaker damping, either acoustical or electrical. In the latter case an amplifier with an appreciable amount of inverse feedback from the voice coil is desirable, with designs such as those described in the author's article, "Audio Transient Distortion" in the June 1949 issue of RADIO & TELEVISION NEWS performing very satisfactorily.

An arrangement using nine four-inch speakers is shown in the accompanying photographs. The cone area involved is about the equivalent of a single twelve-inch speaker but in comparison tests with a single extended-range twelve-inch cone the multiple speaker assembly showed superior power handling capabilities at both low and high frequencies as well as better transient characteristics although the over-all efficiency was somewhat lower. Conventional four-inch speakers, such as are obtainable for about one dollar from radio wholesalers, were used. However, in selecting loudspeakers, it is best to endeavor to obtain units with a relatively smooth over-all response, even though this may mean a falling off of response at high frequencies. The foregoing is the general characteristic of a simple piston type direct radiator, but in some cases the manufacturer may use special cone treatment to increase the apparent loudness or brilliancy of the speaker, with the result that some of the previously mentioned transient troubles of the woofer-tweeter combination may occur.

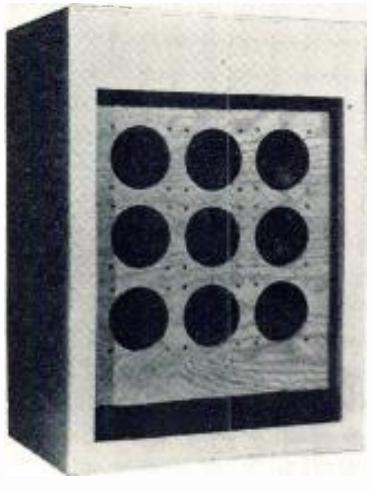
In the arrangement shown, all of the speakers are identically phased, with the exception of the one in the center. The voice coil leads are reversed with this unit, providing a small amount of acoustic inverse feedback. A series connection was used for all nine speakers as this tends to reduce the effects of impedance variations in individual units. However, as this provides a total speaker impedance of approximately thirty ohms, the constructor may prefer to use a series-parallel arrangement to lower the output impedance.

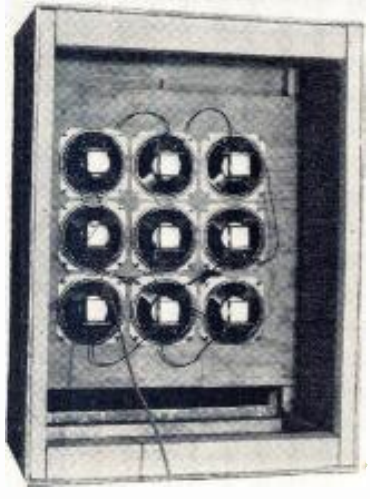
Due to the superior transient response in the low frequency region, it is wise to pay particular attention to the loudspeaker baffle used. A relatively heavy cabinet with rigid walls is preferable in order to prevent spurious vibrations of the speaker housing itself. Similarly, the cabinet should be lined with sound absorbent material, particularly in the case of a bass reflex type of enclosure, and all parts of the system should be tightened down carefully to prevent rattles.

In actual performance, from such high quality program sources as master tape recordings of band and orchestral music, the multiple speaker system described performed very well with excellent dynamic balance between high and low frequencies. Reproduction of low frequency transient tones, such as piano and string bass, was very good, being comparable to other systems using horn loading in the low frequency region. Even at high output levels no distortion was observed that was directly attributable to the speaker system. Even when used without any inverse feedback or loudspeaker damping the reproduction was quite acceptable although bass response was much heavier and speaker hangover tended to alter the tone color of certain sounds.

In conclusion it may be stated that the use of a group of small loudspeakers appears to have several advantages that may be of definite importance to the critical listener. An arrangement of this nature can be assembled at relatively low cost, compared to other high quality speaker systems. It should further be realized that a descending high frequency response in a loudspeaker does not necessarily mean poor power handling capabilities in this region and under certain circumstances it seems definitely desirable to introduce frequency correction in the audio amplifier rather than in the loudspeaker system. -30-

Front and rear views of a multiple loudspeaker system using nine 4-inch speakers.





Mac's RADIO SERVICE SHOP

By JOHN T. FRYE

STANDING BY FOR TV

EVEN the weather seemed to have a sort of hangover from the gay holiday season just passed. There was nothing about the bleak January morning to distinguish it from any other winter day, for it was neither exceptionally cold nor exceptionally warm, exceptionally bright or exceptionally dark. It was just another monotonous stretch of the calendar that had to be passed over on the way toward Spring.

Things were a little in the doldrums at Mac's Radio Service Shop, too. The work, for once, was all caught up, and Barney was taking advantage of this hiatus to clean up an old electric typewriter motor he had acquired. Mac watched him turning down the worn commutator, undercutting the mica between the segments, and cleaning the points that were part of the speed regulating mechanism before he finally spoke:

"May I be so bold as to ask what you intend to do with that thing when and *IF* you get it running?"

"Ignoring the snide insinuation of that 'if,'" Barney replied, "I intend to use it in the color television converter I am building. This motor is a variable-speed, governor-controlled job, and I figure it will be just the ticket to turn the color disc. Do you concur?"

"I never like to discourage optimistic youth," Mac drawled lazily; "so I'll 'concur'; but you kind of remind me of the guy who finally pleads until he gets a car salesman to accept his order for a new car and then buys a can of auto-polish on the way home. A man in this ultra-fringe area is bettering par if he pulls a fair black-and-white picture four nights out of seven, and here you are getting all set for color."

"Well, doggone it," Barney said defensively, "I feel that I have to do something to keep abreast of this television game. The technicians in the good TV areas are getting so much ahead of us in experience that we'll never be able to catch up unless we use experimenting or something to make up for our lack of experience. We seldom have more than a couple of TV calls a week, while many of those birds in the large cities do nothing but TV work. By the time good television reception does get here, we'll be about as up to date as a three-circuit tuner."

Mac suppressed a grin at the glib way the boy mentioned a piece of radio apparatus that he had doubtless never seen, but he said gravely, "You've got a point there, Red, and I am glad to see you've been thinking about it; but I can't quite go along with you in believing that we are being left hopelessly behind in television servicing simply because we do not have the large volume of sets to work on. That *could* happen, but it doesn't have to."

"What's to stop it?"

"Concentrating on the 'Know-why' of television instead of the 'Know-how'."

Barney's freckled face screwed up in puzzlement. "This is not one of my bright days, Boss; suppose you drag that past again a little more slowly."

"I mean that while our actual experience with television is likely to be pretty limited for some time to come, there is nothing to prevent our boning up on television theory; and I, for one, believe that in the long run a good sound knowledge of theory is worth more to a technician than any amount of unqualified experience."

"Whoa there! Back up!" Barney exclaimed. "Do you mean to sit there and say that it is better for a fellow to have a lot of theory sticking out of his ears than it is to be so familiar with a set that he can diagnose its trouble just as soon as he lays eyes on it? Why the experienced guy would have the set fixed and the ticket on it before your theory-man could unlimber his slide rule."

"Granted, but what is your learn-by-doing man going to do with the next set that comes in, a set that is a total stranger to him? Suppose it has a radically new type of tuning mechanism, a sweep circuit that is hot off the drawing board, and a fancy audio detector that he never even heard of before. None of the work he has done previously will help him find his way about these unfamiliar circuits. All he can do is probe around in the dark hoping that sooner or later he may stumble on the trouble. His experience, if he tries to depend upon it, may actually lead him astray, for the fact that one of the new circuits *looks* a little like one he is familiar with may cause him to waste hours working on the false assumption they are the same. Since he does not know why the various parts are connected exactly as they are; he is in no position to judge whether or not those parts are doing the job they should."

"And what will your theory-man be doing with it?" Barney challenged.

"He, too, will be seeing the set itself for the first time, but he has studied the circuits long before this in books and magazines and has made himself thoroughly familiar with the way they operate. Knowing, as he does, why each part occupies the place it has in the circuit, he can quickly determine if it is properly performing its function. His testing will not be a hit-and-miss affair but will be an orderly comparison between actual operation and intended functioning."

"Sounds as though you are trying to fast-talk me," Barney stubbornly contended. "I think you can get your knowledge from books or you can get it from experience; but what you learn by doing is a lot more dependable and sticks with you a lot better. If that guy had worked on enough sets, he would not be meeting up with new ones. His trouble was simply that he did not have *enough* experience."

"There just isn't enough experience to keep you from meeting up with new problems," Mac patiently explained, "but let's approach it from another angle: experience is like a set of handmade wrenches that a mechanic has fashioned to take care of the nuts he ordinarily encounters in his daily work. Being handmade each wrench really fits the nut for which it was made and is quick to use. Theory, on the other hand, is an adjustable wrench that must be reset for every different size, but it will fit *any* nut, large or small. The advantage

(*Continued on page* 104)

Fig. 1. Over-all view of unit built into a small utility cabinet.

A WIDE-RANGE LINEAR SWEEP

By
LOUIS E. GARNER, JR.

A multivibrator type unit which has four ranges and covers 10 to 100,000 c.p.s.

FOR a long time gas triode sweep circuits were used almost exclusively to provide a linear time base in both commercial and home-built cathode-ray oscilloscopes. The result has been that the majority of scopes in use at the present time employ this type of sweep circuit.

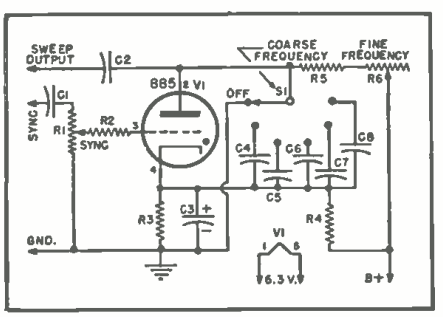
Basically, the gas triode sweep circuit, shown schematically in Fig. 2, is very good, providing a linear sweep with short "flyback" time over a reasonably good range of frequencies. In operation, a condenser (C_1 to C_5) is charged through a series resistor (R_5 and R_6) from the "B" supply. The gas triode is connected across the condenser and when the d.c. voltage across the condenser reaches the proper value for "firing" the gas triode, this tube conducts heavily and discharges the condenser. As the voltage across the condenser drops to a low value, the tube stops conducting, and the condenser starts charging again. The entire operation is repeated. Thus, the saw-tooth or linear sweep produced follows a portion of the "charge" curve for the *RC* circuit.

The frequency of operation is controlled by varying the time constant of the resistor-condenser charge-discharge circuit. Selecting different capacity values by means of the "Coarse Frequency" switch selects the range, while the exact operating frequency is adjusted by means of a "Fine Frequency" rheostat. Synchronization of the circuit with an external signal can be accomplished by feeding a small signal to the grid, which serves to "trigger" the gas triode at the proper point, causing it to discharge the condenser earlier on the charge curve, and thus bringing the sweep into sync with the observed signal.

Unfortunately, this type of sweep circuit, while satisfactory for sweeps up to about 30 kc., cannot be easily used at much higher frequencies. This is due to a number of factors, the most important of which are the tube characteristics themselves—the fact that the tube takes a certain time to discharge the condenser (limiting the "flyback" time), the fact that the tube takes a certain time to "recover" (limiting the frequency of operation), etc.

For the study of wide-band amplifiers, for checking and testing video amplifiers, and for similar applications, it is often desirable to observe signals as high as *several hundred kilocycles*, or more. A 30 kc. sweep would present too many cycles of a high frequency signal on the cathode-ray screen, and thus make close observation and analysis difficult. For this reason, many of the modern scopes as well as the more expensive units, employ a multivibrator type of sweep, permitting sweeps as high as 100 kc. or more.

Fig. 2. The gas triode sweep circuit.



A suitable wide-range, multivibrator sweep circuit is shown in Fig. 3. This circuit will provide an essentially linear sweep (saw-tooth signal) from approximately *10 cycles per second* to *100,000 cycles per second* in four ranges. The sweep, as shown, can be added to an existing oscilloscope by building it in a small metal utility box as shown in Fig. 1, or, if preferred, the old sweep can be removed from the scope, and the new circuit wired in place.

In operation, this sweep is somewhat similar to the thyratron sweep previously described, in that the saw-tooth signal is obtained by utilizing a portion of the charge curve of a resistor-condenser combination. The essential difference is in the fact that a multivibrator is used for discharging the condenser rather than a gas tube. By doing this, a faster discharge can be obtained, together with a wider range of operation as far as frequency is concerned. The only disadvantage of the circuit is that it is slightly more complex than the gas triode sweep.

Two *RC* combinations are used in the multivibrator sweep, one for controlling the frequency of operation and one for the charge-discharge circuit across which the saw-tooth signal is produced. In. Fig. 3, with the "Coarse Frequency" switch set as shown, the combination R_5-R_7-C_4-C_5 acts as the charge-discharge circuit, while the combination R_6-R_8-C_6 serves to determine the frequency of operation. Note that the time constant (*RC* product) of the charge-discharge circuit is much greater than that of the frequency determining circuit. This is necessary to insure a linear sweep.

A dual pot is used for the fine frequency or "Vernier" control so that both *RC* circuits can be varied simultaneously. This serves to keep the output amplitude at a reasonably constant value over any range.

To minimize the number of parts required, and thus to keep both the cost and the size of the circuit down, the condenser used in the frequency determining circuit on one range is used in the charge-discharge circuit on the next higher range.

Synchronization of this circuit can be obtained by applying a negative-going pulse to the grid of the multivibrator. As shown, a pot is provided for controlling the level of the "sync" signal.

This particular circuit, known as a "Potter" multivibrator, is quite popular and has been used, in modified

form, in a number of the better commercial scopes.

The entire unit can be easily built in the 4x5x6 metal utility box as shown in Fig. 1. When decal labels are applied, a neat professional appearance can be obtained.

Since only one tube is used, power requirements are small, and a terminal strip or plug can be provided on the back of the unit. Power can then be supplied either from a small power supply, or from the oscilloscope itself.

Leads should be kept as short as possible, and small parts should be used to minimize distributed capacities and to prevent "rounding" of the higher frequency sawtooth signals. Otherwise, wiring is not especially critical.

It may be difficult to find the special dual pot required as a stock item at your local wholesalers, but an inquiry indicated that special dual pots could be obtained on order, at regular prices, although there might be a delay of one or two weeks. In addition, it is understood that at least one resistor manufacturer is producing "kits" from which almost any desired dual pot combination can be assembled by the builder.

If it is not desired to build the sweep as a separate unit to be used as an accessory with an already existing scope, but to wire the circuit in as an integral part of the unit, then it is convenient to add the "Sweep-Sync Selector" switch shown in Fig. 5. Again, part numbers and connections refer to Fig. 3.

A 3-pole, 5-position switch is employed to provide a variety of sweep and sync conditions. With the switch in the position shown, the multivibrator sweep is used and it is synchronized with the signal applied to the vertical plates of the scope (internal signal). The shielded lead shown connects to the plate of one of the vertical amplifier tubes in the scope.

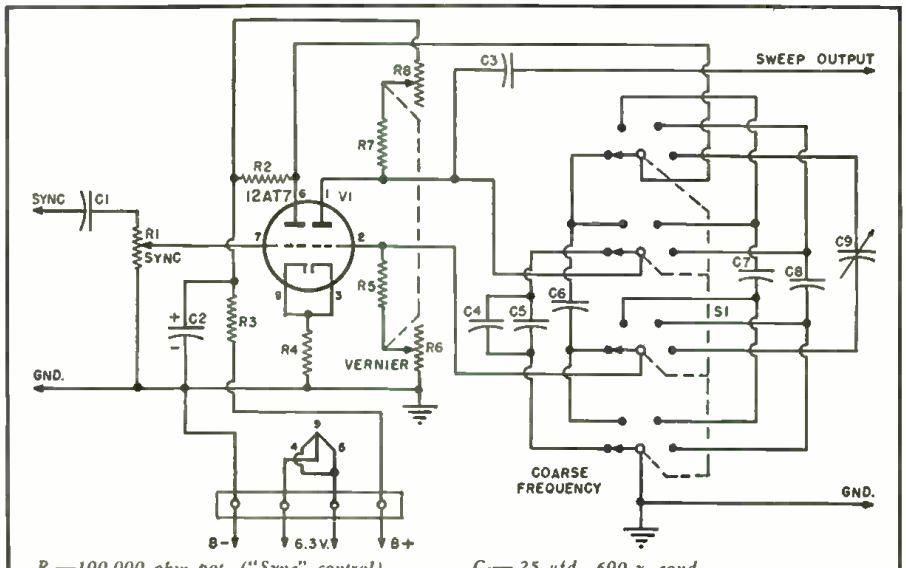
When the switch is turned to the *"Ext."* position, the linear sweep is still used, but can now be synced with an external signal applied to the *"Sync"* terminals.

With the switch in the *"Line"* position, the linear sweep is still connected, but is now synced with the 60 cycle line voltage.

In both the *"H Amp."* and *"60 Cycle"* positions, the linear sweep is turned off. An external sweep signal can be applied to the scope horizontal amplifier at the *"H Input"* terminals when the switch is in the *"H Amp."* position, while a 60 cycle sine wave provides the sweep in the *"60 Cycle"* position.

Return trace blanking may be obtained by applying the pulse on pin 6 of the 12AT7 (Fig. 3) to the cathode of the CRT through a 250 μμfd., 1500 volt condenser. If the cathode of the CRT is bypassed to ground, connect a 100,000 ohm, ½ w. resistor in series.

When building the sweep, if you cannot find the capacity values specified at your local supplier, parallel combinations may be used to get the values shown.



R_1—100,000 ohm pot. ("Sync" control)
R_2—100,000 ohm, ½ w. res.
R_3—22,000 ohm, 1 w. res.
R_4—390 ohm, 1 w. res.
R_5—47,000 ohm, ½ w. res.
R_6—1 megohm pot. (part of dual-pot. "Vernier" frequency control)
R_7—620,000 ohm, ½ w. res.
R_8—8 megohm pot. (part of dual-pot. "Vernier" frequency control)
C_1—.01 μfd., 600 v. cond.
C_2—40 μfd., 450 v. elec. cond.

C_3—.25 μfd., 600 v. cond.
C_4*—.25 μfd., 600 v. oil-filled cond.
C_5*—.1 μfd., 600 v. oil-filled cond.
C_6*—.035 μfd., 600 v. oil-filled cond.
C_7*—3500 μμfd. mica or ceramic cond.
C_8*—350 μμfd. mica or ceramic cond.
C_9*—5-50 μμfd. trimmer cond.
S_1—4-pole, 4-pos. sw.
V_1—12AT7 tube

* Frequency determining condensers. Values should closely approximate those given.

Fig. 3. Complete schematic diagram of the wide-range, multivibrator sweep circuit.

If the sweep is built as an integral part of the scope, it is used in the conventional manner. With the "Coarse Frequency" switch in the position shown, the frequency range is approximately 10 to 100 cycles; in the next position from 100 to 1000 cycles; in the next position from 1000 to 10,000 cycles; and in the last position from 10,000 to 100,000 c.p.s. This last range is determined by the adjustment of C_9. All values are approximate only, for there is actually an overlap on each range. In addition, the actual frequency will change somewhat with different "B" voltages.

To set C_9, turn the fine frequency control or "Vernier" to its highest frequency position, with the "Coarse Frequency" control in its last range. Apply a 100 kc. signal to the scope, and adjust C_9 and the *"Sync"* controls until only one cycle appears on the screen. An insulated alignment tool should be used for this adjustment.

If the sweep circuit is built as an accessory, as shown in the photo (Fig. 1), then the connections to the scope are as shown in Fig. 4. Power can be supplied either from the scope itself or from a separate supply. The scope sweep selector is set so that the internal sweep is disconnected and a signal can be applied directly to the horizontal amplifier. Once this is done, the sweep controls (except for *"H. Gain"*) are disregarded on the scope, and the controls on the sweep unit used instead. They are operated in a conventional manner, sync being supplied by the input signal.

If the scope with which this unit is used does not have a wide-band horizontal amplifier, there may be some rounding of the higher frequency sawtooth signals, resulting in a sweep which is non-linear at the ends. The effect of this can be minimized by expanding the sweep to "oversweep" the screen and using only a portion of the sweep for observing signals.

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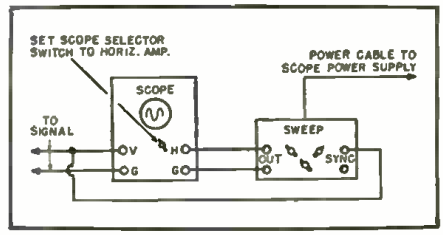
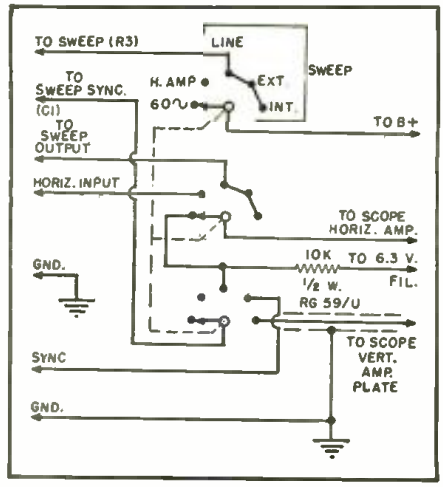


Fig. 4. Method for hooking up sweep unit.

Fig. 5. "Sweep-Sync Selector" switch for use when unit is built into scope cabinet.



A Deluxe SIGNAL TRACER

By
R. H. KRUEGER

Fig. 1. View of signal tracer. The panel measures 10⅝" x 7". Unit is 6" deep.

Fig. 2. Detailed view of the untuned detector probe assembly.

In combining a good, all-purpose, 3-stage audio amplifier and an untuned detector, the author has devised a handy, laboratory-type instrument.

THE need for a good, all-around audio amplifier with high voltage gain and a moderate amount of power output for checks in laboratory and radio service shops is not to be disputed. The one herein described meets these requirements admirably, however it was designed primarily as a signal tracer.

The instrument consists of a power supply, a three-stage audio amplifier with wide frequency response, and an untuned detector—the detector being contained in a probe. Of particular interest in the power supply is the filter circuit which is composed of a conventional filter choke and condensers followed by the resistance-capacitance filter circuit described by H. H. Scott in *"Electronics"* (Vol. 12, No. 8, pages 42 to 48, August, 1939).

As will be seen from the diagram, the high voltage d.c. for the power audio stage is taken from the filter choke. The high voltage d.c., which is supplied to the first and second audio stages, is additionally filtered by the resistance-capacitance filter. Additional filtering is also used on the detector stage.

In the design of any piece of test equipment certain techniques must be followed so that the over-all appearance and the ease with which the instrument may be assembled and wired will not be impaired. A few of these features will be described. First, the over-all appearance of the finished article must be neat and the panel, if one is used, (and most equipment pertaining to radio and electronics will have a main panel) must have a well-designed and finished appearance. This was accomplished in the design of this instrument as shown in Fig. 1. Secondly, the controls, such as gain control, "On-Off" switch, and the input and output connections together with any other items such as the power line cord and fuse must be easily accessible and arranged for the utmost ease in operation. Next, and one of the most important features, is the actual design and layout of parts on the chassis so that when all of these features are combined we have an instrument which will not only have a good appearance but will work to the utmost satisfaction with the greatest of ease. Not to mention, however, are the features in the design and construction which enable the instrument to be easily assembled and wired. Too often little consideration is given to the problem of servicing the instrument and since any piece of electrical or electronic equipment will need a bit of service from time to time as years go by this is a factor which requires attention.

Since this instrument is comprised of a high gain audio amplifier of excellent tone qualities, a detector circuit which is contained in the probe, plus a power supply, it is not likely that it will ever become dated. With this in mind it was decided to design and construct this instrument and then present all the necessary information so that the future duplication of this instrument would be possible.

Although some items could have been omitted and some savings could have been made, such as the panel which could have been constructed of much thinner material, these savings were not considered practical.

The probe was made removable so that the audio amplifier could be used alone, and several output connections were made in order to give the user a choice. The whole instrument was housed in a welded sheet aluminum cabinet which was finished in dark gray crackle finish. A handle has been provide on top of the cabinet so it can be carried easily.

With all the design features mentioned and with great thought as to the final product, a check was made on the necessary parts to be used. Wherever possible standard parts were used so that replacements could be easily obtained in the event that they are needed for repairs. The items of particular interest are the *General Radio* dial plate which is used as a gain or

volume indicator and the binding posts, made by the same company, which are located in the upper right hand corner of the main panel. These items add greatly to the appearance of the finished signal tracer and give the instrument a very professional look. In addition, resistor and condenser mounting terminal boards were used wherever the wiring called for such. This type of construction is neat appearing and lends itself to cable wiring wherever possible. In addition, such individual groups of resistors and condensers can be placed as to make them easily accessible for checking the circuits. The wires were laced together as shown in Fig. 5. Care should be taken so that none of the parts are arranged in such a manner as to produce unwanted feedback circuits which will cause oscillations. Fig. 3, from left to right, shows the 6SN7, the 6V6, and the 5Y3 tubes. The guide pin on the 6SN7 points to the lower right hand corner, that of the 6V6 points to the upper left hand corner, with that of the 5Y3 in the same direction. This arrangement is conducive to good wiring practice as all coupling condensers and resistors can then be mounted directly on the tube sockets.

A voltage output curve *vs.* frequency (Fig. 4) was plotted on a piece of graph paper and shows the gain without the probe. It can be seen from this chart that the gain is nearly constant over the frequency range of from 50 cycles to 30 kilocycles. Since the chart was plotted in volts rather than db. it falls off on either end. The voltage to the input of the amplifier was kept constant and measurements were made across the voice coil winding with a 3.2 ohm non-inductive resistor load.

The Main Panel

The main panel was constructed out of a piece of three-sixteenths inch thick aluminum. A piece of one-eighth inch wire mesh is used to cover the speaker opening in the panel. The panel light is placed to the left and at the top of the panel (Fig. 1). To the right of the speaker and at the top are placed the three *General Radio* binding posts. Two red and one black binding posts are used, as indicated in the schematic diagram (Fig. 6). The black binding post is used as "common," the other two for either high or low impedance, for speakers with or without output transformers. At the bottom (Fig. 1) and to the right is the phono-jack which, when plugged in with phones or speaker, automatically disconnects the speaker within the signal tracer. A vacuum tube voltmeter may also be connected to either the high or low impedance for visual signal tracing.

On either side and just below the speaker are located the fuse (left) and the power switch (right). At the bottom of the panel, at the left, is the *Amphenol* connector for the probe cable. Below the speaker and in the center of the panel is located the volume control which uses a *General Radio* dial plate.

In laying out the panel every effort was made to provide well-balanced appearance and yet have all connections and controls within reach of the operator. Quality parts were used throughout with the result that this unit is a very rugged instrument. The panel was finished in dark gray crackle lacquer. Oval head machine screws were used to mount chassis and speaker while knurled head thumbscrews were used to hold the unit in its cabinet.

The Amplifier

The amplifier consists of three stages wired in a resistance-capacity coupled circuit as shown in Fig. 6. The first two stages are triode voltage-amplifier, followed by a beam power output stage. Cathode degeneration is employed on the input stage, followed by additional degeneration between the second and output stage. The design of this circuit results in low hum, wide frequency range, excellent stability, low distortion, and good phase-shift characteristics, because of the inverse feedback used. The number of tubes was kept to a minimum by the employment of a dual triode in the first two stages of the amplifier. Fig. 5 shows the signal tracer in the position for wiring. All wiring is done before the panel is attached to the chassis, with the exception of the four wires and shield which are visible at the lower left hand corner. These wires go to the speaker and panel lamp and are easy to reach for soldering after the panel is attached.

Again referring to Fig. 5 the two wires which run from the phono-jack to binding posts and speaker transformer were shielded. The wire which leads from the volume control to the tube grid and the plate lead from the output tube were also shielded. All wires from the power transformer to the tubes, resistor strips, and probe receptacle wire were laced together to form a neat wiring job.

The two cutouts in the mounting flanges, as shown in Fig. 5, were made in order to clear the "On-Off" switch and fuse holder, when the chassis is mounted to the main panel. The power output and gain is adequate for all test purposes including reluctance pickups and microphones. The over-all gain and frequency response are indicated on the frequency chart shown in Fig. 4.

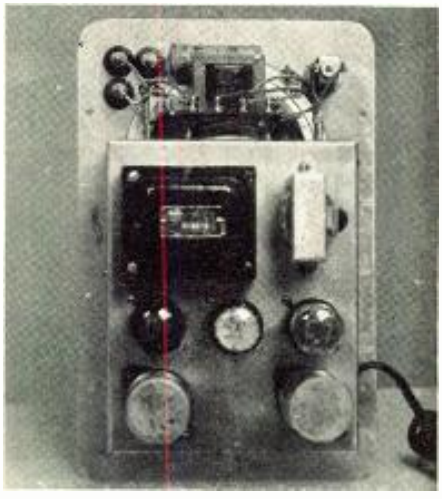


Fig. 3. Rear view of signal tracer. Note how all of components are, in final assembly, secured to the front panel of unit.

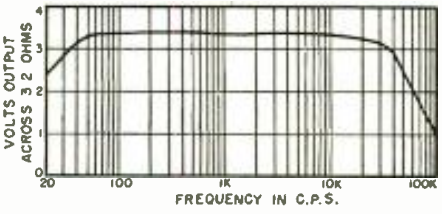
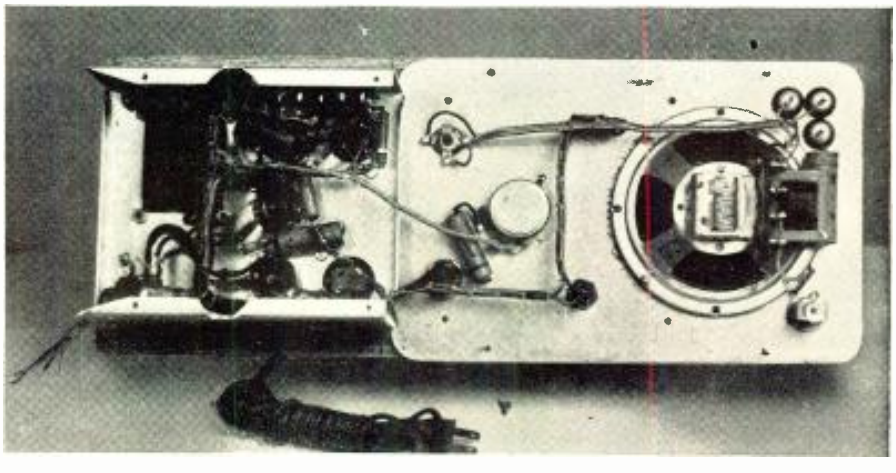


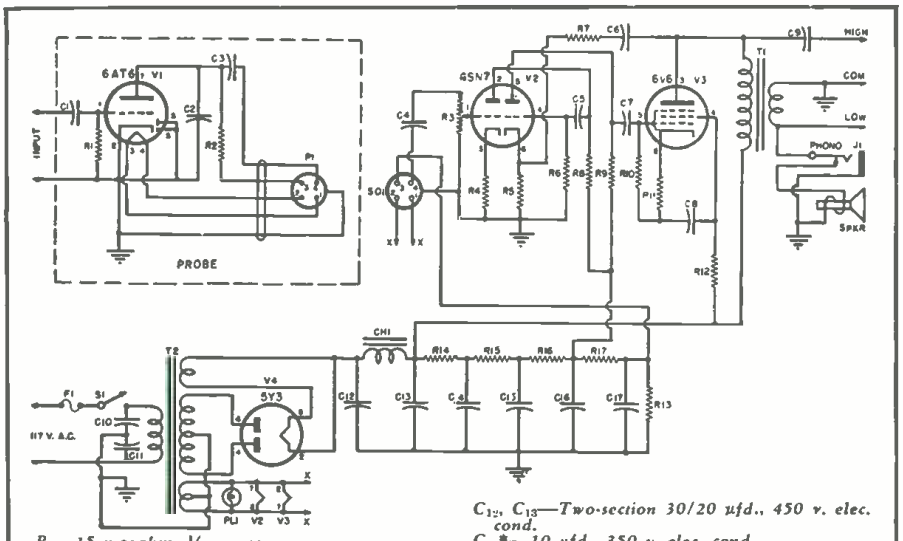
Fig. 4. Frequency response of audio amplifier. Over-all gain (without probe) is reasonably constant from 50 to 30,000 c.p.s.

The Probe

The probe was made up as follows and is diagrammed in Fig. 7. Nos. 1, 2, and 4 were made from a standard test prod. No. 1 is the phono-needle and No. 2 the chuck. The chuck was cut off, drilled and tapped to take the screw (No. 9) which is a 4-40 machine screw, and just long enough to make a tight fit so that the whole assembly is held together firmly. No. 4 is the insulated sleeve which was cut to a length of one and three-sixteenths inches, drilled out with a one-quarter inch drill and then countersunk to fit the chuck as shown.

Fig. 5. Wiring details. Chassis on left folds over and is secured to the front panel.



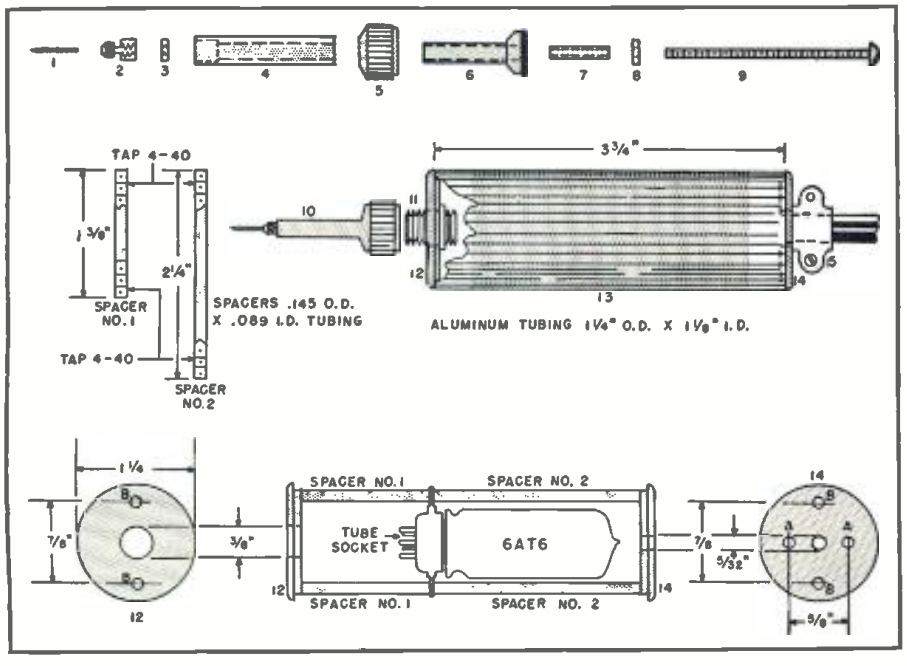


R_1—15 megohm, ½ w. res.
R_2, R_9—470,000 ohm, ½ w. res.
R_3—250,000 ohm pot.
R_4—2700 ohm, ½ w. res.
R_5—1500 ohm, ½ w. res.
R_7, R_{11}—47,000 ohm, ½ w. res.
R_8—100,000 ohm, ½ w. res.
R_{10}—270,000 ohm. ½ w. res.
R_{11}—390 ohm, 1 w. res.
R_{12}—27,000 ohm, ½ w. res.
R_{13}—100,000 ohm, 1 w. res.
R_{14}, R_{15}, R_{16}, R_{17}—4000 ohm, 1 w. res.
C_1, C_2—50 μμfd. ceramic cond.
C_3—.005 μfd. ceramic cond.
C_4, C_{10}, C_{11}—.05 μfd., 400 v. cond.
C_5, C_7—.01 μfd., 400 v. cond.
C_6—.02 μfd., 400 v. cond.
C_8—.1 μfd., 400 v. cond.
C_9—.25 μfd., 400 v. cond.
C_{12}, C_{13}—Two-section 30/20 μfd., 450 v. elec. cond.
C_{14}*—10 μfd., 350 v. elec. cond.
C_{15}*—20 μfd., 350 v. elec. cond.
C_{16}*, C_{17}*—40/40 μfd., 350 v. elec. cond.
*Four-section electrolytic cond.
CH_1—200 ohm, 40 ma. filter choke
T_1—Output trans., 6000 ohms to v.c.
T_2—Power trans. 325-0-325 v. @ 40 ma.; 6.3 v. @ 2 amps.; 5 v. @ 2 amps.
S_1—S.p.s.t. toggle sw.
J_1—Closed circuit jack
P_1—4-terminal plug
SO_1—4-terminal socket
F_1—5 amp. line fuse
PL_1—6.3 v. pilot light
1—5" PM speaker
V_1—6AT6 tube
V_2—6SN7GT tube
V_3—6V6GT tube
V_4—5Y3GT tube

Fig. 6. Schematic diagram of signal tracer. The probe assembly is shown in upper left.

Nos. 3, 6, 7, and 8 were parts from a *Yaxley* phono-plug. The plug was taken apart and part No. 6 was cut down, as shown, to fit into part No. 5. Part No. 5 was taken from an *Amphenol* connector, since it has the same thread inside as the threads on the phono-plug. No. 7 is the insulated sleeving that insulates screw No. 9 from the phono-plug. In Fig 7 looking at Nos. 1, 2, 3, 4, 5, 6, 7, 8, and 9, we have, in order, the assembly of the probe tip. This tip is removable from the rest of the main probe. This assembly results in a tip which is shielded right out to within three-fourths of the end, and which is insulated to prevent shorts in case the probe should accidentally slip when making tests on a receiver. In Fig 7, No. 10 shows the tip assembled and ready to be screwed into the *Amphenol* microphone connector which is mounted on the end plate of the probe proper. Nos. 12 and 14 are the two end plates of the probe. They are made out of a piece of aluminum. The tube housing of the probe was made out of aluminum tubing and a medium knurl was put on, thus adding considerably to the appearance of the probe. A cable clamp was used, No. 15, to take the strain from the connections inside the probe. Ceramic condensers and one-quarter watt resistors were used inside the probe since space was at a premium. The two sets of spacers also hold the miniature tube socket in place, a length of 4-40 threaded rod couples both sets of spacers together. A small insulated terminal strip with two insulated lugs was soldered to the metal part on the tube socket and serves as a tie point for the "B" positive and plate leads. The two filament wires from the probe cable were connected directly to the filament terminals on the miniature socket, the shield of the cable being soldered directly to the metal part of the socket.

Fig. 7. Complete mechanical details for constructing the untuned probe assembly.



In order to remove the tube from the probe all that is necessary is to loosen the two 6-32 screws on the cable clamp, remove the 4-40 screws that hold the cable clamp to the end plate, remove the end plate and slide it back together with the outer shell of the probe and the tube is easily lifted out of its socket. The material for the outer shell and spacers was procured from a hardware supply dealer. A thirty inch length of four-wire shielded rubber-covered cable and an *Amphenol* four-contact male connector completes the probe. This unit measures about six and one-half inches long overall and one-quarter inch in diameter, a size which is easily handled and is not too bulky. The slender tip of the probe is easily applied to any part within a radio set. A ground wire and alligator clip were attached to the cable clamp for clipping onto the ground of a radio set when the probe is used.

The power is turned on and the unit is allowed to warm up. With the probe attached several stations will be heard when the probe is touched to the antenna terminal of a radio. The signal can be traced right down to the speaker by touching the probe to various connections within the radio. A general discussion of signal tracing has been published in past issues, so it will not be given here. The three binding posts at the top of the panel are for connecting to a vacuum tube voltmeter or other suitable meter for visual indication and measurements of approximate gain in signal strength. Other uses of this instrument include checking of speakers for tone quality, etc. Microphones and phono-pickups may be checked for quality and output characteristics by plugging them directly into the probe receptacle or the probe tip may be removed and used as an input receptacle. This will increase the over-all amplification as the tube in the probe is also used as a stage of amplification.

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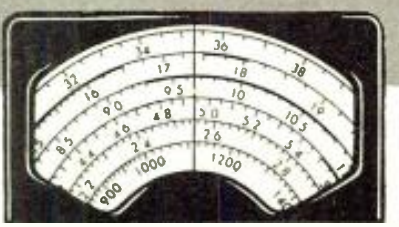
International SHORT-WAVE



Compiled by **KENNETH R. BOORD**

THIS month—through the courtesy of Flavio Serrano, *ISW DEPARTMENT* monitor in Rio de Janeiro, Brazil, we present this data on Mexican radio activities:

Mexico has 95 commercial stations and 4 cultural stations operating on m.w.; there are 14 commercial and 4 cultural stations operating on s.w. Highest-powered station on s.w. (XEWW) uses 10 kw., while the highest-powered m.w. outlet (XEX) has 250 kw., reported to be "the world's tops." Two 500 kw. m.w. stations now are under construction and more than 130 licenses have been issued for the Tropical Band; two TV transmitters—a *RCA* and a *G-E*—are under construction in Mexico City, and another TV license has been issued for a location near the Mexico-USA border.

Short-wave outlets are listed—*Commercial Stations*—XEOI, 6.01, 2.5 kw., Mexico City, D.F.; XEUW, 6.02, 250 w., Veracruz, Ver.; XEKW, 6.03, 500 w., Morelia, Mich.; XETW, 6.045, 100 w., Tampico, Tams,; XEUZ, 6.13, 100 w., Mexico City, D.F.; XECC, 6.185, 50 w., Puebla, Pue.; XEWW, 9.50, 10 kw., Mexico City, D.F.; XEFT, 9.545, 250 w., Veracruz, Ver.; XETT, 9:555, 500 w., Mexico City, D.F.; XERQ, 9.61, 500 w., Mexico City, D.F.; XEBT, 9.625, 500 w., Mexico City, D.F.; XEQQ, 9.68, 1 kw., Mexico City, D.F.; XEBR, 11.82, 150 w., Hermosillo, Son,, and XEHH, 11,88, 1 kw., Mexico City, D.F, *Cultural Stations*—XEJG, 4.82, 200 w. Guadalajara, Jal.; XEEP, 6.155, 1 kw., Mexico City, D.F.; XEXA, 6.175, 100 w., Mexico City, D.F., and XEYU, 9.60, 250 w., Mexico City, D.F. (Not listed is the Mexican s.w. outlet on 11.90 which appears to relay XEX.—KRB).

Here are the s.w. calls, *local* QRA's, and m.w. calls—XEOI, Fomento de Radio, Plaza Santos Degollado 10 (XEOY); XEUW, Independencia 230 (XEU); XEKW, Aldama 154 (XESF); XETW, Madero 204 Ote. (XEFW); XEUZ, Radio Central de Mexico, Reforma 51 (XEFO); XECC, 2 Norte 803 (XECD); XEWW, Cadena Radiodifusora Mexicana, Ayuntamiento 54 (XEW); XEFT, Independencia 74 (XETF); XETT, Dolores 17 (XEQK); XERQ, Corporacion Mexicana de Radio, Reforma 51 (XEQR); XEBT, El Buen Tono, Calle del Buen Tono 6 (XEB); XEQQ, Radio Panamericana, Jose Maria Marroqui 11 (XEQ); XEBR, Serdan 144, (XEBH); XEHH, A.R.S.E., Zempoala 77 Col. Narvarte (XERH); XEJG, Gobierno del Estado de Jalisco, Palacio de Gobierno (XEJB); XEEP, Secretaria de Educacion Publica, Av. Argentina y Gonzales Obregon (XEOF); XEXA, Radio Gobernacion, Calle de Bucareli (XEDP), and XEYU, Universidad Nacional de Mexico, Calle de Justo Sierra 16 (XEUN).

* * *

Club Notes

New Zealand—The *New Zealand Radio DX League* at its recent annual meeting chose these officers for the coming year—Dominion president, Arthur T. Cushen; vice-presidents, A. M. Branks, J. I. Martin; secretary-treasurer, D. L. Lynn; members of the Board of Directors, L. E. Warburton, W. Marsh, A. Allen (Invercargill), L. M. Gerrie, J. F. Fox, F. T. Wilson (Dunedin); magazine committee (*N.Z. DX Times*), Messrs. Branks, Cushen, Warburton, Marsh, Allen; administrative committee (Dunedin), Messrs. Fox, Lynn, Martin, Wilson, Gerrie. (*N.Z. DX Times.*)

* * *

This Month's Schedules

Albania—Radio Korce, in southeastern Albania, is a *new* station on 7.680, heard 0100-0200, 0700-0900, 1200-1430; times vary from day to day; poor modulation; seems to be on test. Scutari, 8,215, is on the air 0100-0200, 0700-0830, 1100-1530. (Radio Sweden.)

Algiers—The 9.57 outlet noted with news in French 1745; signs off 1800.

Frank G. Hartle, Oil City, Pa. uses a Hammarlund HQ129X and an RME DB20 preselector.

Anglo-Egyptian Sudan—Radio Omdurman is again heard nightly on its old frequency of 9.747 with good-to-excellent level at 2315-2345; all-Arabic. (Fargo, Ga.)

Angola—Radio Club de Benguela broadcasts in Portuguese on 4.815 and 9.165 at 0615-0745 (Sun. to 0700) and 1230-1400 (Sun. from 1200); Radio Club de Malange, Malange, can be heard on 7.165 weekdays 0700-0745, 1430-1530, Sundays 0200-0300, 0730-0830; Radio Club da Huila, sa da Bandira, has programs in Portuguese daily 0630-0730, 1300-1500 on 5.024 and 9.755. (*World Radio Handbook* Bulletin) Radio Club de Nova Lisboa, 11.925, noted 1345 with varied recordings; heard until *after* 1500. (Pearce, England).

Argentina—At the time this was compiled, LRA, 9.69, the *new* 100 kw. s.w. outlet, appeared scheduled to North America daily 1800-1900 in Spanish and 1900-0000 sign-off in *English*. Operates separately from other Buenos Aires international outlets, including LRY, 9,455 which has *English* evenings also around 2115-0100.

LRA, 9.69, comes on the air 1800 with 5-note chime and announces in Spanish "SIRA, Servicio Internacional Radiofonica Argentina." (Stark, Texas) Serrano, Brazil, says LRA is the call now used also by former LRY, LRS, and LRU.

LRT, 11.84, Tucuman, noted 1959 with recorded music. (Bromley, Ontario.)

Australia—Radio Australia currently is using VLC7, 11.81, to North America daily 0700-1115; news 0715, 0815, 0930,

VLX, 4.897, Perth, Western Australia, heard with news 0645 daily. (Cox, Delaware.)

Austria—Salzburg, 9.615, signs on now 2355 with schedule, then carries "Rise and Shine" at 0000. (Cushen, N.Z.)

Azores—CSA92, 11.090, Ponta Delgada, heard opening 1500 and closing 1559; good level in North Carolina.

Belgian Congo—OTC2, 9.767, now broadcasts 1100-0100 in French, Dutch, *English*, and Flemish; *English* periods include 1400-1500 and 2030-0015. (Neeley, Calif.)

Bolivia—Stark, Texas, is again hearing La Paz on 9.497 at 1850-2116 sign-off; has "Noticias Internacionales" (world news) in Spanish 2100 to sign-off. Oskay, N.J., reports CP21, 9,428, Sucre, with music 1850.

(*Continued on page* 120)

(Note: Unless otherwise indicated, all time is expressed in American EST: add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.)

The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given.

A Practical Approach To NEGATIVE FEEDBACK

A review of the advantages of inverse feedback. Several proven circuits on how degeneration can be applied are also included.

By
B. E. PARKER
V.H.F. Eng., Gates Radio Co.

MANY of us have often considered adding a negative feedback circuit to existing audio amplifiers or incorporating it in new ones we may be building. A large amount of material has been published on this subject; however, it has all been on a highly technical level, usually accompanied by long mathematical formulas. Often the net result is that we forget about the whole thing or wind up with an arrangement not at all suited to our needs.

Strangely enough, the application of feedback does not necessarily require struggling with these long complicated formulas and equations. Like most other radio problems it can be attacked quite effectively from the old practical shirt-sleeve approach. A general understanding of what constitutes negative feedback and the factors involved, together with a few proven circuits, can achieve the same results just as effectively.

It would be foolish to say that the approach via mathematical equations is no better than our practical shirt-sleeve approach. To do so would be comparable to saying a wrench is no better for removing a nut than a pair of gas pliers. Naturally the wrench will do a better job quicker. But the pair of gas pliers will accomplish the same end result if applied with a will. Our approach to the feedback problem is the "gas pliers" approach. We analyze the fundamental requirements for feedback and present a few practical circuits with parts values used in commercial equipment. From there on it is a case of the plain application of horse sense.

Why Use Negative Feedback?

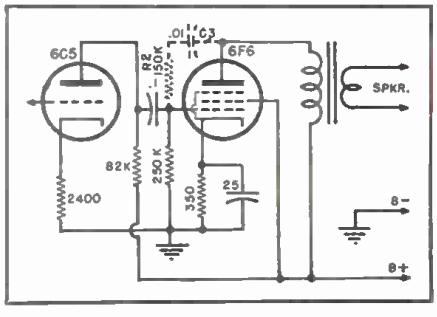
The justifications for using feedback are many and varied. The following, however, represent a good cross-section of the most important reasons.

1. It permits economical reduction of harmonic distortion for a given output. Or putting it another way, it permits increasing the power output of a given output stage for a specified maximum distortion figure. It is not uncommon to be able to increase the power output of a pentode stage for a specified distortion figure of, say, 5% at its rated output of 3 watts without feedback to a full five watts by the addition of feedback.

2. It provides an excellent and economical means of flattening the audio frequency response curve. An amplifier using relatively low cost components and having a frequency response of, say, 100 to 5000 cycles ± 3 db. can often, by the addition of sufficient feedback, extend the frequency response range to 50 and 10,000 cycles. It is interesting to note at this point that it is by means of large amounts of feedback that broadcast and other high quality amplifiers are held to such close frequency response tolerance as ± ½ db. from 30 to 20,000 cycles in production runs of large quantities.

3. Damping is considerably increased when feedback is properly applied. This is a factor most readily appreciated in listening checks. Few laboratories make tests to determine the amount of damping in their amplifiers. This is often the reason two amplifiers having the same frequency response, distortion, and power output may sound radically different when heard side by side. The amplifier having the greatest amount of damping will have "cleaner" sound. Many readers will recall how clean some of the old amplifiers using 45's and 2A3's sounded. This was largely because of the damping resulting from the low plate impedance of the high current triodes used. The popular pentode and tetrode tubes used today have relatively high plate impedance. The use of sufficient feedback can effectively lower the plate impedance, as seen from the loudspeaker end, and increase the damping to a marked degree.

Fig. 1. Simplest form of negative feedback.



4. The internal impedance of an amplifier may be reduced to a fraction of its former value by the use of feedback. Internal impedance is a formidable sounding engineering term which has been gaining attention in recent months. Actually it is little more than the damping discussed in the preceding paragraph. Reducing it to a simple example this formidable term becomes far less awesome. The voltage is measured across the output terminals of an amplifier operating into a resistive load. Remove the load completely and re-measure the output voltage. If the voltage has increased by a large amount, the amplifier may be said to have high internal resistance. If it has not increased materially, the amplifier has very low internal resistance. This is analogous to measuring the voltage of a dry cell battery with the normal load and then noting the voltage with the load removed. A new battery will change very little as its internal resistance is quite low. The voltage of an old battery almost discharged will change radically between no-load and full-load conditions. Since loudspeakers and most telephone lines do not present a constant impedance to the output of the amplifier throughout the frequency range, it becomes obvious that an amplifier having low internal impedance will outperform one with high internal impedance when operated under conditions of this nature.

5. Feedback assists materially in maintaining a constant over-all gain characteristic with tube aging as well as the tube-to-tube variation found even in new tubes. While this is of little importance in the average radio, ham transmitter, or p.a. system, it is of paramount importance in installations where the gain must remain at a fixed value from day to day. Long-distance telephone and broadcast termination equipment do require constant gain for stabilization.

6. Noise of a recurrent nature, such

as hum, may be reduced by the application of feedback around the point of hum origination. No amount of feedback, of course, can reduce hum originating at some point outside the feedback loop. Noise of a periodic nature, such as thermal and shot type noises, cannot be reduced by feedback. In fact the application of feedback may appear to increase this type of noise.

In order to produce negative feedback, the voltage fed back must be of opposite phase. Since phase is an instantaneous measurement, this might be stated as; the voltage fed back must be of opposite polarity in order to cancel out part of the incoming signal. In other words, the energy fed back tends to cancel a portion of the signal and reduce it in amplitude. From this, it may be rightly assumed that the over-all gain will be reduced proportionally to the amount of feedback.

In applying feedback, it must be remembered that it must be 180 degrees out-of-phase with the signal at the point feedback is applied. When the energy is fed back in-phase, oscillations will result. All amplifiers have some degree of phase shift. This is usually most predominant at the high and low frequency extremes. The amount of phase shift is dependent on the value of the coupling condensers and resistors between stages, cathode and screen bypassing, and transformers used. The last is by far the most difficult to correct, as it is usually directly related to the price of the transformer. Large coupling screen and cathode bypass condensers and low value plate coupling resistors result in less phase shift. Should the phase shift of the amplifier approach 180 degrees at some frequency, the feedback will then be in-phase at that frequency and will be what is known as positive feedback. This invariably results in oscillations in high gain amplifiers. It is the phase shift that largely limits the amount of permissible negative feedback.

In designing feedback circuits, consideration must be given to the fact that the phase is shifted 180 degrees between the grid and plate circuit of a stage. In other words, if the instantaneous voltage at the grid of a tube is positive, the instantaneous voltage at the plate of the tube will be negative. Conversely, if the instantaneous voltage at the grid is at the negative crest of the cycle, the instantaneous voltage at the plate will be at the positive crest of the cycle. A rule of thumb is: Plate and grid are out-of-phase, while plate and cathode are in-phase.

Feedback loops over three stages of amplification are rarely used because of the susceptibility to oscillation and, in general, it is easier to work with from the design viewpoint when it is used over only two stages. Where a large number of stages are cascaded or connected in series for high gain, it is common practice to use several separate feedback loops, and apply a separate loop for every two or three stages. This is referred to as pairing or tripling. (Tripling in this instance is not to be confused with frequency multiplication.) In commercial designs of high quality amplifiers, such as those used for broadcasting, it will be noted that coupling condensers are on the order of .25 and .5 μfd., and plate coupling resistors of less than 100,000 ohms are favored. The reason for this is twofold. It extends the frequency response at both ends and results in less phase shift which might otherwise be troublesome if the phase shift is considerable at either the high frequency or low frequency end.

Methods of Feedback

Figs. 1 through 6 illustrate several methods of applying negative feedback. These are methods which have been found sound and dependable enough for their incorporation in commercial broadcasting equipment.

Fig. 1 illustrates what is perhaps the simplest form of negative feedback. Voltage is fed back from the plate to the grid by means of R_2 and C_3. As mentioned previously, the voltage at the plate is approximately 180 degrees out-of-phase with that at the grid. The amount or amplitude of the feedback voltage is determined by R_2 in the middle audio range with C_3 serving as a d.c. blocking condenser. At the low frequency end, however, the reactance of the condenser becomes appreciable, further reducing the amount of feedback voltage. Since feedback results in decreased gain, we have less feedback at the low frequency end and a consequent increase in low frequency gain. This increase in low frequency gain is usually purposely introduced to compensate for the low frequency drop off in response of the output transformer.

The parts values shown are for use with an output transformer of fair quality. By decreasing the value of R_2, the amount of feedback will be increased, "pulling" the middle range of the amplifier response curve further down to compensate even more for poor low frequency response in the output transformer. As is to be expected, the larger the value of C_3 the lower in frequency the compensation occurs. For example, assume an amplifier using a value of .01 μfd. for C_3 with a response curve flat down to 100 cycles and dropping off 3 db. at 50 cycles. By decreasing the value of R_2 the response could be flattened out until the amplifier was flat down to 50 cycles; or for that matter by further decreasing the value of R_2 we could cause a rise in response at fifty cycles making a definite hump at that frequency. In this event, we can use a larger value of C_3, say .1 μfd., and move the hump further down in frequency, resulting in an extension of the low frequency response. From this it appears that this could be carried on further until the low frequency response is extended down to, maybe, 10 cycles. Unfortunately, this is not

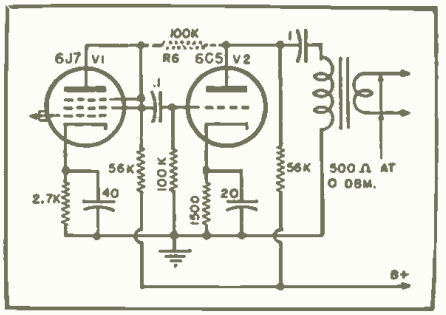


Fig. 2. A modification of Fig. 1. The coupling condenser can be omitted in this case.

true in practice. As mentioned previously, the phase shift of the output transformer limits the permissible amount of feedback.

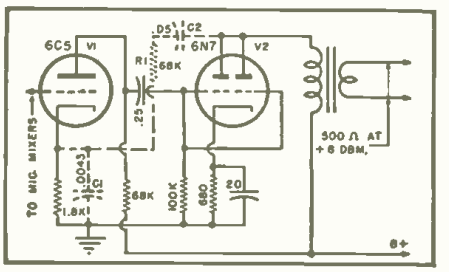
Fig. 2 is actually a modification of Fig. 1. The difference is that C_3, the d.c. blocking condenser, is not used. Since the plate of V_1 and grid of V_2 are virtually in-phase, the feedback voltage may be fed directly from the plate of V_2 to the plate of V_1. In this event, R_6 serves as the feedback resistor limiting the amount of feedback. Obviously, to increase the amount of feedback, it is merely necessary to decrease the value of R_6. To keep the RC phase shift to a minimum, the value of the grid-to-plate coupling condenser between the plate of V_1 and the grid of V_2 should be as large as economically feasible. It is interesting to note that R_6 also furnishes another d.c. path for the plate current of V_1. This is, as a whole, desirable since it serves to further increase the plate voltage on V_1.

Fig. 3 is essentially a further variation of Fig. 2. As pointed out earlier, the cathode and plate of a tube are normally in-phase. Then by modifying Fig. 2, by moving the feedback lead from the plate of V_1 to the cathode of V_1, the same effect is obtained. It is necessary, however, to put C_2 in to block the d.c. current which would otherwise flow. This can be an advantage, since this blocking condenser can be used to extend the low frequency response by judicious selection of its value.

Often it is just as desirable to increase or extend the high frequency response as it is the low frequency response. By the addition of C_1 we can gain considerable control over the high frequency response by decreasing the amount of feedback at the high frequency end. If completely unby-

(*Continued on page* 80)

Fig. 3. Plate-to-cathode feedback loop. C_1 and C_2 provide a means of controlling low and high frequency response.



TELEVISION SYNCHRONIZING CIRCUITS

By J. RACKER and P. SELVAGGI

Part 1. Operational characteristics of several of the popular sync circuits being used in modern TV receivers. Concluding article appears next month.

ONE of the most common and bothersome troubles encountered in television receivers today is the poor operation of the synchronizing circuits. Many people will tolerate relatively poor definition, some distortion, weak images, but when the picture "rolls," "tears," or shifts periodically—the service technician is sure to get a call. The reason for this is easy to understand. It is possible to enjoy television—if you are not overly critical—even though the quality is not especially good, but it is impossible to watch a picture that is rolling, tearing, or shifting.

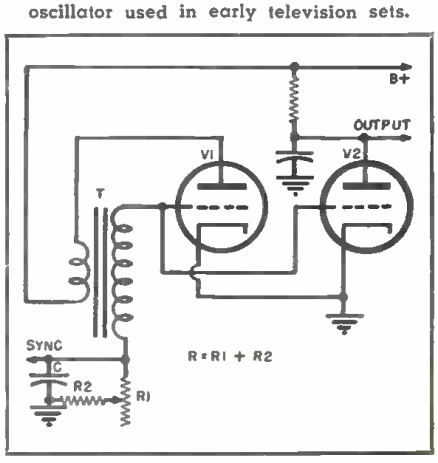
This problem is further complicated by the fact that in many cases it is difficult, if not impossible, to correct the trouble due to the inherent characteristics of the particular synchronizing circuit used in the set. One of the major objectives of this article is to show the reader how to modify such a circuit so that good performance can be obtained. Of course before the technician can modify a given circuit he must clearly understand its basic principles of operation and consequently such a description is also included in this article.

The author would like to emphasize one point before delving into actual circuit descriptions. The television set manufacturer's engineer is confronted with two problems when designing any circuit. One is to make the circuit as economical as possible—for a given performance specification—and the second is to make one circuit suit as wide a variety of reception conditions as possible.

In order to economize it is frequently necessary to reduce the number of tubes employed. This means that if one tube will meet the requirements of the majority of installations, a second tube will not be used although it is known that it will be difficult to obtain good reception in some localities without its inclusion in the circuit. The second factor usually means that some engineering compromise must be made between two conflicting conditions. For example, the "*Q*" of a flywheel circuit (to be described later) should be increased to minimize effects of noise and decreased to minimize possibility of picture shift. The manufacturer generally selects a "*Q*" that represents a compromise between the two.

The technician, on the other hand, is concerned with each installation as an individual problem. If adding a stage to a customer's set saves two or three calls, if a set located in a noise-free area shifts its image frequently, he is justified in modifying the circuit used in the set to meet these individual conditions.

Fig. 1. Simplified schematic of blocking oscillator used in early television sets.



One of the most important functions of a television set is to synchronize and phase the horizontal deflection sweep voltages to the framing and scanning rate of the pickup camera at the transmitter. To achieve this end, vertical and horizontal synchronizing pulses are transmitted along with the video intelligence. These pulses are then used to establish the frequency of the vertical and horizontal sweep circuits. The reader can refer to Parts 17, 18, and 19 of the series of articles "Modern Television Receivers" by M. S. Kiver (RADIO & TELEVISION NEWS, August, September, and October, 1949) for a general idea of the functioning of the various circuits with respect to the synchronizing pulses. The author will assume that the reader is reasonably familiar with these principles in the ensuing discussion.

Blocking Oscillator

One of the simplest and most economical synchronizing circuits is the blocking oscillator. This circuit was used extensively in early sets and, because it has several serious disadvantages, the technician may have many occasions to repair or adjust blocking oscillators. A simplified schematic of the blocking oscillator is shown in Fig. 1. First let us consider the action of this circuit without synchronizing pulses.

The transformer, *T*, in this circuit has the following characteristics. When the plate current increases it induces a positive voltage in the grid leg; when the plate current stays constant, no voltage is induced in the grid leg; and when the plate current decreases, a negative voltage is induced in the grid leg. When the set is first turned on, tube V_1 begins to draw current which induces a positive voltage in the grid circuit, causing a further increase in plate current. The high positive grid voltage draws grid current which charges condenser *C* negatively. This sequence continues until the saturation current of the tube is reached, at which time the plate current stays constant. The grid voltage therefore drops from some positive value to zero, which reduces plate current. Reduction of plate current causes the grid to go negative, causing a further decrease in plate current. This sequence continues until tube cut-off is reached, at which time a negative voltage is induced across the grid which drives it well beyond the cut-off value.

The tube is maintained at this highly negative value by the charge across condenser, *C*, which slowly discharges through resistor *R*. (It should be noted that during the positive cycle, the tube is conducting and hence represents a low resistance so that the time constant is small; however, with the tube cut off the *RC* constant is large.) As the condenser discharges,

the grid voltage increases until the cut-off value is reached. At this point the tube begins to conduct and the entire cycle is repeated. The waveform of the grid voltage versus time is shown in Fig. 2A. The frequency of this cycle is determined by the *RC* constant chosen and the cut-off of the tube. In practice, this frequency is made slightly less than the frequency of the incoming sync pulses.

The sync pulses are applied at some time just prior to the return of the grid voltage to the cut-off value and are of sufficient amplitude to raise the grid voltage above cut-off as shown in Fig. 2B. The oscillator begins its cycle exactly at the time that the sync pulse is applied. This process is repeated as long as sync pulses exist and the receiver is now in synchronism with the transmitter scanning rate. The grid voltage at the time that the sync pulse is applied can be varied by adjusting R_1.

The synchronized positive pulses at the output of the blocking oscillator are then used to generate the saw-tooth waveform. The circuit of V_2 is such that a saw-tooth voltage will appear at its output with the flyback time corresponding to the blocking oscillator sync pulse as shown in Fig. 3A. Thus the effect of the blocking oscillator pulse is to discharge the condenser in the plate of V_2 and cause the electron beam to go from the extreme right hand side of the CRT to the extreme left whence it starts scanning across the tube again.

The disadvantage of the blocking oscillator circuit is that it is extremely susceptible to noise. Two effects may occur. One is that a pulse of noise voltage will appear at the grid just prior to the sync pulse and cause the tube to conduct. In this case the saw-tooth starts prematurely and a point B_1 which should appear at the extreme left of the picture is shifted toward the center. If the noise pulse occurs soon enough, a few cycles may be required for the sync pulse to be in position to fire the tube. This effect is shown graphically in Fig. 3B.

The other effect that may occur is that the noise pulse will partially cancel the sync pulse and the tube will fire later than it should. In this case the picture is displaced to the left, as indicated in Fig. 3C, and again several cycles may be required to return to normal operation. Both these effects, if they occur for a few cycles only, appear as a "tear" on the picture.

It should be noted that up to a certain point the magnitude of the sync pulse is proportional to the signal input, so that for a strong signal a large pulse is available and a small one for a weak signal. If a large amplitude is available the *RC* constant of the oscillator can be adjusted so that the pulse appears considerably before the time that the cut-off value is reached. This increases the magnitude of noise voltage required to trip the circuit prematurely. However, if a weak pulse is available, then the time between the sync pulse and natural oscillation must be made closer so that a weak signal will raise the grid above cut-off.

The manufacturer permits adjustment of the synchronizing circuit to meet these divergent conditions by placing a potentiometer in the grid of the blocking oscillator, corresponding to R_1 in Fig. 1. R_2 in this circuit affects both the upper and lower limit of the *RC* constant and when the picture rolls at the maximum setting of R_1 then the value of R_2 should be checked. In some cases when this resistor overheats its value decreases and a sufficiently high *RC* constant cannot be obtained. In other instances, where low signal and much less noise exists, it may be desirable to lower the value of this resistance for better synchronization.

Another disadvantage of the blocking oscillator is that the flyback time starts exactly at the same time as the leading edge of the sync pulse. Since this pulse is located in the middle of the blanking pulse, part of the sweep near the peak is blanked and the flyback time is limited to the period between the leading edge of the sync pulse and the end of the blanking pulse. Other synchronizing systems will cause the flyback time to start at the beginning of the blanking pulse thus giving more time for flyback and therefore allowing the deflection circuits to be designed more efficiently as far as deflection sensitivity is concerned.

Comparison System

An improvement over the blocking oscillator can be achieved through the use of a comparison circuit which is quite insensitive to noise pulses. In this system a blocking oscillator is also used but in this case its natural frequency is set as close to the sync frequency as possible. The frequency of the blocking oscillator is then compared with that of the sync pulses. If the two frequencies coincide, no action takes place, if they do not, the frequency of the oscillator is varied until they do.

This system is immune to random noise pulses because it is highly unlikely that noise pulses of sufficient amplitude will recur at a frequency near that of the sync pulses. However, as may be expected, correction of the blocking oscillator frequency is not

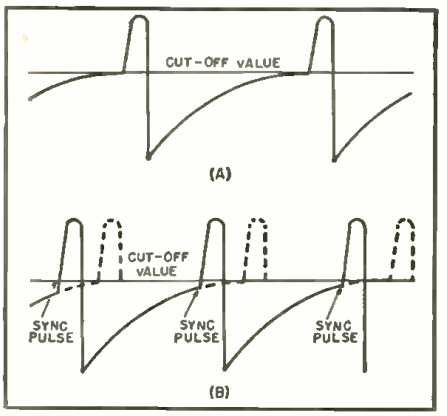


Fig. 2. Blocking oscillator grid voltage, without sync pulses (A) and with pulses (B).

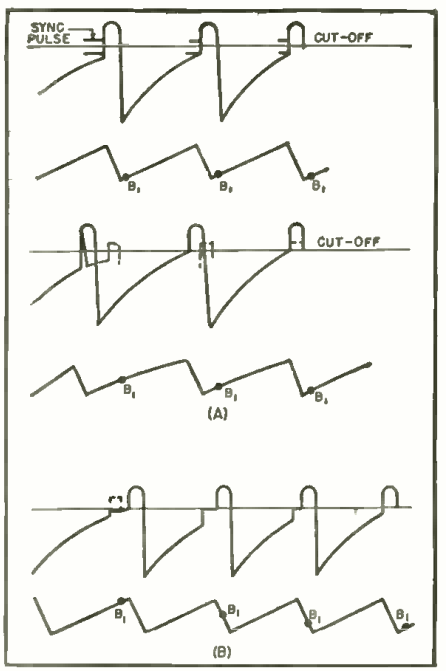
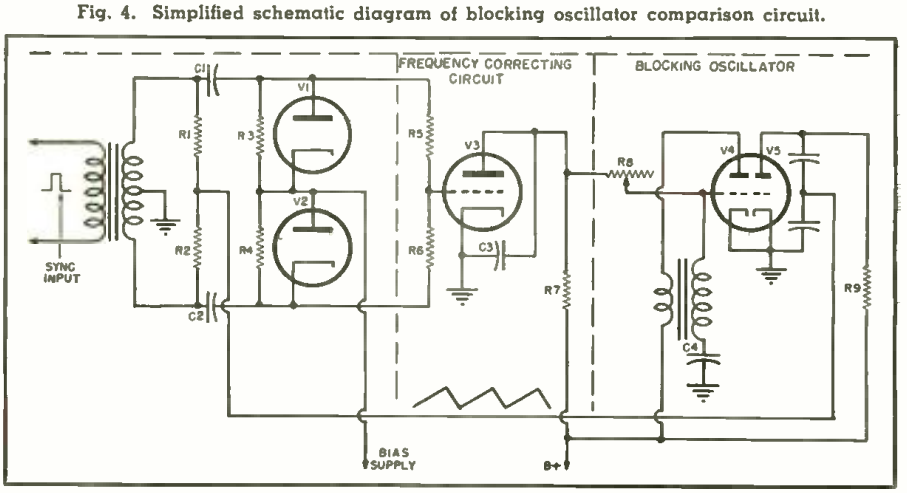


Fig. 3. Effect of noise on blocking oscillator, large pulse tripping oscillator too soon (A), cancelling pulse causing "miss" (B).

Fig. 4. Simplified schematic diagram of blocking oscillator comparison circuit.



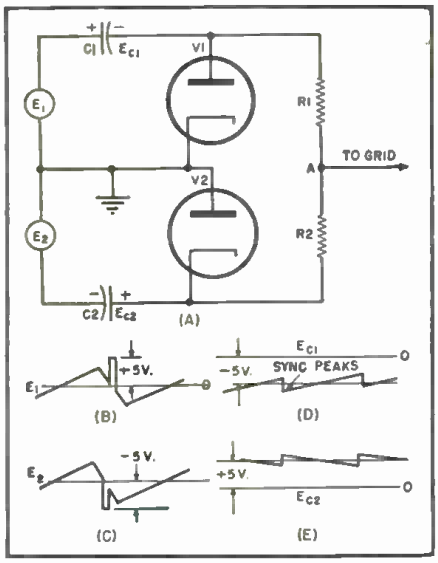


Fig. 5. A simplified schematic diagram of comparison circuit (A) showing voltage E_1 (B), and E_2 (C), and the voltage across the condenser C_1 (D), and across C_2 (E).

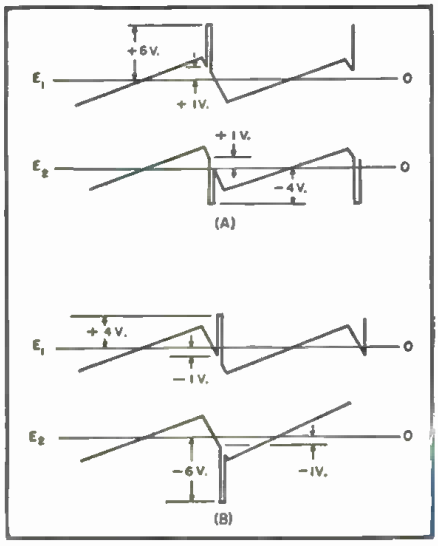


Fig. 6. Waveforms obtained when the sync frequency is higher than the oscillator frequency (A) and when the sync frequency is less than the oscillator frequency (B).

immediate since several cycles of sync pulses are required before the circuit will react to the frequency difference.

Fig. 4 is the simplified schematic of a typical blocking oscillator comparison circuit. At the right hand side of this schematic V_4 there is a blocking oscillator which operates in much the same manner as the one described previously. The grid of this tube is tied to that of V_5, the saw-tooth generator. V_4 and V_5 are conductive and cut-off over the same periods. Thus it is seen that the fly-back time of the saw-tooth again occurs when there is a positive pulse in the blocking oscillator output. This is merely another way of effecting this action and the circuit shown in Fig. 1 could have been used to obtain this result.

The frequency of oscillation of this circuit is a function of the RC constant in the grid of V_4, as before, and of the bias provided by the plate of V_3. Varying the voltage at the plate of V_3 will also vary the frequency of operation.

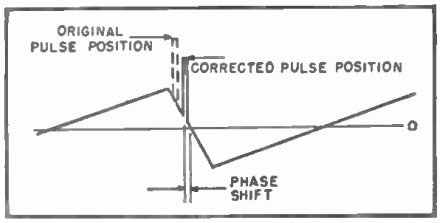
The voltage at the plate of V_3 is a function of its grid bias which, in turn, is a function of the comparison circuit output. To understand the action of the comparison circuit consider the schematic shown in Fig, 5A. E_1 and E_2 in this circuit are the voltage waveforms shown in Figs. 5B and 5C respectively.

Diode V_1 will conduct when E_1 is positive and charge condenser C_1 to the peak positive value of E_1. When E_1 starts to decline, the voltage across the diode will be negative, due to the charge in C_1, and it will cut-off. Since R_1 has a high resistance, the voltage across C_1 will decline very gradually over the cycle until the next sync pulse recharges it to the maximum value. The voltage across C_2 will have the same waveform in the negative direction. These waveforms are shown in Figs. 5D and 5E. Note the voltage across the condenser is of opposite polarity to that of the applied voltage.

The positive voltage across C_1 cancels out the negative voltage across C_2, so that the voltage at point A will be equal to zero. Now consider the effect of the sync pulses when they do not occur exactly at the center but are shifted to the left as shown in Fig. 6A. In this case C_1 charges up to a peak value of -6 volts, while C_2 charges up to a value of only $+4$ volts. The voltage at point A will no longer be equal to zero, but will be approximately equal to -1 volt (one half the difference). Similarly, a shift in the sync pulse position to the right will cause a positive voltage to be reflected at point A.

The comparison circuit shown in Fig 4 acts in this manner with the sync pulses introduced by the transformer and the saw-tooth pulses derived from the output of V_5. When the frequency of the blocking oscillator is exactly equal to that of the sync pulses, the pulses will occur exactly at the center of the flyback time. However, when the frequencies do not coincide, the bias on V_3 will be changed which, in turn, varies the frequency of the blocking oscillator in the direction that will cancel the frequency difference. Condenser C_3 in this circuit has a high value so that the circuit will not respond to sudden momentary changes in plate voltage, but will react only if the plate change is maintained over a relatively long period of time. Thus a single noise pulse, which may have caused C_1, C_2, or C_3 to charge excessively for one cycle, will not affect the frequency of the blocking oscillator. In fact this condenser is frequently large enough to affect insensitivity to low frequency disturbances such as hum or the 30 cycle vertical sweep.

Fig. 7. Phase shift due to frequency difference between oscillator and sync pulses.



The degree to which the system is sensitive to noise also depends upon the gain of V_3. If the gain is high just a few sync pulses will be necessary, for a given condenser value of C_3, to cause the oscillator to sync. However this condition makes the circuit more sentitive to random noise pulses. If the gain is low more pulses are needed to synchronize, but, by the same token, the circuit is less sensitive to random noise. In this latter case it will take much longer for the circuit to get back into synchronization after it is thrown out of sync by a severe disturbance. The manufacturer usually designs his circuit as a compromise between the two extremes of design to cover the majority of reception conditions. The service technician can, however, modify a particular set that is subject to individual conditions to effect better performance. This is most easily done by varying the value of C_3.

Returning to the over-all description of this circuit, it may be seen that when the sync pulses do not fall at the center of the flyback portion of the saw-tooth voltage, an error voltage is applied to the grid of V_3 which corrects the blocking oscillator frequency. Two factors may cause the sync pulse to be off-center. The sync and blocking oscillator frequencies may be the same, but will be out-of-phase as is usually the case when first turning the set on. In this case an error voltage will be developed across the grid of V_3 which increases or decreases, as required, the blocking oscillator frequency until the sync pulse is at the center of the flyback time. This makes the error voltage zero, and returns the oscillator to the starting frequency.

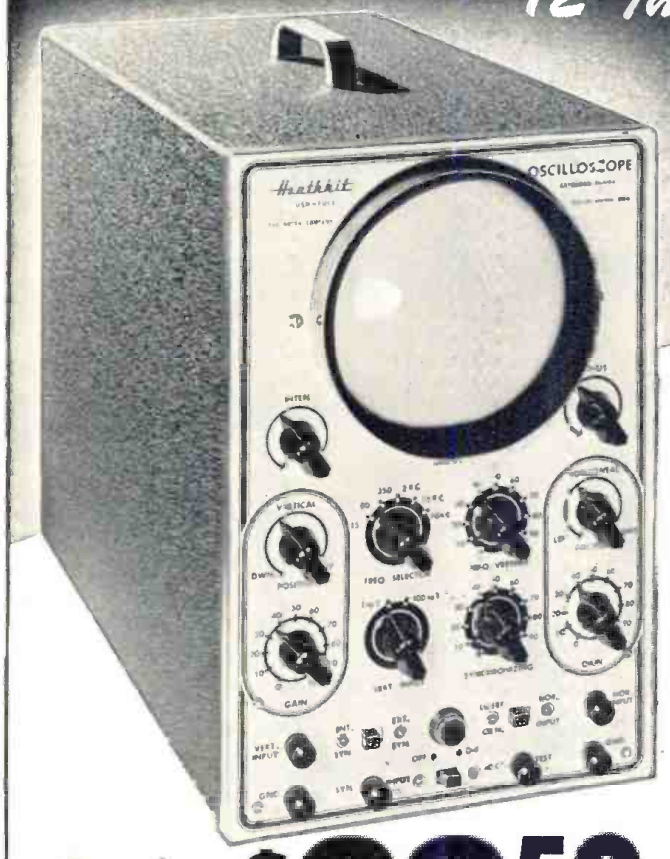
The sync pulse may be off-center due to a difference in frequency between the blocking oscillator and sync. In this case the initial error voltage will change the oscillator frequency so that the sync pulse moves toward the center. The sync pulse will not remain at the center position, however, because at this position the error voltage would be equal to zero, and the oscillator would return to its initial frequency. The sync pulse does not move to the exact center but to some intermediate position. In this condition, shown in Fig. 7, the sync pulse is out-of-phase with the blocking oscillator pulses. This out-of-phase condition is seen on the screen as a shifting of the whole picture to the right, left, up, or down, depending upon the polarity of the phase shift and the sweep affected. This can be adjusted manually by varying R_3 which changes the blocking oscillator frequency.

(To be continued)

12 Improvements IN NEW 1951

MODEL O-6 PUSH-PULL

Heathkit OSCILLOSCOPE KIT



- ★ New AC and DC push-pull amplifier.
- ★ New step attenuator frequency compensated input.
- ★ New non frequency discriminating input control.
- ★ New heavy duty power transformer has 68% less magnetic field.
- ★ New filter condenser has separate vertical and horizontal sections.
- ★ New intensity circuit gives greater brilliance.
- ★ Improved amplifiers for better response useful to 2 megacycles.
- ★ High gain amplifiers .04 Volts RMS per inch deflection.
- ★ Improved Allegheny Ludlum magnetic metal CR tube shield.
- ★ New synchronization circuit works with either positive or negative peaks of signal.
- ★ New extended range sweep circuit 15 cycles to over 100,000 cycles.
- ★ Both vertical and horizontal amplifier use push-pull pentodes for maximum gain.

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Measure either AC or DC on this new scope — the first oscilloscope under $100.00 with a DC amplifier.

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A new synchronization circuit allows the trace to be synchronized with either the positive or negative pulse, an important feature in observing the complex pulses encountered in television servicing

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- ★ New high quality Simpson 200 microampere meter.
- ★ New ½% voltage divider resistors (finest available).
- ★ 24 Complete ranges.
- ★ Low voltage range 3 Volts full scale (⅓ of scale per volt).
- ★ Crystal probe (extra) extends RF range to 250 megacycles.
- ★ Modern push-pull electronic voltmeter on both AC and DC.
- ★ Completely transformer operated isolated from line for safety.
- ★ Largest scale available on streamline 4½ inch meter.
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- ★ New simplified switches for easy assembly.

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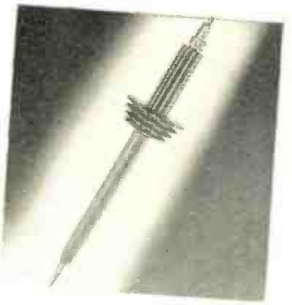

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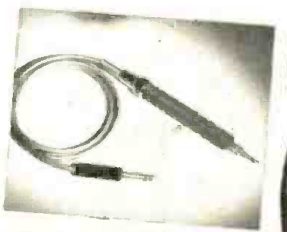

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- ★ New 6 to 1 slow speed drive on both master oscillator and marker tuners.

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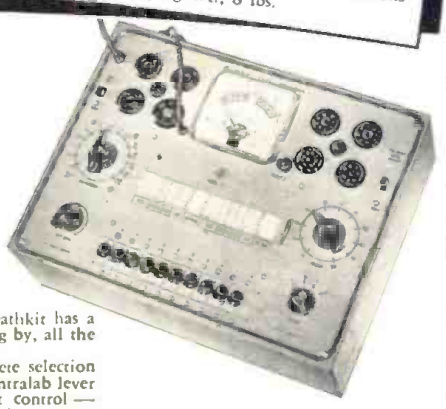

Test your tubes the modern way — dynamically — the simplest, yet fastest and surest method — your Heathkit has a switch for each tube element and measures that element — no chance for open or shorted elements slipping by, all the advantages of the mutual conductance type without the slow cumbersome time consuming setups.

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- New step attenuator output.
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- Calibrated harmonics to 150 megacycles.
- New external modulation switch.
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- 1% Precision ceramic resistors.
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- Multiplying type ohms ranges.
- All the convenient ranges 10-30-300-1,000-5,000 Volts.
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A precision portable volt-ohm-milliammeter. An ideal instrument for students, radio service, experimenters, hobbyists, electricians, mechanics, etc. Rugged 400 ua meter movement. Twelve complete ranges, precision dividers for accuracy. Easily assembled from complete instructions and pictorial diagrams. An hour of assembly saves one-half the cost. Order today. Model M-1. Shipping Wt., 2 lbs.

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- Voltmeter for accurate check.
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New LABORATORY INSTRUMENT KITS

HUNDREDS OF LABORATORIES USE

Heathkit IMPEDANCE BRIDGE as Standard

Features

● Measures inductance 10 microhenries to 100 henries ● Measures resistance .01 ohms to 10 megohms ● Measures capacitance .00001 MFD to 100 MFD ● Measures "Q" and power factor.

Measures inductance from 10 microhenries to 100 henries, capacitance from .00001 MFD to 100 MFD. Resistance from .01 ohms to 10 megohms. Dissipation factor from .001 to 1. "Q" from 1 to 1,000. Ideal for schools, laboratories, service shops, serious experimenters. An impedance bridge for everyone — the most useful instrument of all, which heretofore has been out of the price range of serious experimenters and service shops. Now at the lowest price possible. All highest quality parts. General Radio main calibrated control. General Radio 1,000 cycle hummer. Mallory ceramic switches with 60 degree indexing — 200 microamp type binding posts with standard ¾" centers. Beautiful birch cabinet. Directly calibrated "Q" and dissipation factor scales. Ready calibrated capacity and inductance standards of Silver Mica, accurate to ½ of 1% and with dissipation factors of less than 30 parts in one million. Provisions on panel for external generator and detector. Measure all your unknowns the way laboratories do — with a bridge for accuracy and speed.

$69.50

Internal 6 Volt battery for resistance and hummer operations. Circuit utilizes Wheatstone, Hay and Maxwell circuits for different measurements. Supplied complete with every quality part — all calibrations completed and instruction manual for assembly and use. Deliveries are limited. Model 1B-1. Shipping Wt., 15 lbs.

NEW Heathkit LABORATORY RESISTANCE DECADE KIT

Features

● ½% Accuracy
● Birch Cabinet
● Ceramic Switches
● Covers 1 ohm to 99,999 ohms

The new Heathkit Resistance Decade is a handy tool for laboratory, school and service shop. Ideal for test setups, calibrating instruments, bridge measurements, selecting multipliers, etc.

$19.50

Uses the finest Centralab ceramic switches, ½% ceramic decade resistors and heavy birch cabinet matching other laboratory equipment. The range is 1 ohm to 99,999 ohms in one ohm steps.

Finest quality throughout to withstand school usage — heavy aluminum panel — laboratory type binding posts — the fine decades are extremely simple to assemble — complete kit. Model RD-1. Shipping Wt., 4 lbs.

NEW Heathkit LABORATORY POWER SUPPLY KIT

Features

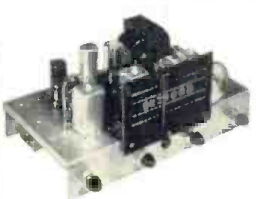
● Supplies 6.3 V. AC at 4.5 Amps.
● Heavy duty construction.
● Handy for schools, labs., and service shops.
● Supplies variable DC 50-300 Volts.
● Shows voltage or current on 3½" meter.

This new Heathkit Variable Power Supply Kit fills hundreds of needs — use it for experimental circuits — no need to build a separate power supply — use it for a test voltage to determine proper coefficients in unknown circuits — calibrate instruments with its variable voltage, etc. This new Heathkit supplies 50 to 300 Volts continuously variable DC together with an AC filament voltage of 6.3 Volts at 4.5 Amperes. A built-in 1 MA 3½" meter has proper shunts to read 0-500 Volts and 0-200 Milliamperes. The circuit uses a 5Y3 rectifier, two 1619 tubes as electronic control tubes to vary the output voltage with a single potentiometer. Case measures 7⅛" x 13" x 7⅛". Has instruction manual for assembly and use. Model PS-1. Shipping Wt., 18 lbs.

$29.50

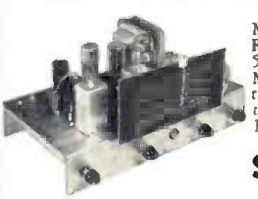
Heathkit RECEIVER & TUNER KITS for AM and FM

TWO HIGH QUALITY Heathkit SUPERHETERODYNE RECEIVER KITS



Model BR-1 Broadcast Model Kit covers 550 to 1600 Kc. Shipping Wt., 10 pounds.

$19.50



Model AR-1 3 Band Receiver Kit covers 550 Kc. to over 20 Mc. continuous. Extremely high sensitivity. Shipping Wt., 10 lbs.

$23.50

Two new Heathkits. Ideal for schools, replacement of worn out receivers, amateurs and custom installations.

Both are transformer operated quality units. The best of materials are used throughout — six inch calibrated slide rule dial — quality power and output transformers — dual iron core shielded I.F. coils — metal filter condensers and all other parts. The chassis has phono input jack — 110 Volt outlet for phono motor and there is a phono-radio switch on panel. A large metal panel simplifying installation in used console cabinets is included. Comes complete with tubes and instruction manual incorporating pictorials and step-by-step instructions (less speaker and cabinet). The three band model has simple coil turret which is assembled separately for ease of construction.

TRUE FM FROM Heathkit FM TUNER KIT

$22.50

The Heathkit FM Tunet Model FM-2 was designed for best possible tonal reproduction. The circuit incorporates the most desirable FM features — true FM — ready wound and adjusted coils — 3 stages of 10.7 Mc. I.F. (including limiter).

Tube lineup: 7E5 oscillator, 6SH7 mixer, two 6SH7 I.F. stages, 6SH7 limiter, two 7C4 diodes as discriminator, 6X5 rectifier.

The instrument is transformer operated making it safe for connection to any type receiver or amplifier. The R.F. coils are ready wound — mounted on the tuning condenser and the condenser is adjusted — no R.F. coils to wind or adjust.

A calibrated six inch slide rule dial has vernier drive for easy tuning. The finest parts are provided with all tubes, punched and formed chassis, transformers, condensers and complete instruction manual. Model FM-2. Shipping Wt., 10 lbs.

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The HEATH COMPANY

. . . BENTON HARBOR 15, MICHIGAN

ENJOY MUSIC AT ITS *Finest* WITH *Heathkit* AMPLIFIERS

NEW *Heathkit* HIGH FIDELITY 20 WATT AMPLIFIER KIT

$21.50

Features

- Push-pull 6L6's.
- Full 20 Watts output.
- Fully enclosed chassis.
- Provisions for reluctance pickup compensation stage.
- Cased high fidelity output transformer.
- Treble and bass boost tone controls.
- Full range of output impedances 3.2 ohms to 500 ohms.

The finest amplifier kit we have ever offered — check the features. This inexpensive amplifier compares favorably with instruments costing five times as much. Nothing has been spared to provide the best reproduction — an ideal amplifier for the new Heathkit FM Tuner listed below.

Dual tone controls for control of both treble and bass. Bass control is of the boost type for maximum listening pleasure. Optional preamplifier stage for use with G. E. reluctance pickup or microphone. Uses inverse feedback to give excellent response over entire range. Tube lineup: 6SJ7 preamplifier stage, 6J5 phase splitter stage, two 6L6's in push-pull and 5Y3 rectifier. (6SC7 as optional compensation stage).

Uses highest quality Chicago Transformer Corporation cased output transformer with taps of 3.2, 8, 15, 60 and 500 ohms to match any speaker combination. Power transformer is conservatively rated for continuous operation in sound systems. Tone control gives maximum bass boost of 6 db at 70 cycles. Amplifier has maximum gain of 75 db. Response within 3 db 20 to 20,000 cycles. Shipping Wt., 17 lbs. Complete with all parts, tubes and instruction manual.

Model A-5A Amplifier with preamplifier for G. E. cartridges or microphone $23.50
12" 20 Watt Speaker, No. 326 ..... 7.50

Heathkit ECONOMY 6 WATT PUSH-PULL AMPLIFIER KIT

$12.50

No. 304. 12-inch Speaker $6.95

This new Heathkit Amplifier was designed to give quality reproduction at a very low price. Has two preamp stages, phase inverter stage and push-pull beam power output. Comes complete with six tubes, quality output transformer (to 3-4 ohm voice coil), husky cased power transformer and all other parts. Has tone and volume controls. Instruction manual has pictorial for easy assembly. Six watt output with response flat ± 1½ db from 50 to 15,000 cycles. A quality amplifier kit at new low price. Better build one. Model A-4. Shipping Wt., 7 lbs.

Heathkit RECEIVERS and TUNER CABINETS

$4.95

Order No. 350 for FM tuner

Blonde birch veneer cabinet for either the receivers or tuner. Modern styling is an asset to any room. 5" speaker fits in end of cabinet when used with receivers. Size 7 x 13½ x 8¼ inches. Shipping Wt., 5 lbs.
Order No. 345 for either receiver

Metal professional type communications receiver cabinet. Finished in deep grey to fit the panel supplied with Heathkit BR-1 and AR-1 Receivers (panel shown not included with cabinet). 5" speaker mounts in end of cabinet. Gives professional appearance to Heathkit receivers. Size 7 x 14 x 7¾ inches. Shipping Wt., 6 lbs.

5" Permoflux Speaker for either cabinet for use with either Heathkit Receiver No. 320 5" Speaker $2.75

$4.50

No. 335 Cabinet for receivers only.

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BENTON HARBOR 15, MICHIGAN

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Quantity	Item	Price	Quantity	Item	Price
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	Heathkit T.V. Alignment Gen. Kit — TS-2			Heathkit R.F. Probe Kit — No. 309	
	Heathkit FM Tuner Kit — FM-2			Heathkit H.V. Probe Kit — No. 336	
	Heathkit Broadcast Receiver Kit — Model BR-1			Heathkit R.F. Signal Gen. Kit — Model SG-6	
	Heathkit Three Band Receiver Kit — Model AR-1			Heathkit Condenser Checker Kit — Model C-2	
	Heathkit Amplifier Kit — Model A-4			Heathkit Handitester Kit — Model M-1	
	Heathkit Amplifier Kit — Model A-5 (or A-5A)			Heathkit Variable Power Supply Kit — Model PS-1	
	Heathkit Tube Checker Kit — Model TC-1			Heathkit Resistance Decade Kit — Model RD-1	
	Heathkit Audio Generator Kit — Model G-2			Heathkit Impedance Bridge Kit — Model IB-1	
	Heathkit Battery Eliminator Kit — Model BE-2			Heathkit Signal Tracer Kit — Model T-2	
	Heathkit Electronic Switch Kit — Model S-2				

On Parcel Post Orders, include postage for weight shown and insurance. (We insure all shipments.)

On Express Orders, do not include transportation charges — they will be collected by the Express Agency at time of delivery.

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Negative Feedback

(*Continued from page* 69)

passed, the audio input signal would produce a voltage drop across the cathode resistor of V_1 varying at an audio rate. Simultaneously the feedback voltage fed through C_2 and R_1 would "buck" or cancel some of this audio voltage, reducing the effective gain. C_1 serves to increase the high frequency response in two ways:

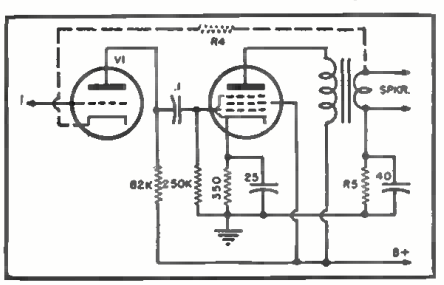
1. All of us are familiar with the way bypassing the cathode of a stage increases the gain. C_1 accomplishes a certain amount of high frequency gain by this method since it furnishes a fairly low high frequency path to ground. A .0043 μfd. condenser would not, however, cause any appreciable gain in the middle register around 1000 cycles.

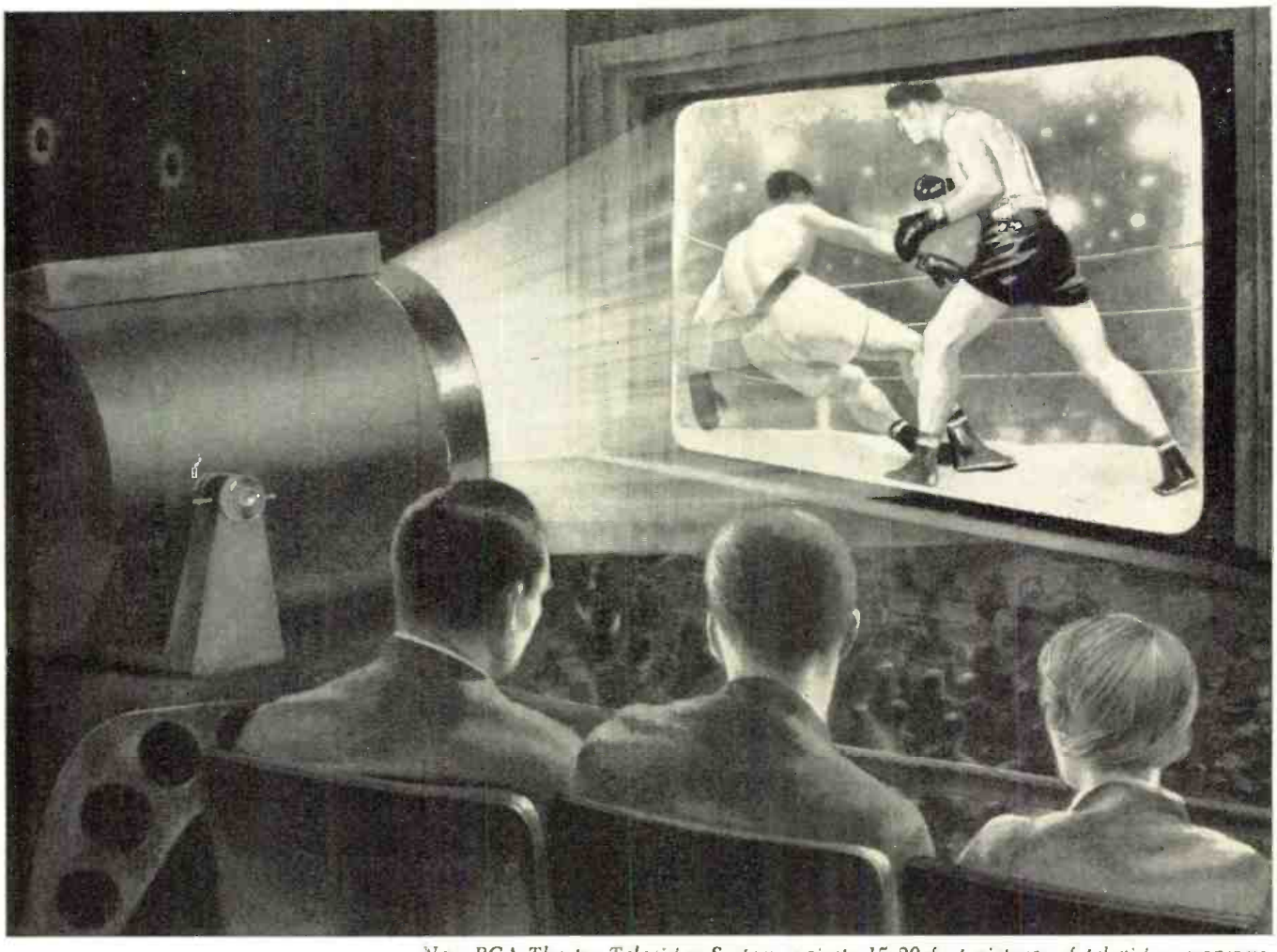
2. Since C_1 tends to serve as a low impedance circuit to ground for the higher audio frequencies, it also bypasses some of the feedback voltage. Since the feedback results in reduced gain in the middle audio frequency range and is effectively bypassed to ground at the high frequency end, then it is to be expected that the middle register will be "pulled" down and the high end left unchanged. With the value of parts shown in Fig. 3, used with a good quality output transformer, the high frequency compensation starts at around 7000 cycles, and the low frequency compensation around 80 cycles. The amount of feedback or "pull down" in the middle register is determined by R_1. Increasing the value of C_1 tends to pull the high frequency "hump" toward the middle register. Increasing the value of C_2 tends to push the low frequency "hump" further toward 30 cycles.

Fig. 4 is a modification of Fig. 3. The cathode of V_1 is returned to ground through the output transformer secondary winding. The voice coil being in series with this return impresses its full voltage between the grid and cathode of V_1. By proper phasing of the two output voice coil wires the feedback is made negative. R_3 merely serves as the usual cathode bias resistor with the proper capacity bypassing.

Fig. 5 is a further modification of Fig. 3 in which the output transformer has been so wound as to have a special

Fig. 4. The entire voice coil voltage is impressed between the cathode and grid of V_1. By proper phasing of the voice coil wires the feedback can be made negative.





New RCA Theatre Television System projects 15x20 foot pictures of television programs.

Giant size Television— "shot from a barrel!"

• You've seen television. Now you'll see it in its very finest form—giant projections of special events, transmitted *only* to motion picture theatres on private wires or radio beams to make movie-going *better than ever!*

Success of the new system comes from a remarkable RCA kinescope, and something new in projection lenses. The kinescope tube, developed at RCA Laboratories, is in principle the same as the one on which you see regular telecasts. But it is *small*—only a few inches in diameter—and produces images of extremely high brilliance. These are magnified to 15x20 feet by a "Schmidt-type" lens system like those used in the very finest of astronomical telescopes.

Because of its size and shape, the new projector is referred to by engineers as the "barrel." It's already going into theatres, where you'll be seeing giant television—shot from a barrel.

* * *

See the latest wonders of radio, television, and electronics at RCA Exhibition Hall, 36 West 49th St., New York. Admission is free. Radio Corporation of America, RCA Building, Radio City, New York 20, New York.

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WORLD LEADER IN RADIO—FIRST IN TELEVISION

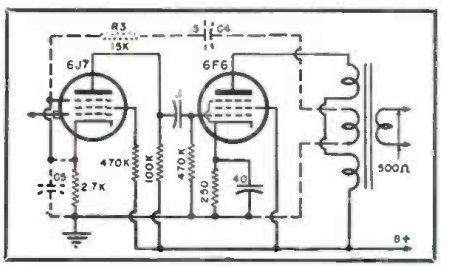


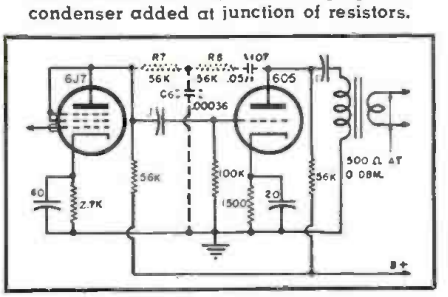
Fig. 5. Instead of obtaining feedback voltage from the voice coil winding as in Fig. 4, a special winding known as a tertiary feedback winding is used. Transformers incorporating these windings are gradually disappearing from the market as less costly methods are used to get degeneration.

winding for supplying feedback voltage. Standard output transformers of this type have appeared on the market since the war. War surplus transformers which have incorporated this tertiary feedback winding are also available.

Fig. 6 is an outgrowth of Fig. 2. In Fig. 6 the feedback resistance has been broken up into two resistors with a high frequency bypassing condenser added at the junction point. This condenser, C_6, serves as a method of controlling the high frequency response since it controls the amount of high frequency feedback allowed through the feedback resistors, R_7 and R_8. C_7 has been added to permit some control over the amount of low frequency response. R_7, R_8, C_6 and C_7 actually constitute a frequency sensitive network. As the value of C_6 is decreased the amount of high frequency compensation is likewise decreased. As C_7 is decreased the amount of low frequency compensation is increased.

In all the preceding circuits the values of the resistors and condensers have been given to assist the builder and designer by giving him a starting point. The actual values will depend on the transformers used and the physical layout. These values for the most part were used in conjunction with transformers having excellent frequency and phase characteristics. Where transformers are used which have either poor frequency response or excessive phase shift, oscillations may be experienced with the given values of feedback resistors. Decreasing the amount of feedback will be necessary and may be taken care of by increasing the value of the feedback resistor. —30—

Fig. 6. A modification of Fig. 2. The feedback resistance has been broken up into two resistors with high frequency bypass condenser added at junction of resistors.



THE EYE IS QUICKER THAN THE EAR

IF YOU SERVICE TV, YOU KNOW THIS!
Customers are quick to *see* imperfections. Much slower to *hear* them. Therefore *premium-quality* Hytron receiving tubes for the tougher TV jobs. *At no extra cost!* You gain also: Through fewer expensive service call-backs. Better customer satisfaction and confidence. More profits.

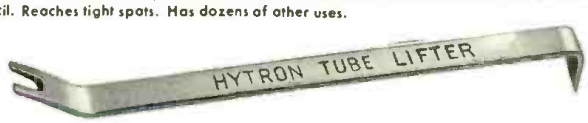
How does Hytron do it? By working closely with leading TV set manufacturers. By endless striving to better already superior performance. By improved design...processing...inspection...testing.

Try Hytron TV receiving tubes: 1X2A, 5U4G, 6AG5, 6AL5, 6AU6, 6BC5, 6BG6G, 6BQ6GT, 6CB6, 6SN7GT, 6V6GT, 6W4GT, 12BH7, 25BQ6GT, etc. Also Hytron rectangular picture tubes: 14BP4, 16RP4, 17BP4A, 20CP4. You pay no more for Hytron. But *see* the difference yourself...on the TV screen...on your cash register.

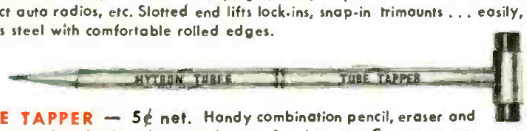
THEY COST PENNIES, BUT SAVE DOLLARS!

Order from your Hytron jobber today

HYTRON SOLDERING AID — 49¢ net. Fork tip effortlessly, quickly unwraps "mechanically solid" joints. Straddles wire, grips, unwraps, pulls it free. Guides new wire; holds it firm while soldering. Spade tip reams solder from lug hole; pushes other wires aside. Tips are hardened, twist-proof, insulated, hard-chromed to shed solder. Tool handles like pencil. Reaches tight spots. Has dozens of other uses.



HYTRON TUBE LIFTER — 15¢ net. *Lift* 'em all the e-a-s-y prybar way: Tubes (GT, G, standard, lock-in, metal). Vibrators and plugs (Jones, Amphenol) — and knobs. A natural for compact auto radios, etc. Slotted end lifts lock-ins, snap-in trimounts . . . easily, safely. Of stainless steel with comfortable rolled edges.



HYTRON TUBE TAPPER — 5¢ net. Handy combination pencil, eraser and tube tapper. Discovers microphonism, shorts, and opens in tubes, etc. Compact, non-metallic, rugged. Doubles in brass for writing orders, etc.

HYTRON TUBE PULLER — 75¢ net. Pull or insert 7-pin miniatures the e-a-s-y way. Neoprene rubber puller works by suction and friction on top of tube. Positive grip. Reaches tight spots. Another Hytron time-temper-and-money saver.

HYTRON AUTO RADIO TOOL — 24¢ net. Substitutes for control cables of universal auto radio. Quickly, precisely turns set on/off, tunes, adjusts volume and tone, re-aligns dial. Square also fits splines. Vee fits spade and other key fittings. Minimum backlash. Compact. Bright-zinc plated. Non-rolling large handle for fine adjustments.

HYTRON PIN STRAIGHTENERS, 7-Pin and 9-Pin — 55¢ net ea. You merely press tube gently into Hytron Straightener until button base seats squarely. Presto, pins are straight! Fast . . . safe. Avoiding one broken tube pays for Straightener twice over. Precise, stainless-steel insertion die. Comfortable knurled aluminum holder. For hand, bench or tube tester use.

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OLDEST MANUFACTURER OF RECEIVING TUBES
HYTRON
RADIO AND ELECTRONICS CORP.

MAIN OFFICE:
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HYTRON RADIO TUBES

McGEE'S "SUPER STORE" OPERATION SAVES YOU MONEY!

5 OZ4 TUBE & 5 VIB. DEAL No. RN-V5 ..... $8.49

Here's a red hot deal for you fellows that do a lot of auto radio service. 5 standard brand metal OZ4 tubes and 5 of our famous 4-prong serrated can vibrators. This vibrator is of the latest design, for long life. Standard diameter can, short enough to fit all Chrysler auto sets, also fits Motorola, etc. Our 20th Anniversary big deal No. RN-V5. You can get 5 OZ4 metal tubes and 5 4-prong vibrators, all for $8.49. Shipping weight 3 lbs.

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MN-16.	16 mfd 450 volt	39c
MN-30.	30 mfd 450 volt	49c
MN-20.	20 mfd 150 volt	29c
MN-40.	40 mfd 150 volt	39c
MN-220.	20-20 mfd 150v	39c
MN-53.	30-30 mfd 150v	49c
MN-442.	40-40-20 mfd 150v	59c

All cond. guaranteed one year.

RED HOT SPEAKER VALUES

McGee has a tremendous stock of 100,000 speakers to fill your needs. Every speaker is fully guaranteed. Order your speakers now.

4 inch, square	1 oz. magnet	$1.29
5 inch, pincushion	1 oz. magnet	1.29
6 inch, pincushion	1.47 oz. magnet	1.79
4 x 6 inch	1 oz. magnet	1.69
5 x 7 inch, oval	1.47 oz. magnet	2.19
7 inch, pincushion	2.15 oz. magnet	2.95
8 inch, pincushion	2.15 oz. magnet	3.29
6 x 9 inch, oval	2.15 oz. magnet	2.95

100 Molded Plastic Bypasses $9.49

100 molded plastic tubular by-pass condensers. All 600 volt. And all by the same nationally known mfgr. Regular dealers' net is over two and one-half times our 20th Anniversary sale price. You'll chuckle when you look these over. Here's what you get: 10—.001, 10—.002, 20—.005, 20—.01, 20—.02, 10—.05 and 10—.1. Our big deal No. RN-202. 100 plastic tubulars. Shipping weight 2 lbs. Net price. $9.49.

100 600 VOLT TUBULARS $6.49

100 top quality 600 volt tubular by-pass condensers. Made this year by a famous condenser factory. Don't confuse these with grab-bag surplus. McGee's deals are guaranteed to please you. Here's what you get: 10—.001, 10—.002, 20—.005, 20—.01, 10—.02, 20—.05 and 10—.1. 600 volt condensers. Our big deal No. RN-203. Shipping weight 2 lbs. Net price. $6.49.

20 50 x 30 150 V. ELECTROLYTICS $9.75

Here's a red hot value. 20 of our XX quality replacement electrolytics. The most popular condensers in use today. Takes care of 90% of your AC-DC radio filter needs. Compact construction 1950 production. 1-year guarantee. 50-30 mfd. 150 volt, housed in a cardboard tube with common negative, has long flexible leads. 20th Anniversary, big deal No. RN-204. Sale price. $9.75.

SELENIUM RECTIFIERS

65 mil Selenium Rectifier, net ..... 59c each
100 mil Selenium Rectifier, net ..... 69c each
150 mil Selenium Rectifier, net ..... 79c each
200 mil Selenium Rectifier, net ..... $1.09 each
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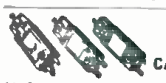
350 mil Selenium Rectifier, net. 1.49 each
450 mil Selenium Rectifier, net. 1.69 each

McGee offers you the finest in Selenium rectifiers. All standard 130 volt.



1 or 4 VOLT CRYSTAL CARTRIDGES $1.99

McGee offers you a famous make crystal cartridge. Standard size and shape, but very light weight. Will track on ¾ oz. or more pressure. Stock A-6, one volt output, replaces Astatic L-70 etc., Net $1.99. Stock No. A-10, 4 volt output, replaces Astatic L-72 and L-82, etc., Net $1.99. Buy 10 assorted for $19.00.

6 UNIVERSAL OUTPUT TRANS. DEAL. RN-UP6 $5.29

Any push-pull or single plate to any voice coil. Popular strap mounting, the same as you use every day. You get 4-5 watt, 1-8 watt, 1-15 watt transformers. Shipping weight 4 lbs. Deal #RN-UP6. Net $5.29.

10 SMALL OUTPUTS DEAL RN-10PT $4.49

5 outputs for any single universal plate to voice coil. 5 watt. And 5 single 50L6 outputs to voice coil. These outputs are small size strap mounting. Shipping weight 4 lbs., Deal #RN-10PT. Net $4.49.

115 PHONO NEEDLES $4.95

2 $3.50 list Duotone Ruby needles, with handy record brush, 3 $2.50 list Duotone Sapphire needles in plastic case and 4 packages of 25 cheap needles and 1 package of 10 cheap needles. 115 phono needles. Deal #RN-P12. Net $4.95.

22 AC LINE CORDS $4.95

20 6 ft. AC cords, with G.E. unbreakable molded caps. 10 brown and 10 ivory, plus 2 ICA universal resistance AC-DC cord sets. Shipping weight 3 lbs. Deal #GE-22. Net $4.95.

20 CONTROLS $5.95

All have SPST switch, which may be used by pulling a small tab. A red hot value. All National Union, individually boxed, 1 each 5,000, 10,000, 25,000, 50,000, 100,000 and 5 each 250,000, 500,000 and 1 megohm. Shipping weight 1 lb. Deal #RN-NU20. Net $5.95.

$2.95 FOR A REG. $7.77 PROBE

Does signal tracer probe, with instructions. Made to sell to you for $7.77. A heavy bakelite probe containing a 6E5GT tube. (The end of the probe is secured by three screws and may be taken apart easily.) A 5 foot lead with 3 circuit amphenol plugs and receptacle and Mueller peewee clip. Connect this probe to any AC amplifier and have a signal tracer. Shpg. wt. 1 lb. Net. $2.95; 2 for $4.95.

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3 tube AC wire recorder oscillator and erase circuits for use with the St. George mechanism, or any wire recorder head. Adapts any radio or amplifier to operate a wire recorder, mike and phono inputs, self powered. Wired, with tubes and instructions. Model RR-Y, shipping weight 6 lbs. Net price, $13.95.

REG. $54.00 LIST 25 WATT DRIVER AND TRUMPET $23.95

This trumpet and driver is especially designed for all outdoor speaker uses; churches, sound trucks, etc. It is the most popular size sold today. McGee offers you more for your money. Each speaker is fully guaranteed.

Model XX-100, all weather proof 3½ foot trumpet, made of aluminum castings and spinnings. 19" bell trumpet can be used with any standard driver. Regular $29.00 list. Ship. weight 15 lbs. Net price $13.50.

Model RM-30, standard 15 ohm. 25 watt driver for use with above trumpet. Quality second to none. Shipping weight 6 lbs. Net $12.50.

Combination offer. Buy the XX-100 trumpet and RM-30 25 watt driver, both for $23.95.

10 WATT PAGING SPEAKER $11.95

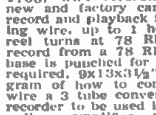
Model 10-XXP. 10 watt paging speaker with built-in weather-proof driver. Spun aluminum construction. 8 ohm voice coil. Regular net on this speaker is over $15.00. A special purchase by McGee makes this $11.95 price possible. Shipping weight 4 lbs.

BIG SALE ALUMINUM CAN ELECTROLYTICS

McGee offers you Nationally known brands of FP type electrolytic condensers at a tremendous saving. After these are gone, we don't know where we can buy any more to sell at these prices. Order a good supply now. Unconditionally guaranteed.

40-40 mfd.	25v.	FP cond. 1	x2"	$0.19	40-40 mfd.	150v, 40-40 25v. FP cond. 1½	x2" $0.39
250 mfd.	25v.	FP cond. 1	x2"	.29	60-40 mfd.	150v, 10 25v. FP cond. 1	x3" .49
20-20 mfd.	150v.	FP cond. 1	x2"	.29	40 mfd. 300v. 50 250v, 20 200v. FP cond. 1½		x3" .59
20-20 mfd.	150v, 25 25v.	FP cond. 1	x2"	.34	15 mfd.	400v, 10-5 350v. FP cond. 1	x3" .49
20-20 mfd.	150v, 100 25v.	FP cond. 1	x2"	.44	8 mfd.	450v. FP cond. 1	x3" .29
40 mfd.	150v, 200 10v.	FP cond. 1	x2"	.29	10 mfd.	450v. FP cond. 1	x3" .34
30-30 mfd.	150v.	FP cond. 1	x2"	.39	16 mfd.	450v. FP cond. 1	x3" .34
40-20 mfd.	150v.	FP cond. 1	x2"	.39	20 mfd.	450v. FP cond. 1	x3" .39
80 mfd.	150v.	FP cond. 1	x2½"	.29	24 mfd.	450v. FP cond. 1	x3" .39
50-50 mfd.	150v, 25 25v.	FP cond. 1	x2½"	.49	30 mfd. 450v, 30 350v, 40 25v. FP cond. 1		x3" .49
80-40 mfd.	150v.	FP cond. 1	x3"	.49	20-10 mfd.	450v. FP cond. 1½	x3" .69
80-40 mfd.	150v, 25 25v.	FP cond. 1	x3"	.59	20-20 mfd.	450v. FP cond. 1½	x3" .89
40-40-20 mfd.	150v.	FP cond. 1	x3"	.59	32 mfd.	450v. FP cond. 1	x3" .59
15-15 mfd.	150v, 1200 1½v.	FP cond. 1	x2"	.49	30-15-10 mfd.	450v, 20 25v. FP cond. 1	x3" .69
30 mfd.	250v.	FP cond. 1	x2"	.19	10-10-10 mfd.	450v, 20 25v. FP cond. 1	x3" .59
40 mfd.	250v.	FP cond. 1	x2"	.19	80 mfd.	450v. FP cond. 1½	x3" .59
15-15 mfd.	250v.	FP cond. 1	x2"	.29	20-20-20 mfd.	450v. FP cond. 1½	x3" 1.19
40-20 mfd.	150v, 100 15v.	FP cond. 1	x3"	.39	40-30-10 mfd.	450v, 20-25v. FP cond. 1½	x3" 1.49
30-50 mfd.	15 3v, 20 50v, 100 10v.	FP cond. 1½	x2"	.49	40-40-40 mfd.	450v. FP cond. 1½	x3" 1.49

$19.95 BUYS A NEW St. George Wire Recording Mechanism



ONLY 200 TO SELL

McGee offers you at a terrific saving the St. George Series 1100, wire recording mechanism. Brand new and factory guaranteed. This unit will record and playback from a standard recording wire, up to 1 hour. The wire take-up reel turns at 78 RPM and will play and record from a 78 RPM phono record. The base is punched for a phono pickup. Space required, 9x13x3½". Shipped with a diagram of how to connect and also how to wire a 3 tube converter to enable the wire recorder to be used in conjunction with any radio or amplifier. St. George wire recording mechanism. Series 1100. Shipping weight 15 lbs. Net price $19.95 each. Crystal phono pickup arm and cartridge $1.95 extra. Recording wire; 15 minute spool. Net price $1.19. 30 minute spool. Net price $1.79. 1 hour spool. Net price $2.79. Crystal mike and desk stand $4.95 extra.

Antenna, R.F., Osc. and I.F. Coils

Small Universal, adjustable slug tuned RF Coil, 39c; Antenna Coil, 39c; Oscillator Coil, 39c.

Made to match any condenser gang. Midget 456 I.F. transformers ¾x1⅛" can with leads 1st or 2nd I.F. 59c each.

Small 5x8" standard loop antenna, 29c ea.

10" HEAVY DUTY P.M. WITH BAFFLE RED HOT SPECIAL $7.49

Super heavy duty 10" 32 oz. Alnico 3 PM speaker, with 8 ohm voice coil. Ideal for music box operators and all sound installations. A lucky purchase makes this possible. The baffle is of the slanting wall type mounting, made of plywood and covered with leatherette. Stock No. MP-10. Net price $7.49 each. In lots of 3 or more, $7.00 each.

19 TUBULAR ELECTROLYTICS DEAL RN-PL19 $5.95

19 tubular electrolytics, guaranteed for one year. All fresh stock in aluminum tubes with cardboard insulating sleeves. You must be satisfied or money back. You get 10 8 mfd. 450 volt, 4 16 mfd. 450 volt, 3 20 mfd. 150 volt and 2 40 mfd. 150 volt condensers. Shipping weight 2 lbs. Deal #RN-PL19. Net $5.95.

10 FP ELECTROLYTICS DEAL RN-10DS $3.49

10 assorted F.P. aluminum can electrolytics. Popular twist tap mounting. Mostly multiple section banks, 150, 350 and 450 volts. A red hot deal. Shipping weight 2 lbs. Deal #RN-10DS. Net $3.49.

10 BOXES OF PILOT LIGHTS $5.49

Pilot lamps, boxed 10 to a handy carton. American made. 7 boxes #47, 1 box #40, 1 box #44 and 1 box #46. A total of 100 lamps. Deal #CM-51. Net $5.49.

100 #47 imported panel lamps. Guaranteed. 100 to the carton. Deal #RN-J47. Net $4.49.

100 KNOBS Set-Screw Type $3.95

100 bakelite set screw knobs, for radio set replacement. All fit standard ¼" shaft. Assorted walnut, black and ivory. A dozen of each style to give you matched sets. This value worth $7.50. Shipping weight 2 lbs. Deal No. RN-10K. 100 knobs. Net $3.95. ½ a Deal or 50 knobs. $2.00.

V.M. 3 SPEED Record Changers

VM Model 406 deluxe 3 speed automatic record changer—plays them all—intermixes records of the same speed—equipped with a flip over crystal pickup with twin needles—a very sleek designed record changer—base size 12¼x13. Ship. weight 12 lbs. VM-406. Net $33.21.

Buy the VM-950 changer with or without base. Choice of G.E. VR or crystal cartridge. We think the VM-950 record changer is the finest in America. It automatically plays all records all speeds and all sizes: 12 10-in., 33⅓ or 78 rpm, 10 12-in., 33⅓ or 78 rpm and 12 and 10-in. records of the same speed intermixed. 12 7-in. 33⅓ or 12 7-in. 45 rpm. Automatically shuts off after the last record. Size 13 13 16x11⅞x7¼ in. high. Offered with crystal cartridge, G.E. VR cartridge, or either with a base. VM-950. 3 speed changer with standard output crystal cartridge and needles for 1 and 3 mil. (78 rpm, 33⅓, 45 rpm.) Net $28.35.

VM-950GE. 3 speed changer with the new RPX-050 magic button, all-in-one variable reluctance cartridge with stylus. Net $31.27.

VM-955. 3 speed changer with crystal cartridge on a base. Net $31.53.

VM-955GE. 3 speed changer with RPX-050 VR cartridge and stylus; with base. Net $33.59.

5-Station Intercom Master $14.95

Model 2700 5-station intercom master, in an attractive walnut cabinet 10x5½x6". Push-button for each sub and talk-listen switch and volume control. AC-DC amplifier with lots of power and full size Alnico V PM speaker, 1950 production of a famous factory. Only 300 left, weight 7 lbs. Model 2700, net, $14.95.

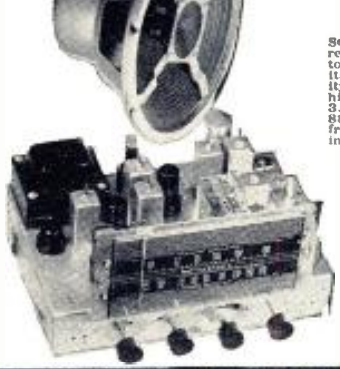
10-Station Intercom Master $24.95

Heavy duty Model 2520 10-station intercom master in beautiful walnut cabinet, 14x8½x7½" high. Powerful AC amplifier with 6V6 output. 6SJ7 and 80 rectifier. Heavy 2.15 oz. Alnico V 5" PM speaker. Push-button for each of 10 stations, talk-listen switch and all call buttons; volume control. Installs as a 3-wire system. A fortunate purchase by McGee makes a saving for you. Model 2520, weight 12 lbs. Net, $24.95 each.

SUB-STATION FOR ABOVE INTERCOMS $3.95

Model MG-300 molded walnut plastic sub-station with call-back switch and heavy PM speaker. 5½x8½x3½", for wall or desk. Weight 2 lbs. Net, $3.95 each; 5 for $18.95.

3 wire intercom cable, plastic. $1.95 per 100 ft.; 500 ft., $9.50.



HALLICRAFTERS S-78 AM-FM CHASSIS WITH 12" COAXIAL PM $99.95

Sensational new Hallicrafters, 10 tube, plus rectifier, Model S-78 AM-FM chassis, for custom installation. A complete radio chassis with its own power supply and push-pull high fidelity audio system. Chassis size, 12½ x 7¾" high and 11" deep. Output transformer matches 3.2 ohm speaker and 500 ohm. Receives FM, 88 to 108 mc and standard broadcast. Automatic frequency control (AFC) on FM holds receiver in perfect tune. A set used in radios of the $500 class. Frequency response, 50 to 14,000 CPS. Bass boost tone control and phono input. Why buy an ordinary chassis, when you can buy a Hallicrafters from McGee? Complete with dial escutcheon, knobs and tubes. Buy your S-78 Hallicrafter chassis with a wide range speaker. S-78 Hallicrafter chassis, complete. Net price, $89.95. S-78 chassis with $32.50 list 12" coaxial PM speaker, both for $99.95. S-78 chassis with $60.00 list 15" coaxial PM speaker, both for $104.95. See automatic record changers listed elsewhere in this ad. One tube pre-amplifier for S-78; adapts chassis for use with the G.E. variable reluctance pickup or crystal mike, 88-69. Net $3.95. Crystal mike and desk stand, $4.95 extra.

McGEE RADIO COMPANY Prices F.O.B. K.C. Send 25% Deposit with Order, Balance Sent C.O.D. With Parcel Post Orders, Include Postage

TELEPHONE VICTOR 9045. WRITE FOR FLYER 1422 GRAND AVE., KANSAS CITY, MISSOURI

IT'S McGEE'S FOR RADIO-AMP KITS, T.V. PARTS

16JP4 $24.95
12LP4 $17.95

We have a few neutral face television picture tubes available at terrific prices. All 1st quality tubes; unconditionally guaranteed for 90 days.

16JP4, 16" round, shipping weight 25 lbs. Net price, **$24.95.**

12LP4, 12" round, shipping weight 19 lbs. Net price. **$17.95.**

20 MATCHED VIDEO COIL KIT $7.95

20 matched TV video and sound I.F. coils. Intended for use with the RCA circuit. You get 6 peaking coils, 4—25.75 mc picture I.F.'s, 2—21.25 mc sound I.F.'s, discriminator and converter coil and 5 filament chokes. Stock No. 205-XX, weight 3 lbs. Net price, **$7.95. $6.95** if purchased with a Sarkes-Tarzian TV tuner; all coils identified.

SARKES-TARZIAN TV TUNER $7.95

Sarkes-Tarzian 13-channel television front end tuner. Factory wired. Rotary switch type, popular today on many TV sets. Also good for building purposes, 6C4 oscillator, 6BH6 RF and 6AG5 mixer. Output of tuner feeds your converter coil, I.F.'s, etc. Stock No. ST-1E, weight 3 lbs.. less tubes, Net, **$5.95**; with tubes, **$7.95.** Our 205-XX video coil kit, **$6.95** extra, when ordered with tuner.

15" COAXIAL PM $17.95

Only $17.95 buys a full 15", 20 watt coaxial PM speaker, with built-in high pass filter. Hook to any 8 ohm output on radio or amplifier. Response below 20 to above 17,500 CPS. Good bass response. A lucky purchase makes this price possible. Full 32 oz. magnet in the woofer. 5" tweeter. Model P-5-9. Weight 14 lbs. Sale price, **$17.95**, or two for **$34.00.**

12" COAXIAL PM $12.95

A $32.50 retail value. 20 watt 12" coaxial PM speaker of quality used on radios of the $300 to $500 bracket. Hook up like any PM speaker. High pass filter is built on speaker. Matches 8 ohm output of radio or amplifier. Wide range response, 20 to 17,500 CPS. Model No. CU-14X, weight 10 lbs. Special sale price. **$12.95**, or two for **$25.00.**

McGee's Super High Fidelity *Best Value in U.S.A.* OUTPUT TRANS. $7.95

20-20,000 CPS.

Model A-403 High fidelity output transformer. Why pay $20 or $30 for an output, when our A-403 is available at $6.95? Impedance: 6,000 ohms plate to plate. (for PP 6L6 or 6V6), 10% feedback winding, 4-8-15-250 and 500 ohm secondary. Housed in a potted case. Net weight 6 lbs. Recommended for all amplifiers up to 34 watts. Size 3⅞x4¼x3". Suggested diagram furnished. Shipping weight 8 lbs. Net price A-403 **$7.95.**

PUSH PULL TRIODE OUTPUT TRANS. $4.95

High fidelity push-pull 2A3 to 8 ohm voice coil transformer. Wide range response, upright mounting. Use with push-pull 2A3 or 6A3 tubes. 3,000 ohms plate to plate. No. K-94157, weight 2½ lbs. Net **$4.95.**

High fidelity push-pull 6V6 output transformer to 8 ohm voice coil. Upright, shielded. Matches push-pull 6V6 or any 10,000 ohm plate to 8 ohm voice coil. Weight 2½ lbs, No. K94241. **$3.95.**

78 RPM AMPLIFIER RECORD PLAYER $11.95

78 RPM record player with self-contained amplifier and speaker. Complete ready to play, housed in plastic case. Excellent tone quality for this size player. Model E-100P, weight 9 lbs.. **$11.95.**

G.E. 78 RPM record player attachment, housed in beautiful plastic case, with heavy duty motor and crystal pickup, has volume control and off-on switch. Model GE-78, weight 8 lbs. Net **$6.95.** 3 for **$19.50.**

MAHOGANY BAFFLE $32.95

Mahogany armchair height speaker baffle for 12 and 15" speakers. 24" high, 27" wide and 16" deep. Specify whether baffle is needed for 12 or 15" speaker. Beautiful matched mahogany, furniture quality finish. High quality, non-rattle construction baffle No. LS-4, weight 40 lbs. Net price **$32.95.**

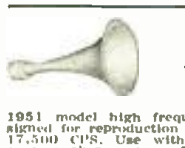
BRAND NEW GENERAL INST. TELEVISION FRONT END-TUNERS Sale Price $7.95

All completely wired, brand new and prealigned, 13 channel selector incorporating fixed inductance and variable capacitance. Converter output transformer is attached to be coupled direct to separate sound and video I.F.'s. 3 6J6 tubes are required. Shaft length 2¼". Built in fine frequency control. Original factory cost over **$20.00.** Weight 4 lbs. Stock No. GI-13I', less tubes. Net price **$7.95.**

SUPER HEAVY DUTY 10" PM $4.95

We made a special purchase on several hundred 20 watt, 10", 32 oz. Alnico 3 magnet PM speakers. Deep throat and easy moving cone. Ideal for all high fidelity sound systems and radio replacement. The magnet on this speaker is usually used on a 15" size. Very efficient, good high and bass response. You'll appreciate it when you get your hands on this speaker. Attractive copper finish. 8 ohm voice coil. Stock No. 1025PS. Weight 7 lbs. Net price **$4.95** each.

Order three of these and use them in a cluster of three. They will take 60 watts of audio and have more cone area than any 15" speaker. For high power, top quality P.A. work. Think this over. 3 No. 1025PS speakers for only **$13.95.**



HIGH FREQUENCY TWEETER 750 TO 17,500 CPS. $10.95

1951 model high frequency speaker, designed for reproduction from 750 to above 17,500 CPS. Use with any high quality cone speaker as a woofer for putting in 2 mfd condenser in series with high frequency tweeter. Has removable 8 ohm driver. Bell diameter 4¾". length 10¾". Model HF-5 speaker. **$10.95** each.

G.E. variable reluctance pickup arm with separate 1 and 3 mil needles for playing all records. The finest General Electric ball bearing pickup arm, UPX-004 with RPX-041 microgroove variable reluctance cartridge and replaceable 1 mil stylus; furnished with an extra 3 mil G.E. stylus for playing 78 RPM records, at no extra charge. Total value over **$11.00.** Stock No. 0042. Net price **$5.95.** 3 speed phono motor and turntable. for 33⅓, 45 and 78 RPM **$5.95** extra.

MOTOROLA REMOTE CONTROLS

Genuine Motorola Controls Heads, 99c each. Pick any of these automatic control heads in factory cartons at 99c each. Automatic heads with push buttons and manual tuning for the following: 42-46 Cadillac, 42, 46, 47 Hudson, 40 Lincoln Zephyr, 42-46 Lincoln Zephyr, 40 LaSalle, Cadillac, 42 Oldsmobile, 41, 46, 47 Packard. Shipping weight 3 lbs. each. Net 99c. 10 for **$7.95.**

4-Prong V.B. $1.29

No. V-53, standard 4 prong vibrator in aluminum serrated can. Replacement for Motorola, Chrysler, etc. **$1.29**, 10 for **$11.90.**

No. VO-13, Delco 4 prong off-set vibrator in aluminum serrated can. New 1951 production. $1.39 each, 10 for **$12.90.**

Delco Buick vibrator replacement, individually cartoned. No. 5050500. Net **$1.95** each. 10 for **$17.95.**

Mallory 534C. 7 prong reversible sync vibrator. Late auto sets and two-way mobile units. Net **$1.95** each, 10 for **$17.95.** All vibrators are unconditionally guaranteed.

T.V. AERIALS WITH 300 OHM LINE

201/XL, all band conical, as picture, less mast, individually cartoned with 50 feet of good standard quality 300 ohm twin lead. Net price **$7.95** each; 10 for **$69.95.**

402-XL, all band, stacked conical, less mast. Individually cartoned with 50 feet of good standard quality 300 ohm twin lead. Net price, **$12.45** each; 10 for **$114.95.**

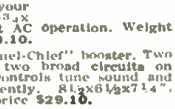
TV BOOSTERS AND ROTORS

Regency DB-400 television booster. A real engineered unit, small and compact. Plug tuned, using 2-6J6 tubes as neutralized push-pull amplifiers. Dollar for dollar, your best booster buy. 5¾x4¾x4¾". For 110 volt AC operation. Weight 6 lbs. Net price **$19.10.**

Astatic AT-1, "Channel-Chief" booster. Two tuned circuits and two broad circuits on all channels, dual controls tune sound and picture independently. 8½x6½x7¼". Weight 6 lbs. Net price **$29.10.**

Astatic BT-1 television booster. Continuous variable tuning on all channels; simplified single knob tuning; low noise design, uses single 6AK5 tube and selenium rectifier. For either 72 or 300 ohm input and output. Woodgrain metal cabinet. Weight 4 lbs. Net **$19.10.**

Koenig, "Tele-Beamer" antenna rotator will carry any weight antenna with ¾ to 2" mast. Take winds up to 80 mph. Positive action push-button control. Uses 2 heavy duty motors. A precision light weight instrument with machine cut gears and electrical stops. Net **$28.95.**



2-STATION INTERCOM $14.95

Complete, top quality two station intercom system, $14.95. With 50 feet of connecting cable. New 1951 production, housed in matching walnut plastic cases. Master has push-to-talk switch. May be used on wall or desk. Conventional amplifier using 12SJ7, 50L6 and 35Z5 tubes. Stock No. MG-38, weight 8 lbs. Net price **$14.95.** Extra sub for use in parallel with other sub as a non-selective 3 station system. **$3.95.**

Mahogany Armchair radio-phonograph cabinet with blank panels, 24" high, 27" long and 16½" wide. Will hold record changer up to 14" square; radio compartment 14" long, 9" high and 10" deep. Baffle cut for 12" speaker. Top quality furniture construction. Weight 40 lbs. Net price **$32.95.**

12" 32 OZ. PM SPEAKER $6.95

12", 32 oz. magnet, 20 watt PM speaker, with 8 ohm voice coil. A regular $17.00 list Consolidated speaker. Weight 8 lbs. No. CX-1232. $6.95 each, 4 for **$26.00.**

COMPLETE RADIO AND AMPLIFIER KITS FOR SCHOOLS AND CUSTOM BUILDERS

5-TUBE BROADCAST SUPERHET RADIO KIT $11.95

Model NS-5X 5 tube AC-DC superheterodyne radio kit. Has loop antenna and 2 gang condenser, with lighted slide rule dial and attractive plastic cabinet.

Receives broadcast, 550 to 1650 kc. Full size dynamic speaker, matched 456 I.F.'s, automatic volume control. This is a complete radio kit. Everything furnished, including diagram, photos and tubes: 14H6, 14Q7, 14A7, 50H5 and rectifier. Shipping weight 7 lbs. Stock No. NS-5X. Net price **$11.95.**

Build Your Own Phono-Mike Oscillator Kit $6.95

Kit Model DE-6X. With this simple kit, you can build a 4 tube phono oscillator that also has a mike input. Will broadcast over any radio, within your home, (about 75 feet) from 800 to 1500 kc. Inputs for crystal mike or crystal phono pickup. Fader control fades from mike to record. Ideal for a home P.A. system, baby listener and home entertainment. A complete kit of parts including tubes. Kit Model DE-6X. Net price. **$6.95.** DE-6XWT, wired and tested. Net price, **$8.95.** Crystal mike and desk stand, **$4.95** extra. Concealed microphone unit, only 1" in diameter and 1¼" thick. Specify hidden mike when ordering. Stock No. T-001. Net. **$3.95** extra.

New 16 Watt Utility Amp Kit $14.95

Kit Model TM-16, push-pull wide-range 16 watt amplifier kit. Ideal for a high quality record player, as a P. A. system or recording amplifier. Matched component parts, ready punched chassis. One control fades from phono to mike. Input compensation for G.E. variable reluctance, or crystal pickup, fully shielded. Output matches 8 ohm voice coil. 100 mil power transformer. Complete with tubes, photos and diagram. 2—7C5, 7F7 and rectifier. Variable tone control. Model TM-16. Weight 10 lbs. Net **$14.95.**

3-SPEED RECORD PLAYER KIT $13.95

Complete record player kit to build a 3 speed player. Heavy 3 speed phono motor, universal crystal pickup, all parts and tubes to build a 7D7 type amplifier in an attractive walnut case with grill for speaker cut on top. Kit model D-3378, net price **$13.95.**

SELF POWERED AC Broadcast Tuner Kit. 3-Gang Tuning. Complete Kit, $11.95

A self powered, 3 gang superhet tuner kit, with R.F. stage. When wired according to our diagram will make the best possible broadcast tuner, 550 to 1650 kc) for use with any amplifier. Has a 6" lighted slide rule dial. Don't class this with ordinary tuners, this has its own transformer. The complete kit is furnished with a diagram and photo, with tubes: 6SK7 R.F., 6SA7 converter, 6SK7 I.F., 6H6 detector, 6X4 rectifier. Connect to any audio amplifier. Ideal for use with our 7X5, TM-16 or S-2020 amp. kits. Chassis size: 9¼x8¾x4¼" high. Shipping weight 8 lbs. Broadcast tuner kit. Model BT-38. Net price **$11.95.**

8-TUBE 22 WATT Wide Range Amp. Kit Only $29.95

A complete kit, including tubes (3-7E5, 2-7F7, 2-6A3 or W.E. VT-52, plus rectifier), diagram and photos. All triode circuit makes for minimum harmonic distortion. Inputs for radio tuner any kind of phono pickup (crystal or G.E. variable reluctance) and either crystal or dynamic mike. Output transformer matches 8 ohm voice coil. Twin electronic tone controls, bass and treble with range selector switch for either juke box quality with heavy bass response or brilliant symphonic range. The best quality amplifier kit we know how to make. Has a very wide range output and heavy power transformer. Response 18 to 20,000 CPS, 8 tube all triode amplifier kit, complete with tubes. Weight 25 lbs. Net **$29.95.**

$19.95 BUYS THIS ALL PURPOSE 18 WATT AMP KIT

High fidelity amplifier kit. Model S-2020. Has inputs for radio tuner, any phono pickup, crystal or G.E. variable reluctance as well as crystal or dynamic mike. Controls can be mounted on the chassis or on extension leads, as pictured. Has broadcast quality shielded $10.00 value output transformer. Matches 8 ohm speaker. A complete amplifier kit with tubes: 3-7F7, 2-7C5, plus rectifier. A fine amplifier for the home music system. Model No. S-2020. weight 16 lbs. **Net $19.95.**

PRICES Slashed

SAVE UP TO 50% during GIGANTIC CLEARANCE SALE of USED TEST and COMMUNICATION EQUIPMENT

OUR $50,000 STOCK OF RECONDITIONED, "GOOD-AS-NEW" EQUIPMENT MUST GO AT A RECORD-BREAKING SACRIFICE TO MAKE ROOM FOR NEW MERCHANDISE!

Each and every instrument thoroughly checked and guaranteed to be in normal operating condition when shipped to you. While the following is only a partial list of our huge inventory (available at the time this publication goes to press) bargains like these simply can't last! So act now and avoid disappointment. Wire, write, phone or use the handy coupon, today! When ordering, indicate first, second and third choice. All merchandise subject to prior sale.

COMMUNICATION EQUIPMENT

RECEIVERS

COLLINS 75A	with spkr. only	$299.50
HAMMARLUND SUPER PRO	with spkr. only	139.50
HAMMARLUND HQ129X	with spkr. only	139.00
NATIONAL 1-10	less spkr. only	27.50
NATIONAL HRO5TA1	with spkr. only	175.00
NATIONAL HRO7	with spkr. only	239.50
NATIONAL NC173	with spkr. only	147.50
NATIONAL NC183	with spkr. only	210.00
NATIONAL NC240D	with spkr. only	155.00
PILOTUNER FM TUNER	only	14.95
RME 45	with spkr. only	95.00
RME 45A CALOMATIC	with spkr. only	99.50
RME 84	with spkr. only	57.50
RME 99	with spkr. only	79.50
SURPLUS BC348 110V	less spkr. only	49.50

TRANSMITTERS

(With tubes and coils for one band)

HALLICRAFTERS HT9	only	$225.00
HALLICRAFTERS HT18	"	89.50
HARVEY WELLS TBS50	"	79.50
HARVEY WELLS TBS50A	"	94.50
HARVEY WELLS TBS50C	"	89.50
HARVEY WELLS TBS50D	"	110.00
HARVEY WELLS APS50 Pwr. Supply for TBS-50 Series	"	$ 25.00
McMURDO SILVER 700	"	29.50
MECK T60-1	"	89.50
TELVAR T60-2	"	129.50
WRL GLOBE TROTTER	"	57.50

NBFM EQUIPMENT

SONAR	XE10	only	$14.95
SONAR	AMP50	only	29.50
SONAR	MB611	only	29.50
SONAR	VFX680	only	39.50

MILLEN EQUIPMENT

90700	VARIARM	only	$19.00
90501	FREQ. STANDARD	only	69.50
92105	SIDEBAND SEL.	only	34.50

MISCELLANEOUS EQUIPMENT

GON-SET	6-15 CONV.	only	$49.50
GON-SET	10M CONV.	only	27.50
MEISSNER EX SHIFTER WITH FM		only	59.50
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HICKOK	51X COMBINATION	only	$22.50
R.C.P.	802N COMBINATION	only	24.50
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McMURDO SILVER	906	FM-AM	only	$69.50
McMURDO SILVER	909	SWEEP	only	17.50
PRECISION E200		FM-AM	only	42.50

VACUUM TUBE VOLTMETERS

McMURDO SILVER	900	VOMAX	only	$29.95
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DUMONT	164E	3"	only	$ 64.50
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DUMONT	274	5"	only	99.50
HICKOK	195	5"	only	99.50
HICKOK	305	3"	only	89.50
RCA	TMV122B	3"	only	35.00
SUPREME	546	3"	only	35.00
WATERMAN S10A POCKET-SCOPE			only	29.50

Brand New Equipment Specially Priced

	Reg. Price	Sale Price
FERRET 730 SIGNAL TRACER & VTVM COMB.	$ 99.95	$67.50
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TRIPLETT 2470 APP. TESTER	only	52.50
WESTON 785 VOM	only	67.50

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What's New in Radio

For additional information on any of the items described herein, readers are asked to write direct to the manufacturer. By mentioning RADIO & TELEVISION NEWS, the page, and the issue number, delay will be avoided.

AMPEX RECORDER

Ampex Electric Corporation of San Carlos, California, has recently introduced a new recorder unit, the Model 400.

The new instrument provides simultaneous erase, record, and playback and permits the recording of 132 minutes of program material on a single 10" standard reel. The recorder has a

range of 15,000 cycles on half-track tape recorded at 7½" per second tape speed.

The Model 400 comes in a single portable case weighing approximately 62 pounds. The same machine is also available in console cabinets and for standard rack mounting.

AUDIO OSCILLATOR

The Electronic Workshop of 351 Bleecker Street, New York 14, New York has announced the availability of a new model audio oscillator, the 510-A.

This test instrument has a frequency range of 18 cycles to 210,000 cycles in four decades. It will deliver 10 volts into 10,000 ohms with input constant within .5 db. over the entire frequency range. Distortion at this amplitude is less than .3% from 100 cycles to 15,000 cycles and rises to no more than

.5% at 30 cycles, according to the company.

The source impedance of the cathode-follower output is 560 ohms. A matching transformer for feeding low-impedance balanced lines is available as an accessory. The total frequency error due to drift and dial calibration is less than ± 2%. The 320 degree dial gives a scale length of over 8". The output control is logarithmic and is calibrated approximately in output voltage. The new unit measures 4"x 5½"x4".

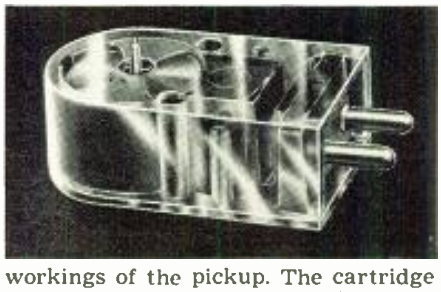
Full details are available from the company.

CLARKSTAN PICKUP

A new variable reluctance pickup has been developed by the *Clarkstan Corporation* of 11921 West Pico Blvd., Los Angeles 64, California.

The unit is a "junior" model of the company's well-known Type RV cartridge. Known as the Model 204, the new pickup has several unusual features. The stylus is easily removable and interchangeable so that microgroove, standard, and transcription recordings can be played. Styli are available with ball points for all these various types of records.

The instrument is housed in a crystal clear polystyrene plastic which permits the operator to see the inner



workings of the pickup. The cartridge weighs 14 grams. The compliance is adequate for all types of recordings. The instrument is velocity responsive and is essentially flat, by recording playback standards, to above 10,000 c.p.s. The cartridge is 1½ inches long.

V.T.V.M. KIT

Allied Radio Corporation of 833 West Jackson Blvd., Chicago, Illinois has just introduced a new vacuum tube voltmeter kit which has been designated the "Knight V.T.V.M."

The new instrument, which is low in cost and easy to build, includes 4 milliampere ranges and 6 capacity ranges in addition to the 20 standard v.t.v.m. ranges. Because of these added features the company recommends this kit as an all-around test instrument for the service technician, experimenter, kit-builder, student, ham, or for industrial or school laboratory use.

The available ranges of the instrument include 7 d.c. volts, 6 a.c. volts, 4 d.c. milliamperes, 6 ohms, 5 decibels,

and 6 capacity. The unit reads up to 5000 volts d.c., 1000 volts a.c., and to 1000 megohms. Special probes are available for extending the d.c. range to 30,000 volts and for extending the a.c. range to read r.f. to 100 mc.

Matched pair resistors are used for high accuracy. The unit has a zero-center d.c. scale for use in FM discriminator alignment, and a pilot light for "off-on" indication. The instrument uses a 4½" meter. The all steel case is finished in Hammertone gray and is 10"x6"x5".

The kit comes complete with all parts and step-by-step instructions for assembling the instrument.

"MAGNEROTOR"

The *Viking Tool & Machine Corp.* of 2 Main Street, Belleville 9, New Jersey has developed a new type of motor which produces high starting torque, can be reversed, and has variable speed.

Tradenamed the "Magnerotor," the new unit supplies speeds of from ½ r.p.m. to 100 r.p.m., without reduction gears, in either unidirectional or reversible models operating on 6, 24, 115, or 220 volts, 60-cycle a.c.

At 35 watts input, the starting torque at 1 r.p.m. is 80 inch-pounds. The standard model is supplied in a weatherproof diecast housing which requires no oiling and will operate at extremely high and low temperatures under extreme weather conditions.

The motor can be remotely controlled in much the same way as a servomechanism. The unit can be used as an antenna rotator, for operating radio tuning and direction finding controls, for operating remote controlled rheostats, etc.

Additional details on the new unit are available from the company.

LUG TWISTER

A new and handy tool, designed for twisting mounting lugs on fabricated plate condensers, has been introduced to the trade by *Kenneth D. Clayson,* Box 1032, Bethlehem, Pa.

The new unit makes use of a slotted end which fits over the lug. A simple twist in either direction anchors or loosens the lug as desired. A skirt around the slot prevents the tool from slipping off and damaging other parts. Lugs which are soldered to the chassis can be twisted until they break off. The skirt on the tool is removable so that twisted lugs may be disengaged from the slot in case of jamming.

The tool has a sturdy plastic handle, with the over-all design emphasis being placed on slenderness so that the unit may be used to reach into tight spots on radio and television chassis.

CRYSTAL CARTRIDGE

The Astatic Corporation of Conneaut, Ohio has recently introduced a new crystal cartridge, the CAC-J, which has been especially designed for playing all types of slow-speed records.

The new cartridge is internally equalized to follow *Columbia* records

and provides ideal frequency response for the recording characteristics of the LP records (30 to 11,000 cycles).

The unit has a small, lightweight aluminum housing with standard ½"

(*Continued on page* 118)

YOU'RE FIRST IN LINE!

FOR TOP VALUES IN TV, RADIO & ELECTRONICS

TYPICAL CONCORD BUYS

THE MODERN CONTROL MECHANISM
Sessions
SWITCH TIMERS

Especially designed for turning radios, TV sets, Air Conditioners, and other common household appliances on and off automatically. Offers the best in clock-radio movements. Easily installed as replacement unit in old clock-radios. All controls, including on-off, switch set, time set, and "Sleep Slector" are conveniently located on front of attractive clock face. "Wake-up" feature turns your radio on in the morning or turns on any desired program at any pre-set time within a 12 hr. period. Special safety feature turns off controlled appliance within 1-1/2 to 2 hrs. should you forget to turn it off manually. "Sleep Slector lets you go to sleep with your radio playing and turns it off at a pre-set elapsed time up to 90 min. Has low speed, long life motor...built compactly, neat in appearance extremely quiet in operation...no buzz or whine of high speed gears. Size: 3-1/2" dia., 2" deep from clock face. Bezel finished in bronze. Shipped complete with mounting bracket, and mounting and operating instructions. Switch rating 10 amps at 115 V. For 110 V, 60 cycle AC. UL approved.

33-25472 - Model W-31, Shpg. wt. 3 lbs..... **6.50**

33-25492R - As above except with 3-1/2" square face and bezel.....$6.50

Model W-26, same as W-31 except without "Sleep Slector" and has switch rating of 15 amps at 115 volts.

33-25473R.....$5.50

33-25493R - As above except with 3-1/2" square face and bezel $5.50

MOBILE HIGH VOLTAGE PWR. UNIT

For mobile radios, amateur equipment, PA amplifiers, and many other types of equipment. Well built made of the finest materials available to meet strict specifications. Especially adapted to furnish plate supply for above mentioned units. Input 12 volts at 10 amps. Output consists of two volt ranges. (1) 275 volts at 10 ma., 12 volts @ 3 amps. (2) 500 volts at 50 ma. Contains two nationally known permanent magnet dynamotors, complete with all hash filters. Each high voltage range individually fused and the input has an "on and off" switch and an indicating pilot light assembly. Olive drab wrinkle finish. Size: 8-3/8"x 6-1/4"x 11-5/8".

5-9513R - Shpg wt. 27 lbs..... **9.50**

PERMANENT MAGNET DYNAMOTOR

Input 12/24 volts @ 8/4 amps., Output 12/275 volts @ 3/.110 amps.

99-9589R - Shpg wt. 10 lbs.....$3.95

RECORDING TAPE

Best Recording Tape Buy on the market! Made by a famous national manufacturer to Concord's strict specifications. 1200' long, 1/4" wide with uniform coating of red oxide particles on kraft paper base. Magnetic coating wound facing in. Plastic reel included. Order while our supply last.

35-16297R - 1200' Kraft Paper Base Tape..... **1.49**

As above but on stronger more efficient plastic base for more uniform output and lower noise level.

35-16296R - 1200' Plastic Base Tape.....$1.95

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BUYER'S GUIDES

jam-packed from cover to cover with TV, FM and AM receivers phonos, high-fidelity sound components, amateur equipment, servicemen's supplies, tubes and other critical parts. All listed as they are available and ready for immediate shipment to you.

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Address.....

City.....Zone...State.....

SUPERIOR'S new model 770

AN ACCURATE POCKET-SIZE VOLT-OHM MILLIAMMETER

(SENSITIVITY: 1000 OHMS PER VOLT)

FEATURES

★ Compact-measure 3⅛" x 5⅞" x 2¼".
★ Uses latest design 2% accurate 1 Mil. D'Arsonval type meter.
★ Same zero adjustment holds for both resistance ranges. It is not necessary to readjust when switching from one resistance range to another. This is an important time-saving feature never before included in a V.O.M. in this price range.
★ Housed in round-cornered, molded case.
★ Beautiful black etched panel. Depressed letters filled with permanent white, insures long-life even with constant use.

The Model 770 comes complete with self-contained batteries, test leads and all operating instructions.

SPECIFICATIONS

6 A.C. VOLTAGE RANGES:
0—15/30/150/300/1500/3000 VOLTS

6 D.C. VOLTAGE RANGES:
0—7.5/15/75/150/750/1500 VOLTS

4 D.C. CURRENT RANGES:
0—1.5/15/150 MA. 0—1.5 AMPS.

2 RESISTANCE RANGES:
0—500 OHMS 0—1 MEGOHM

$14.90 NET

Superior's new model 670

SUPER-METER

***A COMBINATION* VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS**

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5 Amperes
RESISTANCE: 0 to 500/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to .2 Mfd. .1 to 4 Mfd. (Quality test for electrolytics)
REACTANCE: 700 to 27,000 Ohms 13,000 Ohms to 3 Megohms
INDUCTANCE: 1.75 to 70 Henries 35 to 8,000 Henries
DECIBELS: —10 to +18 +10 to +38 +30 to +58

ADDED FEATURE:

The Model 670 includes a special GOOD-BAD scale for checking the quality of electrolytic condensers at a test potential of 150 Volts.

The Model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½" x 7½" x 3".

$28.40 NET

Superior's new model TV-20 *and*

20,000 OHMS PER VOLT MULTI-METER TELEVISION KILOVOLTMETER

The Model TV-20 was designed to provide all the multi-meter measurement requirements of A. M., F. M. and Television. Unlike other recent models, which are actually standard V.O.M.'s converted to test the new Television Voltages, the Model TV-20 is a completely new unit. It provides the sensitivity, ranges and accessories which are needed to service F. M. and Television in addition to A. M. Radio. The High Voltage Probe for example, with a range of 50,000 volts and designed to withstand 100,000 volts, is an integral part of the instrument with a special compartment for housing it when not in use.

SPECIFICATIONS

- 9 D. C. VOLTAGE RANGES: (At 20,000 ohms per Volt)
  0-2.5/10/50/100/250/500/1,000/5,000/50,000 Volts
- 8 A. C. VOLTAGE RANGES: (At 1,000 ohms per Volt)
  0-2.5/10/50/100/250/500/1,000/5,000 Volts
- 5 D. C. CURRENT RANGES
  0-50 Microamperes
  0-5/50/500 Milliamperes
  0-5 Amperes
- 4 RESISTANCE RANGES:
  0-2,000/20,000 ohms 0-2/20 Megohms
- 7 D. B. RANGES: (All D. B. ranges based on ODb = 1 Mw. into a 600 ohm line)
  — 4 to + 10 db + 36 to + 50 db
  + 8 to + 22 db + 42 to + 56 db
  + 22 to + 36 db + 48 to + 62 db
  + 28 to + 42 db
- 7 OUTPUT VOLTAGE RANGES:
  0 to 2.5/10/50/100/250/500/1,000 Volts

ADDED FEATURE:

The Model TV-20 includes an Ultra High Frequency Voltmeter Probe. A Silicon V. H. F. Diode together with a resistance capacity network provides a frequency range up to 1,000 MEGACYCLES. When plugged into the Model TV-20, the V. H. Probe converts the unit into a Negative Peak-Reading H. F. Voltmeter which will measure gain and loss in all circuits including F. M. and T. V.; check capacity and impedance; test efficiency of all oscillator circuits; measure band-width of F. M. and T. V.; etc.

The Model TV-20 operates on self-contained batteries. Comes housed in beautiful hand-rubbed oak cabinet complete with portable cover. Built-in High Voltage Probe. H. F. Probe. Test Leads and all operating instructions. Measures 4½" x 10¼" x 11½". Shipping Weight 10 lbs.

$39.95 NET

USE CONVENIENT RUSH ORDER FORM ON OPPOSITE PAGE

GENERAL ELECTRONIC DISTRIBUTING CO. DEPT. RN-1, 98 PARK PLACE NEW YORK 7, N. Y.

Superior's New Model TV-10

TUBE TESTER

SPECIFICATIONS:

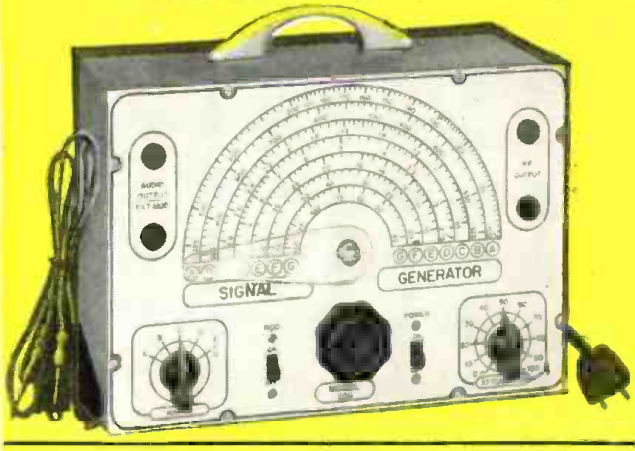
★ Tests all tubes including 4, 5, 6, 7 Octal, Lock-in, Peanut, Bantam, Hearing-aid, Thyratron, Miniatures, Sub-Miniatures, Novals, etc. Will also test Pilot Lights.
★ Tests by the well-established emission method for tube quality, directly read on the scale of the meter.
★ Tests for "shorts" and "Leakages" up to 5 Megohms.
★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin-number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-10 as any of the pins may be placed in the neutral position when necessary.
★ The Model TV-10 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.
★ Free-moving built-in roll chart provides complete data for all tubes.
★ Newly designed Line Voltage Control compensates for variation of any line voltage between 105 Volts and 130 Volts.

The Model TV-10 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

$39.50 NET

The New Model 200

AM and FM SIGNAL GENERATOR



SPECIFICATIONS

★ **R.F. FREQUENCY RANGES:** 100 Kilocycles to 150 Megacycles.
★ **MODULATING FREQUENCY:** 400 Cycles. May be used for modulating the R.F. signal. Also available separately.
★ **ATTENUATION:** The constant impedance attenuator is isolated from the oscillating circuit by the buffer tube. Output impedance of this model is only 100 ohms. This low impedance reduces losses in the output cable.
★ **OSCILLATORY CIRCUIT:** Hartley oscillator with cathode follower buffer tube. Frequency stability is assured by modulating the buffer tube.
★ **ACCURACY:** Use of high-Q permeability tuned coils adjusted against 1/10th of 1% standards assures an accuracy of 1% *on all ranges from 100 Kilocycles to 10 Megacycles* and an accuracy of 2% on the higher frequencies.
★ **TUBES USED:** 12AU7—One section is used as oscillator and the second is modulated cathode follower. T-2 is used as modulator. 6C4 is used as rectifier.

$21.85 NET

The Model 200 operates on 110 Volts A.C. Comes complete with output cable and operating instructions.

Superior's new model TV-30

TELEVISION SIGNAL GENERATOR

ENABLES ALIGNMENT OF TELEVISION I. F. AND FRONT ENDS WITHOUT THE USE OF AN OSCILLOSCOPE!

FEATURES Built-in modulator may be used to modulate the R. F. Frequency, also to localize the cause of trouble in the audio circuits of T. V. Receivers.

Double shielding of oscillatory circuit assures stability and reduces radiation to absolute minimum. Provision made for external modulation by A. F. or R. F. source to provide frequency modulation. All I. F. frequencies and 2 to 13 channel frequencies are calibrated direct in Megacycles on the Vernier dial. Markers for the Video and Audio carriers within their respective channels are also calibrated on the dial.

Linear calibrations throughout are achieved by the use of a Straight Line Frequency Variable Condenser together with a permeability trimmed coil.

Stability assured by cathode follower buffer tube and double shielding of component parts.

SPECIFICATIONS Frequency Range: 4 Bands—No switching; 18-32 Mc., 35-65 Mc., 54-98 Mc., 150-250 Mc.

Audio Modulating Frequency: 400 cycles (Sine Wave). Attenuator: 4 position, ladder type with constant impedance control for fine adjustment. Tubes Used: 6C4 as Cathode follower and modulated buffer. 6C4 as R.F. Oscillator. 6SN7 as Audio Oscillator and power rectifier.

Model TV-30 comes complete with shielded co-axial lead and all operating instructions. Measure 6" x 7" x 9". Shipping Weight 10 lbs.

$29.95 NET

MONEY BACK GUARANTEE!!

GENERAL ELECTRONIC DISTRIBUTING CO. DEPT. RN-1, 98 PARK PLACE, NEW YORK 7, N. Y.

GENTLEMEN: PLEASE RUSH THE MATERIAL LISTED BELOW: RN-1

QUANTITY	MODEL	PRICE	
	TOTAL		

Name_____

Address_____

City_____ Zone____ State_____

$_____ (Payment in Full Enclosed)

$_____ (Deposit Enclosed—Ship Balance C.O.D.)

Dielectric Heating

(*Continued from page 39*)

the surface is prevented. Secondly, because the loss factor of the glue is greater than that of the wood, the glue heats more rapidly and is set before the moisture content of the wood can be affected.

The plywood may be formed or curved in the same operation. Fig. 1 illustrates this process. In 120 seconds, the glue is set and the panel is formed for curved-front radio cabinets. Each panel will eventually be sawed to produce four cabinet fronts. The completed cabinet contains twenty-eight electronically glued joints, and no nails, screws or other fastening devices are necessary.

Fig. 3 shows a staggered arrangement of electrodes used for edge gluing. In this manner, wide panels are readily and rapidly built up from narrow stock. Raw lumber fed into a continuous edge gluer will emerge as a glued and set panel at a rate up to thirty lineal feet per minute.

Dielectric heating is employed in a variety of food preparation and processing operations. It is used, for instance, for destroying larvae in stored grains and for roasting coffee.

Fig. 5 shows the use of dielectric heating to cure and dry foam sponge rubber. A rubber latex mixture is poured into the mold and r.f. power applied. In six minutes the rubber is cured. This same process, by steam-oven methods, required thirty minutes. After having been cured, the rubber is washed and is then dried again by the same heating equipment.

The plastics industry has made wide use of dielectric heating. Before being subjected to the compression molding operation, the plastic must be pre-heated. By older heating methods, the outside became "soft" before the interior was affected. Continued heat eventually made the interior workable, but by that time the outside had passed the "soft" stage and begun to harden. Dielectric heating completely eliminates this problem by heating the plastic uniformly. By decreasing production time and increasing mold life, r.f. preheating has established itself as a standard procedure in the plastics industry.

—30—

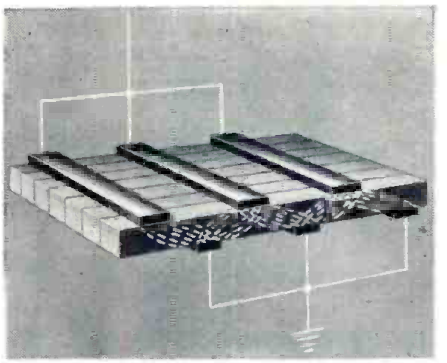


Fig. 3. Staggered arrangement of electrodes used for edge gluing. In this way, wide panels can be built up from narrow stock.

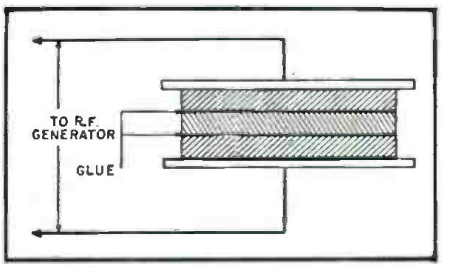
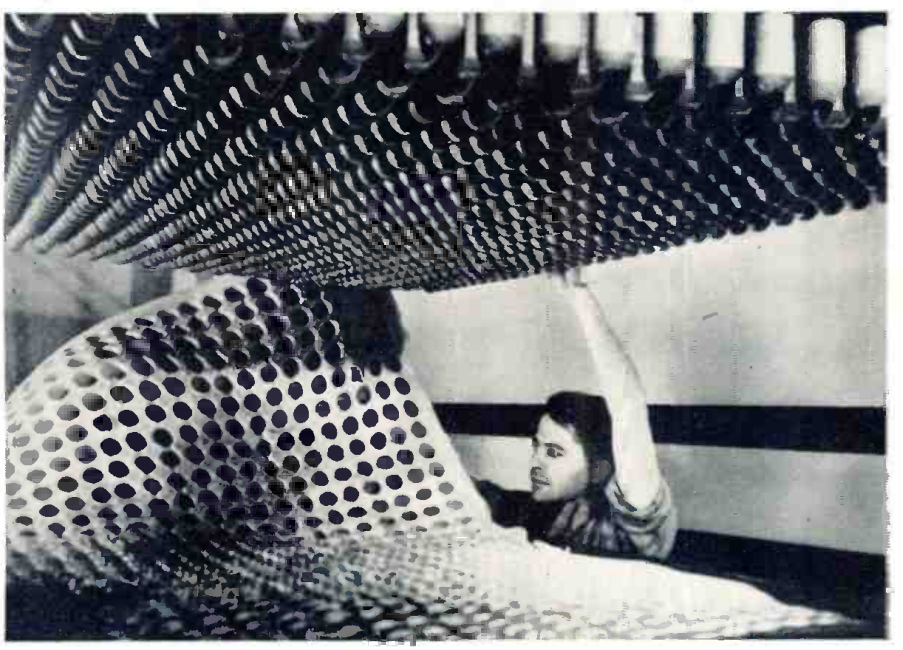


Fig. 4. Bonding of plywood by dielectric heating. This system is superior to older methods which involved the use of steam heat or hot platens which often damaged or charred the surface of the plywood.

Fig. 5. Dielectric heating is used to cure and dry foam sponge rubber. Curing time by this method is six minutes as compared to thirty minutes by older methods.



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Olson's Great Bargain of the Year

AM-FM RADIO CHASSIS

$49.95 EACH

- IT'S A BEAUTY
- COMES TO YOU WITH EIGHT TUBES

Stock No. RA-52

It's new! Never offered before by any jobber! A high quality, high-fidelity radio that you will be proud to own. You'd expect to pay more but Olson made a remarkable deal with the manufacturer. When present stock gone, there will be no more. This receiver can be used in combinations selling from $350.00 to $500.00. It's a perfect unit for custom building into cabinets, shelves, etc.

This amazing set is equipped to receive standard broadcasts from 540 to 1650 KC and FM reception from 87.5 to 108.5 mc. Two dual controls are provided for simplicity of operation.

Phono connection on rear of chassis. Wide vision, easy to read dial. This radio cannot be beat for quality and precision.

Any PM speaker can be used with this set. Choose one from this flyer. Set is supplied with 8 tubes: 1—12AT7, 1—6BE6, 2—6BA6, 1—6AL5, 1—6AV6, 1—6V6GT, 1—5Y3GT, less speaker. Individually packed in factory-sealed cartons. Chassis size 13¼"x7-1/16"x8⅞".

ALLIANCE TENNA-ROTATORS

OLSON'S SPECIAL PRICE ONLY

$26.43 FOR BOTH

One of Olson's Great Values

Stock No. AU-21

It's new—the Automatic Model HR Antenna Rotator with the most accurate indicator on the market. Here's the answer to better TV reception. Actually aims your antenna to broadcast stations by just setting the knob on the front of the control. No buttons to hold down. Just walk away and the antenna will turn automatically and stop when it's lined up with the transmitter.

Equipped with "Mystic Moving Light" which moves along dial and shows position of antenna at all times. You get the motor unit for installation on the mast and the "Automatic Control Box" which stands on the TV set. Shpg. wt. 12 lbs.

4-Conductor Cable
For use with above Tenna Rotor. Shpg. wt. 4 lbs.
W-62. 100 ft. $2.99

Thrust Bearing
For use with extra heavy antennas. Shpg. wt. 4 lbs.
AU-13. each $2.91

3-SPEED PHONO-GRAPH

Special $19.97

RA-56

Plays 78-45-33⅓ RPM Discs

Complete

Finest components in the manufacture of these gorgeously designed phonographs. Features include: 3 speed Alliance motor, heavy flocked turntable, 5 volt output tone arm with precious-tip needle, volume and tone control. 2 tube built-in amplifier, Alnico 5 PM speaker, leatherette covered case with rounded corners, convenient carrying handle. Order early and order enough. Every phonograph 100% guaranteed. Original factory-sealed cartons. Operates 115 volts AC or DC. Shpg. wt. 15 lbs.

V-M TRI-O-MATIC 3-SPEED RECORD CHANGER

$28.35 MODEL 950 OLSON'S GREAT VALUE

100% Automatic in operation. Plays 33⅓, 45 and 78 RPM records. Load capacity is twelve 10" or ten 12" (33⅓ or 78 RPM); twelve 7" 33⅓ or 45 RPM); 10" and 12" records of the same speed can be intermixed. Jamproof—tone arm can be held at any time without damage to mechanism. Shuts off after last record. Size 14½x12¼. 5¾" above and 2⅛" below plate. 115 volts AC, 60 cy. Includes turn-over cartridge and dual needles. Regular list price $44.50.
Model 950. Olson's Price, each..... **$28.35**

With GE triple-play variable reluctance cartridge and dual needles. List price $49.00.
Model 950 GE, Olson Price, each.....$31.27

Plays 33⅓, 45 and 78 RPM Discs

VM 3-SPEED AMPLIFIED RECORD PLAYER

MODEL 970 $37.08 Olson's Special Price

This instrument consists of the above 950 V-M changer built into an attractive base with amplifier, speaker, volume control and tone control. Plays 33⅓, 45 and 78 RPM records. Shuts off after last record. Just load on records, select speed and enjoy music. Complete with dual needles in turn-over cartridge. Size 13x8½x12". For 115 volts AC, 60 cy. List price, $56.50.

TV BOOSTER KIT

RA-26 **$9.95** Complete

Build your own TV-FM booster. Improves reception on low-signal, "fringe" areas. 3 to 5 db gain in signal to noise ratio. All channel tuning. Complete with 6AK5 tube, pre-aligned coils, etc. Shpg. wt. 5 lbs.

30 WATT AMPLIFIER

- Factory Built
- Latest Design

Olson's Price less tubes. RA-23 ..... $34.95

A real commercial amplifier which looks good and performs well. Not a kit. Gain, mike, 130DB, phono 80DB. Has dual tone controls, one for bass and the other for treble tone. Output impedances 4, 8, 16 and 500 ohms. Input for two mikes and one crystal pickup. Shpg. wt. 20 lbs. Tubes required: 3—6SQ7, 1—6SC7, 2—6L6g, 1—5V4g.

Only **$8.95** Model 19

GE RECORD PLAYER

Attractive cabinet contains quiet 33⅓ RPM motor, on-off switch and handsome pick-up with genuine GE variable reluctance phono cartridge and permanent needle. Brand new factory sealed cartons. Can be used on any set with pre-amp. Operates on 115 volts AC. Regular price $19.95. Shpg. wt. 5 lbs.

Send for our latest Radio and Television Bargain Catalog

RIM DRIVE PHONO MOTORS

Famous Makes! Real bargains at these low prices. Self-starting; complete with turntable. All parts included. Shpg. wt. 4 lbs.

M-52, 78 rpm for 115 volts AC..... **$3.29**

M-63, 3-speed, 33⅓, 45 and 78 rpm..... **$5.49**

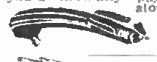
ASTATIC "TURNOVER" PICK-UP ARM

$4.95 M-64

Cartridge turns by means of knob on front. One side plays 33⅓ and 45 RPM records and other side plays 78 RPM. Only 8 grams needle pressure. Employs the famous ASTATIC LQD-1 Double needle cartridge. Die cast curved arm. Equipped with 2 long life needles. Frequency response 50-7000 cps output 1.2 volts. Shpg. wt. 2 lbs. Reg. list price $15.00.
M-64 ..... **$4.95**

GENUINE ASTATIC PICK-UP ARM

With crystal cartridge . . . at less than you'd normally pay for the cartridge alone.



OLSON'S Special M-58 **$2.99**

GE RPX-040

Variable Reluctance Cartridge with Removable Stylus

Regular price is $9.95 on this GE Phono Cartridge with removable 3 mil Stylus for 78 RPM discs. Stylus pressure 3 oz.
XC-4S only **$3.49**

PHONO AMPLIFIER

Connect to phono or speaker or just the thing for a portable. Uses: 12SQ7, 50L6, 35Z5 tubes. 2 controls: on/off volume and tone. 7" x 3¼" x 2". Shpg. wt. 2 lbs

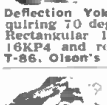
TUBES FOR ABOVE SET. AS-22 **$2.64**

RA-19 **$3.98**

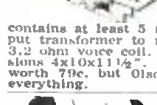
TV COMPONENTS

Deflection Yoke for use with 10BP4, 12 LP4, 16AP4 and all similar kinescopes, same RCA 201D1. WT. 2 lbs.
T-84. Olson's Price only **$2.99**

Deflection Yoke for use with kinescopes requiring 70 degree magnetic deflection such as Rectangular 14BP4, 14CP4, 16RP4, 16TP4, 16KP4 and round 16GP4. WT. 2 lbs.
T-86. Olson's Price, only.....**$3.59**



Hi-Voltage Flyback output transformer for 10" & 12" kinescopes. Provides 9KV. Same as RCA 211T1. WT. 4 lbs.
T-82, Olson's Price, only **$3.59**



RADIO CHASSIS

79¢ each

Real value for the experimenter. X-228 Each chassis contains at least 5 sockets, and one output transformer to match single tube to 3.2 ohm voice coil. Approximate dimensions 4x10x11½". Transformer alone is worth 79c, but Olson's price is 79c for everything.

4 Prong Universal VIBRATORS

The most popular vibrator in use today. Replaces Mallory 294, 859, 901M, Radiart 5300, 5301. Size 1½" dia. by 2⅞" high. Reg. list price $4.10. Brand new, individually boxed. Shpg. wt. 8 oz.
Stock No. V848.....ea. **$1.49**

Build a Receiver Set of Basic Components

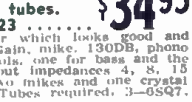
Price for Kit of 5 parts AS-38

You get this kit of 5 basic parts to build an AC-DC set or portable:

Parts	Reg. List Price
Loop	$0.95
R. F. Coil	1.10
I.F. Transformer (456 KC) Input	1.60
Output	1.60
Oscillator Coil	.75
List Price of Set ...	6.00

Use any 365 mfd variable for tuning. Covers 535-1625 KC.

$1.89



Akrad TUBULAR ELECTROLYTICS

Packed 10 of a size to a box. Order 10 of a size.

Stock No.	Cap.	Working Volts	Each
C-136	40	25	$0.25
C-137	25	25	.30
C-138	20	150	.39
C-139	40	150	.45
C-140	20-20	150	.59
C-200	50-30	150	.69
C-141	8	450	.39
C-211	8-8	450	.69
C-142	16	450	.57
C-197	20	450	.69
C-198	30	450	.79
C-199	40	450	.89

Olson "Akrad" Condensers are becoming more widely used by radio servicemen everywhere—and for a good reason! They're made to take hefty surges and overloads and pack a mighty wallop. They cost so little, too! Every "Akrad" condenser is backed by Olson's famous Satisfaction or Your Money Back Guarantee! Always get "Akrad," Compact size with superior characteristics. Easily mounted. Sealed aluminum inner tubes insure maximum life. Tinned copper leads. Give long, trouble-free service.

4 Drawer Steel Cabinet FREE with OLSON'S *Gigantic* AKRAD CONDENSER KIT

Olson's Price AS-20 **$16.95**

You get $45.20 (list) worth of "Akrad" condensers plus cabinet, 8½"x 7⅛"x10¼".

42 "Akrad" By-Pass Condensers!

Qty.	Cap.	Volts	List ea.	Total
2	.001	600	$.25	$.50
2	.002	600	.25	.50
2	.005	600	.25	.50
5	.01	600	.30	1.50
5	.02	600	.30	1.50
10	.05	600	.40	4.00
10	.1	600	.45	4.50
2	.005	1600	.55	1.10
2	.008	1600	.55	1.10
2	.01	1600	.60	1.20

27 "Akrad" Electrolytic Condensers

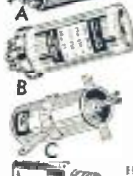
Qty.	Cap.	Volts	List ea.	Total
2	10	25	$ .75	$1.50
2	25	25	.85	1.70
5	20	150	.95	4.75
5	40	150	1.10	5.50
4	20-20	150	1.30	5.20
5	8	450	.95	4.75
4	16	450	1.35	5.40

69 Total List Value $45.20

Close Out Entire Stock CORNELL-DUBILIER CONDENSERS

Save big money during Olson's big C-D close-out sale. Over 35,000 brand new shiny electrolytic condensers will be purchased by Olson's customers. Be sure of getting your share. Order early.

Stock No.	Fig.	Capacity	Volts	Close-out Price
C-530	A	8	450	$0.59
C-510	B	15	300	.29
C-501	B	10-10-20	450-450-25	.39
C-617	B	20-10-10-10	450-450-450-450 ..	.99
C-502	C	32	350	.39



Cornell Dubilier Paper Filter Block

Hard to get, but Olson has these 4 MFD 400 volt tough condensers. Not Electrolytic. Dry construction throughout. Size 3¼"x2"x1". Reg. list price $2.95. **49c**
C-523 Olson's Price, each.....

TL-3 each $9.98 FAIRCHILD GRINDER

Every service shop needs one of these handy tools made by Fairchild, famous manufacturer of precision electric grinders. Regular nationally advertised price is $19.75. The set consists of 1—115 volt high speed, air cooled grinder, 6 assorted grinding wheels, 1 circular saw blade, 1 hardened steel reamer, 1 buffing brush, 1 abrasion stone and a natural finish wood case size 10"x5"x3" to house the grinder. Shipped in original factory sealed cartons.

OLSON'S GIGANTIC NEW AKRAD KIT—WITH 4-DRAWER STEEL CABINET FREE

Reg. List Price $18.38.

AS-36. Olson's Price only..... **$6.95**

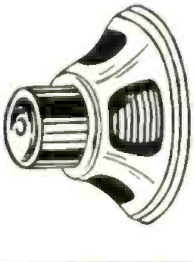
We have a limited quantity of Olson Akrad "Super Sealed" by-pass condensers available in 4 drawer steel cabinets, size 6¼x5¾x8⅛. Drawers have compartments. Condensers are designed to give long dependable service even in the tropics.

Kit Contains 42 Condensers

You get the 4 drawer steel cabinet and the following 42 Olson Akrad "Super Sealed" By-pass condensers.

Qty.	Cap.	Volts	Qty.	Cap.	Volts
2	.001	600	10	.05	600
2	.002	600	10	.1	600
2	.005	600	2	.005	1600
5	.01	600	2	.008	1600
5	.02	600	2	.01	1600

GREAT SPEAKER VALUES FROM OLSON



PM SPEAKERS

2 lb. MAGNET

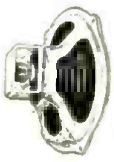
A solid 2 lb. magnet on these fine PM speakers creates the illusion of living tone. These speakers were ordered by Olson while prices were low and now we pass the savings on to you. Perfect for radio replacement use, juke boxes, amplifiers, hi-fi systems, etc. Excellent bass and high response designed to deliver full wattage for prolonged periods. Voice coil 8 ohms. Choice of 2 sizes.

10" Diameter, 20 Watts
Stock No. S-158, each $4.95
Shpg. wt. ea., 8 lbs.
Special price, 3 for $13.95

12" Diameter, 25 Watts
Stock No. S-159........ $5.95
Shpg. wt. ea., 10 lbs.
Special price, 3 for $16.45

OLSON AKRAD

THE HOUSE OF RADIO AND TELEVISION BARGAINS



RCA 8" PM SPEAKER

$3.49
S-123

Known as the RCA "Mighty 8." Delivers tremendous volume because of advanced engineering design and super-size Alnico 5 magnet. For radio and PA use. Voice coil 3.2 ohms. Shpg. wt. 6 lbs.

AN OLSON VALUE — 12" CO-AXIAL SPEAKER

Lots of 2, each **$12.50**
S-122

Single, each **$12.95**

Woofer-Tweeter design. Response 40 to 17,500 CPS

Months of research went into the design of these high efficiency speakers. The 12" woofer section is driven by a heavy Alnico 5 6.8 oz. magnet and this part delivers the bass notes. The 3" tweeter which is built into the center of the speaker is driven by a 2.15 oz. Alnico 5 magnet and delivers the treble notes. The high pass filter is built into the speaker and the entire combination gives you tone you never dreamed possible. There are only two wires to connect to any radio or amplifier and the speaker is ready to play for you. Voice coil impedance is 8 ohms. This high quality speaker should not be confused with inferior makeshift units. Olson sells these speakers on an ironclad money-back guarantee if you are not 100% satisfied. Order today. Shpg. wt. 8 lbs.

For 'Talking Out Loud' Order
Famous Olson Trumpets and Drivers

Completely all weather. Made by Famous Manufacturer. 10 Watt Paging Speaker. An outdoor or indoor all weather paging speaker. Capable of continuous 10 watt operation. You get the complete unit consisting of an Alnico 5 driver unit (8 ohms) and a spun metal exponential horn with swivel bracket. Bell diameter is 7". Regular list price $26.00. Packed in original factory sealed cartons. Shpg. wt. 4 lbs.
S-150. Special each $11.95

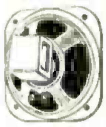
Trumpet and 25 Watt Driver Unit

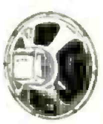
The most popular combination on the market. This driver and trumpet is perfect for outdoor (all weather) use on sound trucks, churches, parks, etc. Fully guaranteed by Olson and the famous manufacturer.

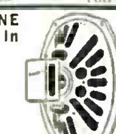
All Weather Trumpet: 19" diameter bell, equivalent to a 3½' exponential trumpet. Made of aluminum castings and spinnings. Can be used with driver listed here or any other standard driver. Factory sealed cartons. Shpg. wt. 15 lbs. Regular list price $29.00.
S-152, special each $13.50

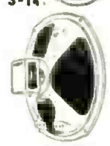
Driver Unit: 25 watts, 15 ohms for use with trumpet offered here or will fit any standard trumpet. Order from Olson with confidence. Factory sealed cartons. Shpg. wt. 6 lbs. Regular list price $25.00.
Stock No. S-151, special, each $12.50

PRICE SLASH ON GENUINE MAGNAVOX (The Oldest Name In Radio) PM SPEAKERS.


S-142


S-143


S-141

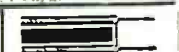

S-140

Latest designs to come from the Magnavox laboratory. Super Alnico 5 magnets employed. Voice coils built to utilize every bit of input power and to deliver volume and fidelity you never dreamed possible. Each speaker individually packed in an attractive carton. The name Magnavox on each speaker is your guarantee of the best. Voice coil impedance 3.2 ohms on all speakers except 12" which is 8 ohms.

Stock No.	Size	Watts	Olson's Price
S-142	4"	3	$1.39
S-143	5"	4	1.49
S-141	6x9"	6	2.99
S-140	12"	9	4.95

JENSEN PM SPEAKERS

Genuine Jensen PM speakers for PA or radio. Cone and coil assembly permanently aligned. Heavy Alnico V magnets.
S-12, 12 Watts, 12" dia. Shpg. wt. 7 lbs. Net...... $7.95



300-Ohm Lead-in

High grade, low loss. For all TV installations. Shp. wt. 3 lbs.
W-68. 100 ft. coil....
SPECIAL at OLSON'S $4.00

SPECIAL COMBINATION OFFER

Olson will supply you with a 25 watt Driver Unit S-151 and an all weather trumpet S-152 at the special price of both for $23.95

KIT OF THREE VARIABLE CONDENSERS

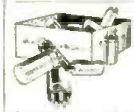
A $3.50 value. Perfect for the experimenter. Brand new stock. Quantity limited. Get a kit containing 3 assorted variable condensers. Popular values, 2-gang and 3-gang. Some have trimmers, vernier drives. AM and FM styles.
Olson's Price $1.29
X-226. Carton of 3 asst.

4-Drawer Steel Chest

For small parts, etc. Knob on each drawer; various size compartments. Each drawer 1¼" deep. Size: 6¼" H., 5¾" W., 8⅛" D. Shpg. wt. 5 lbs.
X-199 Each $2.19

MATCHED PAIR AM-FM CONDENSERS

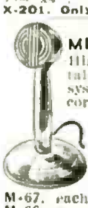
Beautifully built! 3-gang. Build a tuner or AM-FM set. AM sections are 365 MMFD; FM is 15 MMFD per section. Can be operated by push-buttons, too. Shaft ⅜" dia. Condenser 3"x1¼"x4". Shpg. wt. 3 lbs.
X-201. Only at OLSON'S .... 69¢ Pair



FP COND. KIT

Olson's Special Price $3.98
AS-24

Assortment of 15 popular FP condensers, double and triple sections. Capacities from 10 mfd to 50 mfd; from 25 to 450 volts. Shpg. wt. 3 lbs.



ASTATIC MICROPHONE

High output crystal mike for PA systems and recorders. Equipped with handle base and 7' shielded cable. Shpg. wt.—5 lb.
M-67, each $5.95
M-66, same but with on-off switch built into handle.... $6.95

HOOK-UP WIRE KIT

Olson bought all the Guaranteed high grade wire in sight—and is passing a bargain on to you. Kit contains 5, 100 ft. rolls—total 500 ft. Various colors, push back, plastic and rubber insulation: solid and stranded copper. Shpg. wt. 3 lbs. AS-19 500 feet $3.95

Olson's Special $3.99
M-71

NEW CRYSTAL MIKE

Nationally famous make. Smart New Design, easy to hold. Used in many tape, wire and disc recorders. Can be used on P. A. systems, amplifiers, etc.

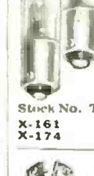
MUSICAL INSTRUMENT MIKE

Famous quality! Sells for twice our sale price. Easily attached. Delivers brilliant tone from string instruments. With 4' shielded cable and volume control.
M-61 .... $6.95

UNIVERSAL OUTPUT TRANSFORMER

99c
T-87

Matches any single tube to any 3.2 ohm voice coil. Primary tapped at 2,000, 7,000, 10,000 ohms. 2-inch mounting centers. List price $2.50.



PANEL LAMPS

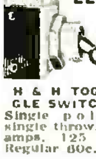
Westinghouse, GE, and Tung-Sol bayonet panel lamps. 100 of a type to the box.

Stock No.	Type No.	Price per 100
X-161	47	$5.19
X-174	44	

BATTERY CHARGER

4 Amps
Olson's Price $7.50
RA-55

Highly efficient storage battery charger. Automatically decreases charging rate as battery becomes charged. Housed in sturdy steel case with 117 volt AC cord, plug and battery leads with heavy-duty clips.



X-158 22c

H & H TOGGLE SWITCH

Single pole, single throw, 6 amps, 125 V. Regular 60c.

WHIZ WIRE STRIPPER

Strips off insulation clean and fast. Takes wire up to ¼" diameter, gauges No. 14 and smaller. Has 4 hole blade. Automatic grip releases after stripping. No tool box complete without this handy tool.
TL-1 .... $2.95

IT'S EASY TO ORDER FROM OLSON'S

How to order: Order directly from this ad. For convenience use this order blank. Fill in columns below with quantity desired, stock number, description and price. You may send remittance with order (include enough for postage or parcel post shipment), or if you prefer SEND NO MONEY. Olson will ship C.O.D. and you may pay mail or expressman for merchandise and postage.

MONEY BACK GUARANTEE: *Everything you order from Olson is guaranteed as advertised. If you are not more than satisfied, you may return merchandise for cash refund.*

Please Minimum Order $3.00

QUANTITY	STOCK NUMBER	DESCRIPTION	PRICE EACH	TOTAL
			TOTAL	
			ADD: POSTAGE	
			TOTAL AMOUNT	

NAME ____________________

ADDRESS ____________________

CITY ____________ ZONE ___ STATE ______

RN-151

Cut Out and Mail to: OLSON RADIO WAREHOUSE, INC.
73 E. MILL ST. • AKRON 8, OHIO

Improving TV Sets

(*Continued from page* 35)

tuned to a station, preferably one with a test pattern and tone, and the fine tuning adjusted for maximum detail. Then the top and bottom of the ratio detector or discriminator transformer are adjusted very slowly. The bottom adjustment usually tunes the secondary. If the sound is clear but weak, the top and the sound i.f. transformers are touched up last.

Bigger Picture Tube

Installing a new larger picture tube depends on the physical construction of the chassis and cabinet as well as certain electrical limitations. To substitute a magnetically deflected tube for an electrostatic type requires a complete redesign of the sweep and high voltage sections and is, therefore, not recommended.

Whenever a larger picture tube is installed it is necessary to change the cut-out or mask. Sometimes it is advisable to purchase a standard size plastic mask or else a suitable picture frame with a safety glass insert can be mounted in front of the screen. The picture tube, deflection, and focus coils, can be fastened either to the cabinet or chassis, whichever is more convenient. Before proceeding to drill or screw things on, however, the actual physical dimensions of the new tube should be checked again.

The electrical characteristics of all magnetically deflected tubes are not the same and deserve some consideration. Table 1 lists the most important electrical differences between present day cathode ray tubes.

Picture tubes having a 63 to 70 degree deflection angle require a special deflection yoke and to obtain the high voltage necessary, either a voltage doubler or a high-efficiency flyback transformer must be used. Most of the tubes listed use either a single or double pole ion trap. Either can be tried and the one giving the brightest picture used.

Undoubtedly there are many other circuit changes possible which will improve the performance of older television receivers. Whatever steps are taken, the technician should make sure that the customer is well satisfied with his overhauled set. One of the shortcomings of many technicians is their lack of neatness and cleanliness in finishing the job. A few extra minutes spent in finishing the job right will leave a good impression and will add to the customer's satisfaction in your work.

Borrowing the vacuum cleaner to clean the inside of the chassis and cabinet as well as the rug surrounding the working area shows your tidiness and thoroughness. Polishing the cabinet lightly with furniture polish or lemon oil after the chassis is in the set and cleaning the glass one last time leaves that good impression as well as no fingerprints. —30—

"TAB" THAT'S A BUY

TRANSFORMERS

115 V 60 Cyc Input TV & CR Pwr Xfmr for 7" to 20" Tubes. Hi VOLTS to 20KV (w/quadrupler ckt.). ALL Tubes, Pl. & Fil. wndgs divrng: 100 VDC/ 225ma Full-Wave, 6.4V/10.5A, 5.4V/8A, 2.5V/3A Hypersil Cores. DC Amprg. $8.98

1400vct/80ma, 6.3v/4a, 5v/3a H'Sld. 4.98

1000vct/150ma, 300v Bias, 6.3v/5a, 5v/3a, 2x6.3v/.65v/1.25a H'Sld. 4.50

1000vct/45ma, 785vct/80ma & 360 vct/55ma, 5x5v/3a, 6.3vct/1a. 6.3vct/.5a Csd, HiVinsul. 3.98

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2E43	1.39	CK543DX	.98
CK501AX	1.26	CK544DX	.98
CK505AX	1.79	CK551AXA	1.69
CK506AX	1.26	JRP5670	1.49
CK512AX	1.79	CK5678	2.48
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CK526AX	1.98	CK5703	1.25
CK529AX	1.98	JRP5704	5.79
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.1	.45	.65	14.98
.35	.69		15000 wvdc
.75	.65	.0016	8.98
1.09			25000 wvdc
1.89		.00025	6.49
2.29			1 95.00
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1.69			
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3.89		5	1.08
2.98		225vac/ 600dcw vac	
6.98			
2000wvdc			
.98		3.8	.59
1.19		230vac/ 600dcw vac	
1.45			
2.29			
3.69		5	1.08
4.29		330vac/ 1000dcw vac	
5.29			
8.98			
2500wvdc		1.25	.59
1.89		1.5	.69
2.29		1.75	.75
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2.19		2.5	.85
2.69		2.8	.89
4.29		3	.98
5.49		4	1.08
5.95		5	1.29
4000wvdc		12	3.29
7.98		15	3.49
5000wvdc		25	5.49
3.29		40	8.98
9.98		405vac/ 1200dcw vac	
17.98			
5500wvdc		.15	1.08
11.98		600vac/ 1800dcw vac	
7000wvdc			
1.29			
1.69		16	6.98
3.89		660vac/ 2000dcw vac	
7500wvdc			
2.29		5	3.98
2.69		6	4.49
3.29		10	6.49
13.98		16	7.98

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E. Small Shell DUODECAL, 2BP1 etc. .75

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J. 5-prong STEATITE Johnson, 807. .30

K. 7-pr STEAT Johnson, 1625. .36

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M. MINI 7-pin Mica 'B-HF & Shield. .30

M. MINI 7-pin Mica 'B Top Mtg&½Shld B. .23

M. MINI 7-pin Bot Mtg Bkit Sim Amph 147-500 .13

M. NOVAL 9-pin Mini, ½ Shld Base, Top Mtg. .45

M. NOVAL 9-pin Mini, Full Shld, Top Mtg. .59

M. NOVAL Shield 1½", 12c; 1-15/16" or 2⅜". .14

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O. 4-pin AMPH49RS84 & mtg Ceramic. .27

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R. LOKTAL 8-pin & lock Mica 'B HF. .10

S. KLYSTRON socket Cinch. .35

T. LOKTAL Amph 498SL Steatite. .30

U. OCTAL Amph 7888 mica Bklte. .09

U. 11-pin 78S11/931 Amph. .16

V. OCTAL Amph 49S88 steatite. .25

W. HiV Safety 4-pin Amph 77A4. .39

Y. MAGNAL 49S811, ceramic, 5BP1, 5BP4. .69

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RM29A Control Unit

Self Contained Incl Ringer Ckt, 3Pos. Locking-type Selector for Monitor, Direct of Radio Control, or use as Telephone. BRAND NEW. $10.00

810 Watt Powerstat

230V, 50/60cyc, 1ph Input No. 216U: Brand new Bench or Wall mtg. Output: 0-270 Volts, 3 amps, 810VA. Can operate from 115volt single phase source to deliver 0-270 Volts output—Uncsd, Less Cord. Complete with Knob, Dial Plate & Instructions. 11 lbs. $19.95

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Postage Micas: .003/.004/ .006/.01 mfd. ea. 10c

Lug Trm: .006mfd/600 wv. 10c

Type	Mfd.	WV	Each
B	.0006	600	$ .25
B	.008	600	.25
B	.01	600	.30
A	.02	600	.45
B	.03	600	.98
B	.002	1200	.30
B	.01	1200	.50
A	.0004	2500	.35
A	.003	2500	.75
A	.015	2500	1.30

Transmitting Micas

Mfd.	Volts	Each
.0006	2500	$1.35
.00015	3000	.65
.0001	3000	.90
.0007	3000	.90

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0.607	286	1260	3290	16000	100000
0.7	289	1300	3333	16500	110000
	299	1350	3384	16800	115000
1.03	300	1355	3500	17000	116667
1.3	310	1400	3509	17500	120000
1.75	311.5	1488	3700	17977	125000
2.5	320	1495	3730	18000	130000
3	325	1500	3760	18300	135000
3.83	330	1510	4000	18500	140000
4.35	340	1518	4030	18500	141000
5	350	1600	4200	18800	145000
5.025	360	1640	4220	19000	147000
6.25	366.5	1646	4280	19500	150000
	370	1650	4300	20000	155000
7	375	1670	4314	20441	160000
7.8	380	1680	4440	20500	165000
7.9	389	1710	4487	21500	166750
8	390	1712	4500	21500	167000
10.38	400	1740	4720	22000	169200
11.25	410	1770	4750	22500	175000
12	414.3	1800	4850	22990	180000
13.52	418.8	1818	4885	23000	180600
14.2	425	1830	4900	23150	185000
14.25	426.9	1865	5000	23325	186600
14.5	427	1892	5100	23400	190000
15	440	1894	5210	23500	198000
16	450	1895	5235	24000	200000
17	452	1896	5270	24600	201000
19	460	1897	5300	25000	205000
19.2	470	1898	5500	25200	210000
20	475	1899	5600	25400	215000
22	478	1900	5730	25833	220000
23	480	1901	5770	26000	225000
24	487	1902	5910	26500	229000
25	500	1903	6000	26667	230000
26	520	1904	6100	27000	235000
28	525	1905	6125	27500	238000
30	540	1908	6140	28000	240000
31.5	550	1907	6200	28430	245000
37	575	1908	6300	28500	250000
48	580	1909	6495	29000	265000
49	588	1910	8500	29500	268000
50	600	1911	6840	29990	270000
51.78	612	1912	6990	30000	275000
55	625	1913	7000	31000	294000
56.7	633	1914	7300	31500	295000
60	640	1915	7500	32000	307500
63	641	1916	7700	33000	311000
68	645	1917	7717	35000	314000
74	649	1918	7900	37000	316000
75	650	1919	7930	38140	325000
80	657	1922	7950	38500	330000
81.4	665	1924	8000	39000	330000
88	668	1926	8094	39500	333500
89.8	670	1930	8250	40000	350000
95	673	1980	8500	42000	353300
100	675	2000	8700	43000	375000
101	680	2045	8770	45000	380000
105	681	2080	9000	47000	400000
105.7	684	2095	9100	47500	402000
107	689	2141	9445	48000	420000
120	697	2142	9500	48660	422000
121.2	699	2145	9710	49000	425000
125	700	2150	9800	50000	450000
130	711	2160	9900	52000	458000
135	733	2180	9902	55000	478000
147.5	740	2187	10000	58000	500000
150	750	2195	10430	57065	520000
160	800	2200	10500	58333	521000
165	806	2250	10600	60000	525000
170	850	2300	10900	61430	543000
175	854	2400	10936	62000	550000
179	899	2450	11000	64000	570000
182	900	2460	11450	65000	575000
182.4	910	2485	11500	66600	580000
200	917	2490	11690	66650	620000
209.4	946	2500	12000	67500	650000
216	978	2525	12500	68000	654000
220	1000	2600	12600	70000	660000
220.4	1030	2625	13000	72000	690000
225	1056	2635	13100	73500	700000
230	1059	2700	13500	75000	750000
235	1067	2750	13550	80000	761300
240	1100	2850	13600	82000	800000
245	1110	2860	14000	84000	813000
245.4	1150	2870	14250	85000	850000
250	1152	2900	14400	85750	900000
280	1162	3000	14500	88000	930000
				90000	950000

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1.2	1.65	2.75	4.23	6.7	10
1.25	1.75	2.8	4.25	7	11.55
1.3	1.8	2.855	4.5	7.5	12
1.35	1.9	3		7.62	12.83
1.39	2	3.3	5	7.74	13
1.4	2.11	3.5	5.5	8	13.85
1.5	2.2	3.673	6	8.02	
1.57	2.25	3.75		8.5	

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2-Band Operation With Folded Dipole and Ribbon

Ordinary 300 ohm twin-lead wire is used as an antenna for operation with 2-band transmitter.

By
WALTER S. ROGERS, W1DFS

SO MANY hams have benefited from the convenience and efficiency of the two-wire, 300 ohm ribbon (twin-lead) antenna that it seems too bad that more amateurs do not use it. Because it is usually just a one-band antenna, many hams shy away from ribbon antennas. This is unfortunate since it is light, easy to string, and gets out with the greatest of ease.

Back in the fall of 1946, the author started doing something about two-band operation. His first thought was to write W9SZ, an OM capable of shedding some light on the subject. Dick used to be in Boston and his interest in the "unusual" always manifested itself in the form of some new twist in his ham station. With his encouragement, several types of two-band antennas were tried with sufficiently good results to warrant telling other hams about them.

In the early spring of 1947 the first two-band rig, as shown in Fig. 2B, was hauled up at North Falmouth on Cape Cod. This antenna was rather low by "ideal" standards but an average of 20 feet was the best that could be managed with this temporary lash-up around an old Cape Cod house. After being limited to an indoor apartment house antenna in Boston, this layout seemed fairly lavish!

The center folded dipole was cut for the high frequency band, 40 meters in this case, and lengthened, in accordance with the suggestion from W1DBM, not for the high frequency band but for the low frequency with the over-all length for the 75 meter phone band. This was not difficult to do, using the W1DFS center block and end pieces of brass, as shown in Fig. 1. Without these center pieces and the end blocks, the folded dipole is liable to come down just when most needed.

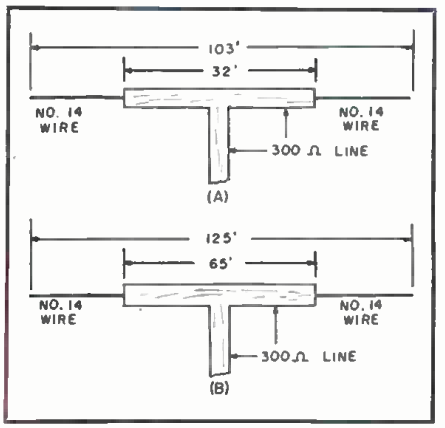
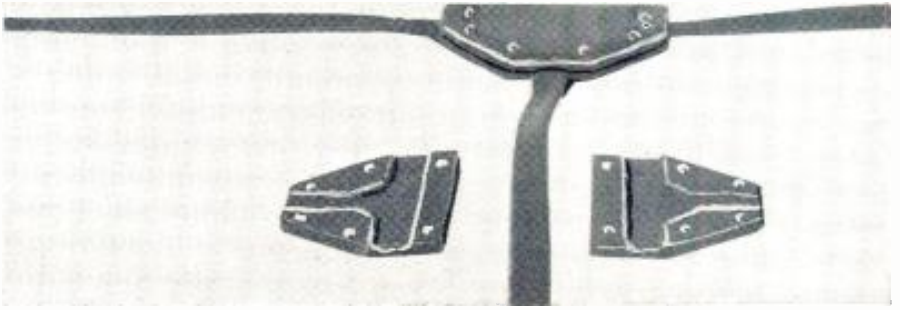


Fig. 2. (A) Mechanical details of 20-75 meter antenna and (B) the 40-75/80 meter antenna.

The transmitter was a surplus Navy TCS unit which was modified and then powered by a variable voltage power supply which had been built for lab testing rather than this particular application. One side of the transmitter output is grounded. There is a variable inductance in series with the hot antenna lead, a means of controlling the coupling, and a 50 $\mu\mu$fd. condenser that may be used in series with the antenna or across the antenna to ground. See Fig. 3. At times it was found convenient to use an auxiliary 200 $\mu\mu$fd. condenser in order to secure the best possible match for the antenna. For a balanced antenna, two

Fig. 1. Over-all view of 300 ohm twin-lead antenna assembly for 2-band operation.



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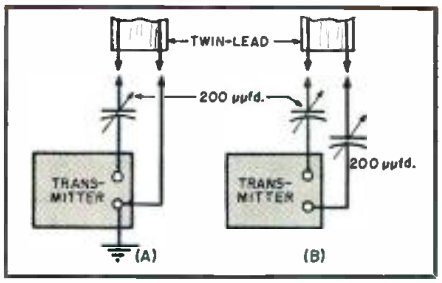


Fig. 3. Methods for feeding the antenna. (A) Unbalanced and (B) balanced methods.

series condensers are recommended.

There were losses with this arrangement but on these frequencies repeated tests, using the whole antenna system against ground, indicated that the dipole was superior. With the limited power available (the Navy rated these sets at 25 watts output c.w. and 10 watts phone) it was possible to maintain many skeds and have a good time keeping in touch with friends. It was impossible to feel any heat along the line. Despite the disadvantages of the dipole, it was still preferable to using the whole antenna system.

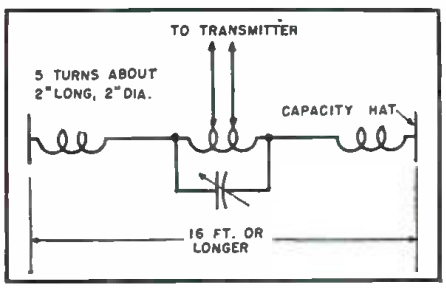
It was another story when W1DFS was to go on the air in Melrose, Massachusetts. I was anxious to get on 20 as well as 75/80. The antenna for operation on these bands was cut as shown in Fig. 2A. This setup worked very well on these two bands with inputs up to 500 watts, but usually at low power. Here again repeated tests using the system against ground showed that the folded dipole was superior in every respect.

On this particular antenna there are three half-waves on 20 and one on 75 and it loads up less efficiently than it would if it had been cut for that 75. These dipoles are really rather broadband antennas.

Both of these two-band folded antennas have been given a good workout in the open and tests indicate that they may be good antennas for emergency or portable use where more than one-band operation is a desirable feature.

An antenna which will give satisfactory results in restricted space is shown in Fig. 4. The coil at the center of the antenna should resonate with the condenser used at a somewhat higher frequency than the operating frequency. Either direct coupling by means of variable taps or link coupling may be used.

Fig. 4. Center-fed capacity and inductively loaded low frequency antenna for use in operating on the 75 meter phone band.



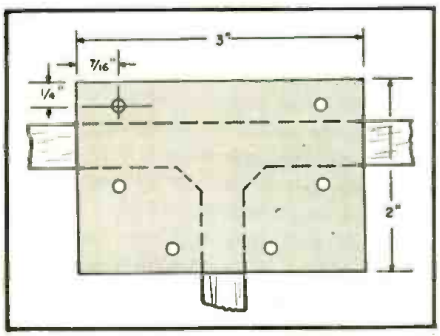


Fig. 5. Details of the center block assembly.

The coils at the end of the antenna, together with the "capacity-hats," serve to add to the electrical length of the antenna. In one experimental set-up the "capacity hats" consisted of the window screens at opposite ends of the room.

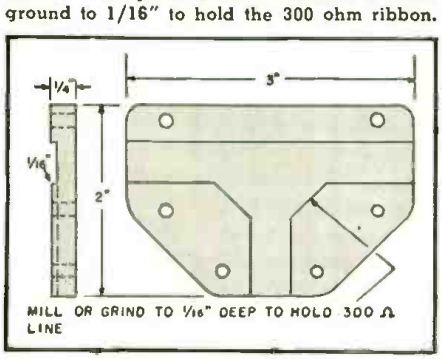
No exact dimensions can be given for an antenna of this type due to the many variables. With the dimensions shown it is possible to obtain satisfactory performance on the 75 meter band. In one exceptional case, an 18-foot length of wire was loaded to 105 kc. with good results.

Of course, one of the ever-present threats to operation with a folded dipole is the possibility that it may come down during really rugged weather. The 300 ohm line is light in copper and insulation and unless one secures a factory-molded job it is not easy to make a good electrical and mechanical connection capable of taking the strain and bending to which these antennas are subjected.

The first try at licking this particular problem involved the construction of a light ⅛" bakelite "sandwich" which was made by bolting the center splice as shown in Fig. 5. This unit, as suggested by W1DBM, proved to be larger than the hand-milled version shown in Fig. 6. Hams who have access to a machine shop have a decided advantage in making this unit although the job can be done reasonably well with a hand grinder. Use ¼" phenolic stock for each piece. The squeeze, which can be further regulated by the use of friction tape if required, should be sufficient to hold the ribbon securely without having to depend on the light copper wire as a supporting member.

For terminal pieces with the ribbon

Fig. 6. Two pieces of ¼" phenolic are required. One piece should be milled or hand ground to 1/16" to hold the 300 ohm ribbon.



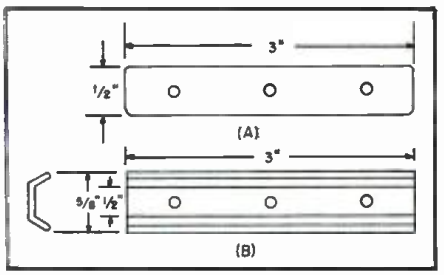


Fig. 7. One of each of these pieces is required in order to clamp ends of 300 ohm twin-lead. To be made from 1/16" brass. 6/32 brass bolts and washers are employed.

folded dipole, a pair of brass pieces about 3" long were cut and drilled as shown in Fig. 7A. One of the 6/32 brass bolts goes through the webbing and pinches the whole ribbon while the second bolt is around a soldered loop in the line and is equipped with the necessary washers to hold it firmly. The outboard bolt holds the 14 gauge antenna trim section of the folded dipole. A further improvement was made at a later date by bending one of the larger side pieces in order to center the ribbon positively in position, as shown in Fig. 7B.

In about two years of weathering the antenna the author built didn't break once. —30—

Servicing Projectors
(*Continued from page 38*)

positioning of the aperture plate. The best advice I can give you here is to secure an instruction manual for the particular machine you are working on, or better yet, send the machine to the factory or to one of the company's authorized service depots.

It is not advisable to try to stock oscillator coils, photoelectric cells, film guides, etc., etc., because the net gain doesn't warrant such an investment. I would suggest that you inquire around and find out what machines might be needing your services and stock a few exciter lamps for these. It would also be a good idea to purchase a good 16mm. sound film. You can secure a short subject such as one of the "News Parade" series, that will have both speech and music in excellent quality. Be sure to check the film with a good machine before you make the purchase as sometimes a defective print does slip on the market. There are test films available for servicing purposes but good ones are quite expensive and unless you plan to do plenty of this work, it is not advisable to invest that much money. —30—

NEW SOUND TAPE TESTING SERVICE

THE Minnesota Mining and Manufacturing Co. of St. Paul, Minnesota, maker of the "Scotch" brand recording tape, has recently set up laboratory equipment that can test the performance characteristics of sound recording tape, recorders, and playback units in a matter of minutes.

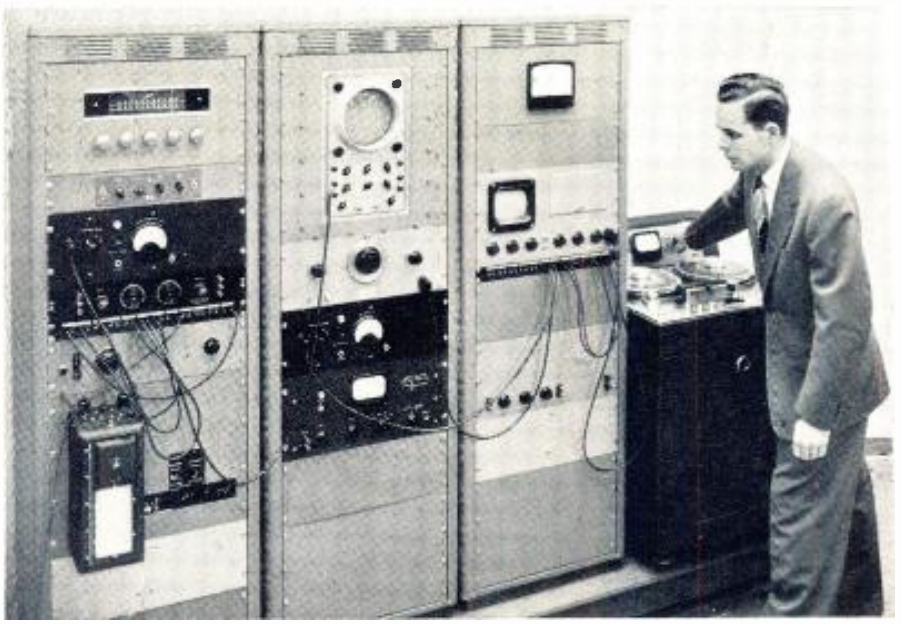
This new equipment and the staff to operate it is being supplied by the company as a service to the industry.

The three racks of laboratory equipment, plus recorders and speakers, permit measuring such performance characteristics as output at any frequency, uniformity of output at any frequency, signal-to-noise ratios, dynamic range, wow, flutter, harmonic distortion, intermodulation, and modulation noise.

Included in the equipment are an AM-FM tuner, oscilloscope, wow meter, Ballantine voltmeters, dual-channel oscillograph with associated d.c. amplifiers, two high-fidelity audio amplifiers, two professional-type recorders that operate at any speed from 3¾ to 15 inches-per-second, and a sonic analyzer for measuring distortion and frequency response and for showing noise spectra.

A special bias circuit was built into the recorders to permit introducing wide variations in bias. —30—

Over-all view of the new sound tape testing laboratory set up by Minnesota Mining.



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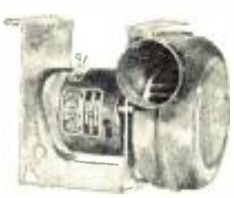

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1H4G	.68	6AD6	.88	7B6	.58
1H5GT	.53	6B5	1.56	7C5	.56
1H6G	.86	6B7	.88	7C6	.72
1J6GT	.88	6B8	.68	12A6	.18
1L4	.54	6B8G	1.28	12K8	.58
1LA4	.78	6C5	.46	12SH7	.34
1LA6	.88	6C6	.56	12SL7GT	.58
1LB4	.88	6CBG	.68	12SR7GT	.48
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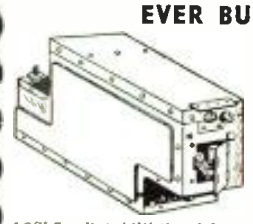

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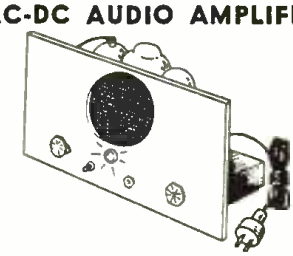

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Mac's Service Shop

(*Continued from page* 61)

that 'Experience' gains in working on familiar material is lost when an odd-sized nut for which he has no wrench is encountered and he has to stop and make a whole new wrench just for that one job."

"You mean that theory is more flexible than experience," Barney said slowly. "Could be, at that. I suppose a lot of the stuff a guy had to learn at the very beginning of television is of no use at all to him now. But where is a man going to get this theory without going back to school?"

Mac waved a hand at the shelves carrying books and magazines at one end of the service shop. "You are practically standing up to your chin in it all of the time," he declared. "Anyone who can read has every opportunity to be right up to the minute on every aspect of radio and television these days. The first thing to do, of course, is to study a good book on television fundamentals.

"After you have all of that stored under your curly red thatch, all you have to do is supplement it by doing a lot of current reading. The radio magazines are doing a wonderful—and sometimes unappreciated—job of keeping their readers right up to the second on every new development in TV theory, design, application, and service. Those magazine editors must almost steal some of the new ideas right off the drawing boards of the engineers, for you invariably read about a new development many months before you have a chance to encounter it in actual service work."

"But *I* read the magazines. Why is it I feel so dumb about television?"

"Mostly because you skip entirely or at least barely skim over any article that is not concerned with something you think you may need tomorrow or the next day at the latest. For example, if you see an article entitled 'Improvements in A.G.C. Systems', that looks rather weighty and has some complicated-looking diagrams, you turn past it hastily to read an article on 'How I Use Old Discarded Razor Blades to Solve Intermittents.' You shy away from any information unless you think you can put it to practical use right away."

"I plead guilty, Your Honor," Barney said with a grin, "but I promise to do better—not because of any of your preaching, mind you, but because of some thinking I was doing on my own while you were talking.

"As I see it, a knowledge of theory is something that will keep, while practical experience is good just for a little while. If I really study everything I can get my hands on about television, I'll sort of be putting away in a deep-freeze a lot of information that can be thawed out and used in a hurry whenever I really need it—no matter if that time is tomorrow or five years from now. From here on in, just call me Bookworm Barney!"

"Now you're talking," Mac applauded, "and don't forget that your knowledge of theory will allow you to absorb experience in the large king-size bites when the opportunity affords. When you already have the 'Know-why,' you can learn the 'Know-how' in jig time."

"What really convinces me," Barney muttered almost to himself, "is something I was reading just yesterday. It seems that one of the world's outstanding authorities on the American Indian is a plumber in England who never set foot in the United States or Canada. If he can do it, Old Barney can do it too!"

—30—

MORE FREAK TV

SINCE the item concerning freak television reception appeared in the November issue (page 184) we have received several letters concerning the experiences of other of our readers.

From LeRoy H. Smeltzer, 243 South Washington Avenue, Greensburg, Pa., comes a report on an unusual evening of video fare. On October 30, 1950, Mr. Smeltzer reports that from 5 to 7 p.m. sound was available on all channels but that there was no picture. Then from 7 to 10:35 p.m. thousands of set owners in his area were able to get pictures on every channel although about 95 percent of the viewers had never been able to get any station but WPTV (Channel 3) in Pittsburgh before.

Every channel, except 6, came in with moving picture quality, according to Mr. Smeltzer. Erie, Cleveland's three stations, and Detroit were all received well.

At 10:35 p.m. the stations began to fade and by 10:45 p.m. they were all too weak for good reception except in some high locations where reception remained good until 11:15 p.m. when all reception ceased.

As a result of this "big night of video," Mr. Smeltzer reports that the whole of Western Pennsylvania is TV "crazy."

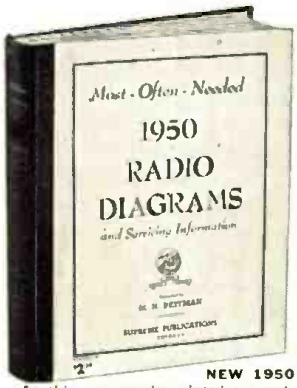
—30—

CLEANER USES

By JIM KIRK, W6DEG

MY customers see a deluxe, tank-type vacuum cleaner sitting along-side my service bench and often ask me if I also repair vacuum cleaners, which I definitely do not. However, not a day goes by but what I use this useful device. First I blow out the dust in all sets brought in. Then I keep the bench and floor near the bench neat at all times by immediately picking up filings and bits of insulation with the suction end. It will pick up small tools so these are laid aside. The cleaner is left plugged in and handy so all I have to do is reach for it. Before I bought this outfit, I used to step in iron and aluminum filings and get them on my shoes and then track muss all over the place. I also used to take an old-fashioned broom to sweep the sidewalk in front of the store. It took only the large pieces of litter off. The dirt was swept into the cracks and it was hard work. Now I take the blower on a long rod and in a few minutes, standing up, I blow the sidewalk "clean as a hound's tooth."

—30—



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Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

TELEVISION EQUIPMENT

Polarad Electronics Corporation of 100 Metropolitan Avenue, Brooklyn 11, New York, has recently issued a comprehensive catalogue covering its line of television equipment for broadcast, manufacturing, and laboratory use.

The new 14-page publication fully describes the company's television cameras, synchronizing generators, monitors, TV amplifiers, and TV power supplies designed for broadcast operation. The equipment described is adaptable to either 525 or 625 line standards.

Of particular interest to management personnel of television stations is the complete line of portable monitoring equipment included.

Copies of the new catalogue may be secured without charge by writing direct to the company.

CONDENSER CATALOGUE

Astron Corporation of 255 Grant Avenue, East Newark, New Jersey, has recently issued a new 12-page catalogue covering its line of condensers for radio, television, and electronic applications.

Designated the Catalogue AC-2, the new publication covers dry electrolytics, molded paper tubulars, oil paper condensers, and the company's new "Metalite" units which are self-healing, subminiature, and fabricated of metallized paper.

In addition to the condenser listings, the new catalogue includes complete descriptive material on standard r.f. filters, as well as units for aircraft and heavy duty applications.

Copies of the new catalogue may be secured from the company.

ALLIED'S 1951 CATALOGUE

Allied Radio Corporation of 833 W. Jackson Blvd., Chicago 7, Illinois, has just released copies of its 1951 catalogue, a 212-page buying guide covering radio, television, and industrial electronic equipment.

Designated Catalogue No. 124, the new publication contains a comprehensive listing of radio, television, and electronic parts; test equipment, public address systems, television and radio sets and accessories, TV components, recording equipment and accessories, new 3-speed record players and changers, high-fidelity amplifiers, speakers, tuners and other components for custom installations, as well as complete high-fidelity phono-radio systems, amateur gear, radio builders' kits and supplies, tools and hardware, books, manuals, and diagrams.

The new catalogue will be sent free to those requesting it from the company.

HIGH SPEED RELAYS

A data sheet covering the company's ultra-high speed relays is now available from *Stevens-Arnold Inc.*, 22 Elkins Street, South Boston, Massachusetts.

Catalogue 105B describes the new units in some detail as to contacts, life expectancy, load, contact rating, mounting, operating speed, and coil specifications.

Copies of this catalogue sheet are available without charge from the company.

HERMETIC TERMINALS

To assist those persons concerned with the design and specification of hermetic terminals for electrical and electronic products, the *T. C. Wheaton Co.* has recently published a 12-page catalogue containing much essential engineering data on the subject.

Designed for practical use, this two-color catalogue contains complete details on glass-to-metal, "Alumina," "Alumina" lead-thru, multiple refrigerator types, as well as other units in the company's line. In addition there is a special section devoted to metallized glass seals and electronic insulators and another section containing helpful engineering information relating to terminal selection and use.

Copies of the catalogue may be secured without charge. Address all requests to the company at Millville, New Jersey.

PORTABLE AUDIO EQUIPMENT

A complete new catalogue covering portable sound equipment for schools, churches, clubs, recreational activities, etc., has just been issued by *Newcomb Audio Products Co.* of 6824 Lexington Ave., Hollywood 38, California.

The publication lists a wide selection of combination transcription players and public address systems with both two- and three-speed turntables. Two recently-developed portable phonograph units are also described.

All of the models are illustrated and full specifications are given on all of the units. All of the products listed carry the *Underwriters' Laboratories* approval.

Copies of the new catalogue are available from the company.

ANTENNA GAIN CHART

Technical Appliance Corporation of Sherburne, New York is making its new Engineering Bulletin No. 64

"Premier" Prices on TUBES and PARTS

World's Best Indoor TV Antenna

A beautiful antenna which is the ultimate in reception, highest signal gain, nothing to adjust.

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For 50L6, 35L6, 50A5, 35A5, 117L7 ..... **47c ea.**

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VERY BEST BRANDS	10 or more Each	Price Each
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Very best brands. Fresh stock

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10-10-10-20—450V-150-25 V	ea. 59c
30-30—400 V-350 V	ea. 47c
30-30-25—400 V-25 V	ea. 47c

150 Working Volts

8—150 V	ea. 23c
8 8—150 V	ea. 23c
10—150 V	ea. 23c
10-10—150 V	ea. 29c
10-10-10—150 V	ea. 35c
15—150 V	ea. 25c
20—150 V	ea. 30c
30—150 V	ea. 35c
40—150 V	ea. 35c
15-15—150 V	ea. 35c
20-10—150 V	ea. 35c
20-20—150 V	ea. 35c
30-20—150 V	ea. 47c
30-30—150 V	ea. 47c
35-35—150 V	ea. 47c
40-20—150 V	ea. 47c
40-40—150 V	ea. 47c

40-40—150 V 20-25 V	ea. 47c
50-30—150 V	ea. 47c
20-16-16—350 V Sprague type	ea. 47c
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1A6	1.60	6K7G	.83	12SJ7GT	.90
1A7GT	1.00	6K7GT	.83	12SK7	.90
1B3GT/8016	1.33	6K8	1.20	12SK7GT	1.00
1C5GT	1.10	6K8GT	1.20	12SL7GT	1.20
1C6	1.60	6L5G	1.33	12SN7GT	1.10
1C7G	1.60	6L6	1.78	12SQ7	.75
1D5GP	1.95	6L6G	1.78	12SQ7GT	.83
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1D8GT	1.95	6N8G	1.95	12SR7GT	1.10
1F4	1.33	6P5GT	1.20	12Z3	1.33
1F5G	1.33	6Q7	1.00	14A7	1.10
1G4GT	1.33	6Q7GT	.90	14AF7	1.20
1G6GT	1.33	6R7GT	1.33	14B6	1.10
1H6G	1.60	6S4	.90	14B8	1.10
1J5G	1.33	6S7GT	1.60	14E6	1.10
1J6G	1.80	6S8GT	1.33	14E7	1.33
1J6GT	1.80	6SA7	1.00	14F7	1.10
1LA4	1.33	6SA7GT	1.00	14F8	1.33
1LC5	1.33	6SC7	1.00	14H7	1.20
1N5GT	1.00	C5D7GT	1.45	14J7	1.33
1P5GT	1.33	6SF5	.83	14N7	1.33
1Q5GT	1.33	6SF5GT	.90	14Q7	1.10
1R5	1.33	6SF7	1.00	14X7	1.33
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1T4	.90	6SH7	1.10	19BG6G	3.00
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1U4	1.33	6SJ7	.90	20	1.95
1U5	1.00	6SJ7GT	.90	22	1.60
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1X2	1.10	6SL7GT	1.45	25A7GT	3.00
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2A5	1.60	6SQ7	.75	25CQ7GT	1.60
2A7	1.10	6SQ7GT	.83	25C6G	1.45
2E5	1.33	6SR7GT	.90	25D8	1.95
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3C6	1.60	6T8	1.45	25Y5	1.45
3E6	1.33	6U5	1.00	25Z5	.83
3LF4	1.33	6U6GT	1.00	25Z6GT	.75
3Q4	1.10	6U7G	.90	26	.90
3Q5GT	1.20	6V6GT	1.00	27	.75
3S4	1.00	6V7G	.90	30	1.00
3V4	1.00	6W4GT	.90	31	1.33
5T4	1.95	6W6GT	.90	32L7GT	1.60
5U4G	.83	6X4	.75	33	1.60
5V4G	1.20	6X5GT	.75	35/51	1.00
5W4	.83	6Y6G	1.20	35B5	1.00
5W4GT	.83	6Y7G	1.60	35C5	1.00
5X4G	.90	7A4	1.00	35L6GT	.90
5Y3GT	.68	7A5	1.10	35W4	.63
5Y4G	.75	7A6	.90	35Y4	.90
5Z3	.90	7A7	.90	35Z3	.90
5Z4	1.33	7A8	.90	35Z4GT	.75
6A3	1.60	7AF7	.90	35Z5GT	.75
6A4	1.60	7B4	.90	35Z6G	1.33
6A7	1.00	7B5	.90	36	1.33
6A8GT	1.00	7B6	.90	39 44	1.33
6AB4	1.00	7B7	.90	41	.83
6AB7	1.60	7B8	.90	42	.83
6AC5GT	1.45	7C4	1.60	43	.83
6AC7	1.45	7C5	.90	45	.83
6AG5	1.33	7C6	.90	45Z5GT	.90
6AG7	1.60	7C7	.90	46	1.33
6AH6	1.95	7E5	1.33	47	1.20
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6AU6	1.00	7R7	1.10	58	1.00
6AV6	.75	7S7	1.33	59	1.78
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6B4G	1.60	7X7	1.33	71A	1.00
6B5	1.60	7Y4	.90	75	.83
6B8GT	1.60	7Z4	.90	76	.83
6BA6	.90	10	1.80	77	.83
6BA7	1.20	12A	.68	78	.83
6BC5	1.00	12A6	1.45	79	1.33
6BC7	1.10	12A7	1.60	80	.68
6BE6	.90	12A8GT	1.00	81	1.95
6BF5	1.10	12AT6	.75	82	1.33
6BF6	.83	12AT7	1.45	83	1.33
6BG6G	2.40	12AU6	1.00	84	.90
6BH6	1.00	12AU7	1.20	85	1.10
6BJ6	1.00	12AV6	.75	89Y	1.10
6BN6	1.60	12AV7	1.60	117L7 M7GT	1.95
6BQ6GT	1.60	12AX7	1.20	117N7GT	1.95
6C4	.83	12BA6	.90	117P7GT	1.95
6C5GT	.83	12BA8	.90	117Z3	.75
6C6	1.00	12BE6	.90	117Z6GT	1.20
6CB6	1.00	12BF6	.83	VR150	.50
6CD6G	3.00	12BH6	.90	4B2B	.30
6D6	1.00	12F5GT	.90	483	.30
6D8G	1.60	12J5GT	.75	199V	.30
6F5GT	.83	12K7GT	.83	807	1.50
6F6GT	.83	12Q7GT	.90	813	6.75
6F8G	1.60	12S8GT	1.33	1619	.10
6G6G	1.33	12SA7	1.00	1622	1.75
6H4GT	1.33	12SA7GT	1.00	2050	2.25
6H6	.83	12SC7	1.10	2051	1.75
6H6GT	.83	12SF5GT	1.00	7193	.18
6J5GT	.75	12SF7	1.00	9001	.36
6J6	1.45	12SG7	1.00		
6J7G	1.00				

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PREMIER RADIO TUBE CO.

"Your Tube Source Since 1926"

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Chicago 6, Ill.

available to television technicians and others interested in antenna measurements.

This new publication contains actual measurements in db. gain over half-wave dipoles for all popular antenna types. The information contained in the bulletin is based on actual laboratory and field tests conducted by the company. The booklet is designed to assist service technicians in selecting the proper antenna for a given television installation.

Any television technician can secure a copy of this bulletin by writing the company direct or by contacting his "Taco" jobber.

REPLACEMENT DATA

Additional data sheets covering TV control and resistor replacements have just been released by *Clarostat Mfg. Co., Inc.* of Dover, New Hampshire.

Following up on the first release covering *RCA* chassis types, the latest sheets deal with additional *RCA* models and with *Du Mont, Stromberg-Carlson, Crosley,* and *Emerson* models. Handy reference charts indicate model and chassis, stock and part numbers, *Clarostat* catalogue number, list price, function, and description. Any standard TV control or resistor replacement can be readily identified in these data sheets, and ordered by corresponding catalogue numbers.

These 8½ x 11 sheets with standard binder punchings may be obtained directly from the company or through *Clarostat* distributors without obligation.

TV FIELD EQUIPMENT

A 6-page illustrated folder which covers the company's latest field television equipment has just been released by the Engineering Products Department of *Radio Corporation of America.*

Listed are an improved friction head, a new tripod, a new field desk, and a rotatable mount, and remote control for microwave parabola.

Distribution of the brochure (Form 2J-6881) entitled "New TV Field Equipment" is limited to broadcasters. Copies may be obtained from any of the *RCA* district sales offices or by writing to Department No. 522, *RCA Engineering Products,* Camden 2, N. J.

TV-AM-FM COILS

Stanwyck Winding Co. of Newburgh, New York has just issued a comprehensive catalogue covering its line of TV-AM-FM coils.

Included in the new 24-page catalogue are adapter plates, antenna coils, broadcast antenna coils, cartwheel i.f. coils, chokes, traps, FM coils, horizontal output transformers, horizontal linearity controls, i.f. transformers, long-wave antenna coils, long-wave oscillator coils, long-wave r.f. coils, loop antennas, marine antenna coils, midget i.f. transformers, oscillator coils, peaking coils, permeability-tuned units, r.f. chokes, r.f. coils, ratio detector coils, regenerative i.f. transformers, sound discriminators, syncro-

lok coils, syncro-guide coils, TV coils, wavetraps, and width controls.

Complete specifications are given on all of these units in addition to five pages of pertinent circuit diagrams.

SPEAKER BAFFLES

Acousti-Craft, 48 East San Jose Avenue, Burbank, California is currently offering copies of a six-page folder covering its line of speaker baffles.

The company's line includes 506 styles, colors, and sizes of baffles and range from wall speaker baffle units, bass reflex cabinets, corner speaker units, flush mount grilles, to reducing speaker baffles.

Available colors include walnut, blonde, ivory enamel, mahogany, and maple in wood cabinets; ivory, brown, red, and grey leatherboard, and a variety of colors in wood and leatherboard combinations.

Full details on all of these units are included in the new folder. Write the company direct for your copy.

RCA TUBE MANUAL

A new edition of the "*RCA* Receiving Tube Manual" has been announced by the Tube Department of *Radio Corporation of America*, Camden, New Jersey.

This well-known publication, long used by radio and television technicians, electronics engineers, schools, laboratories, hams, and experimenters, incorporates many new features reflecting new developments in electronics.

Designated RC-16, the new manual has been completely revised, expanded, and brought up-to-date. Containing over 300 pages, it is 25 per-cent larger than the previous (RC-15) edition.

The same complete coverage of technical data which characterized previous editions, ranging from elementary theory to descriptions of latest receiving tube applications, has been continued and enlarged in the new RC-16. In addition, the new manual, which now has a new "lie-flat" binding for ease of use, contains many new features. Detailed technical information is provided on more than 460 *RCA* receiving tubes and kinescopes including many discontinued types. The section on tube and circuit theory has been expanded and includes formulas and examples for calculation of power output, load resistance, and distortion for several classes of amplifier service as well as cathode follower design information. Television coverage includes kinescope installation data and handling information.

The manual is 50 cents and is available from *RCA* tube and parts distributors.

SERVICE WALL CHART

Of interest to radio and television technicians is the new and completely revised edition of the "Tell-U-How" wall chart which has just been issued by *Sprague Products Company* of North Adams, Massachusetts.

Lithographed in color, the 22 x 28 inch chart includes valuable service application data on condensers as well as descriptions of common circuit troubles and their remedies, complete color codes for all types of condensers, transformer color codes, resistor color codes, electrical formulas, and other useful and related service information.

The new chart is free of charge if secured from *Sprague* distributors. Orders by mail addressed to the company in North Adams, Massachusetts carry a ten cent postage and handling charge.

REPLACEMENT MANUAL

A 16-page "Television Replacement Capacitor Manual" which lists critical replacement condensers for 497 television models, produced by 55 different manufacturers, is currently available from distributors of the *Sprague Products Company,* North Adams, Massachusetts.

Designed specifically for the television technician, the new manual (Form M-461) lists all original equipment parts by their manufacturers' part numbers and shows the recommended replacements which are regularly available from television parts distributors.

STRIP THERMOSTATS

Stevens Manufacturing Company, Inc. of Mansfield, Ohio is currently offering copies of a new bulletin which describes in detail the company's Type S bi-metal strip thermostats.

These units have been designed for use in appliances and industrial apparatus and schematic diagrams showing operating principles and dimensions have been included in the bulletin. Also given are photographs of the 13 standard Type S models and typical thermostat response curves.

A copy of this data sheet is available on request.

GEIGER COUNTERS

The New York University College of Engineering is currently offering a four-page booklet to those interested in various phases of Geiger counter circuitry and operation.

Entitled "Counters," the booklet has been prepared by Dr. Serge A. Korff, a well-known authority on Geiger counters. The folder is illustrated with a dozen drawings and the text explains the elements of a Geiger counter as well as the behavior of electrons, positive ions, ion clouds, and impulses.

Another section of the folder deals with penetrating, non-penetrating, and decaying cosmic ray particles.

The author concludes with a discussion of the use of Geiger counters for oil prospecting, thickness gauges, monitoring of x-ray machines, radioactive wastes, and in locating lost tubes of radium.

The booklets are ten cents each and may be secured from V. W. Palen, Bureau of Public Information, New York University College of Engineering, New York 53, N. Y. —30—

ARROW "The Home of Values!"

BC 906—Frequency Meter

Range 150-225 MC with modification possible for lower frequencies of TV, etc. Contains 0-500 DC microammeter and uses Battery pack of 1.5 V and 45 VDC.
Like New—Less Batteries..... **$10.95**

HERMETICALLY SEALED CHOKES

10 H.	100 M.A.	59c
3.7 H.	145 M.A.	59c
10 H.	20 M.A.	39c

CONDENSERS

	Each
1 mfd. 6000 VDC. OIL FILLED	$1.98
.00025 mfd. 25000 VDC. OIL FILLED	2.95
1 mfd. 600 VDC. OIL FILLED	.24
	5 for 1.00
50 mmfd—5KV—5 Amp. Vacuum Cond	1.19

TUBE SPECIALS!

211	$0.39
307A	5.50
703A	1.89
723A B	12.95
724B	1.89
803	2.89
805	3.29
807	1.89
813	6.95
832	2.95
832A	7.95
837	1.19
841	.49
860	4.95
864	.24

Dynamotors

DM 32A	PE 73
DY2 ARR2	PE 94
DA 1A	PE 86
DM 34	DM 28
DM 35	DM 33
DM 36	PE 206
DM 37	PE 101
DM 40	DM 53A
DY 12	PE 218
DY 17	MG 149
BD77	

Many other types are also in stock. Your inquiry is invited. Prices upon Request.

RADIO EQUIPMENT
RC 100 B

This equipment made by General Electric, was designed for ground use as an identification of friendly aircraft.

CABINET CH-118 is of the Standard 19 inch rack type structural steel frame with runner angles for each of the units. A full length access door with safety interlocks forms the rear of the cabinet..... **$34.95**

TRANSMITTER BC-769 is designed to transmit RF pulsed signals at 470 megacycles with the use of the two type 15E Tubes operating in push-pull with resonant grid, plate and filament lines.....less tubes.. **$19.95**

KEYING UNIT BC-770 furnishes the pulse of the transmitter.....less tubes.. **$14.95**

RECEIVER BC-768 was used to detect the 493.5 megacycle reply pulses from the interrogated station and to sufficiently amplify these signals for oscilloscope observation.....less tubes.. **$19.95**

RECTIFIER RA-52 produces the high voltage. An O-15 kilowatt DC Meter is connected across the output of the filter to measure the voltage fed to transmitter BC-769, while an O-20 milliammeter is connected to the ground return to measure the average current drawn with tube.... **$74.50**

AIR COMPRESSOR M-349 together with 12 feet of ¼ inch soft copper tubing and necessary hardware is used to fill and maintain transmission lines with dry air under pressure. Operation is direct from 110 V AC 60 cycles.. **$42.50**

OVEN M-348 is furnished for removal of moisture from the dehydrating cylinders of the compressor. It too operates from 110 V AC 60 cycles.. **$29.50**

FREQUENCY METER BC-771 is used for frequency checking and for tuning operations on Radio Transmitter BC-769 and Radio Receiver BC-768. It is a separate unit mechanically and has its own power supply, which requires a 110 to 120 Volt, 50 to 60 cycle source..... **$49.50**

TECHNICAL MANUAL TM11-1113B covering entire equipment..... **$ 5.00**

COMPLETE UNITS are available at amazing low price . . . WRITE TODAY!

BC-604 Transmitter FM 20-28 MC

11 and 15 meters. Can be operated on 10 meters—10 channel push button crystal. With all tubes and meter but less dynamotor. Excellent Condition.....$19.95

Crystals—
Set of 80.....$19.95

BC 603

Receiver—Good. Used $24.95

Complete **SCR-508** Installation available—price and information upon request.

Flap Pitch Motor

24 VDC. will operate on AC—3300 or 11,000 R.P.M. Complete with gear box and limit switches....each $2.95

MISCELLANEOUS SPECIALS!

	Used	New
ASB 7 Indicator Scope	$12.95	——
MN 26 C	17.50	$24.95
RA 10 DA Receiver	17.50	24.95
RT7 APN1 Transceiver	6.95	9.95
APN 1 Complete	——	24.50
BC 347 Interphone Amplifier	——	2.95
I-70 Tuning Meter	——	.89
BC 461 Veeder Root Counter	——	.59
BC 442 Less Condenser	1.49	1.95
APS 13 UHF Antenna, Pair	——	.98
FL 8 Filter	——	2.95
I-97 Bias Meter	3.95	4.95
RM 29 Remote Telephone Control	7.95	9.95
RL 42 Antenna Gearbox Motor and Reel	4.95	7.50
TS 10—Sound powered phones	6.50	——

BC 1066 B—150 to 225 MC Portable Receiver adaptable to many amateur uses. In Canvas Carrying Bag. Used.....$5.95

Tuning Units for **BC 375**—Presently most numbers are available in excellent condition with case at.....$2.95 ea.

One Tube Interphone Amplifier—Small compact aluminum case fully enclosed. 2¼"x3¾"x5¾" Less Tube.....79c

96Q1 Complete Autotune assembly with motor and frame as used in **ARC-1** Transmitter. New $35.00

BC 709 Battery operated lightweight interphone amplifier. Complete with tube and shock mount, but less battery.....New $3.95

SCR 183 Complete.....New $49.50

220 MA Circuit Breaker.....New .59

Collins VFO Dial—S calibrated ham bands from 3.2 Mc to 32 Mc; complete with pointer, gears, logging dial and flywheel. Scale 6" on 8" plate New.....each .95

C-18—Antenna coil assembly slug tuned used in BC 603 receiver. Frequency range 20-27.9 Mc.—fully shielded.....New. 10 for $1.95

I 82 F—Five Inch 360 degree compass indicator and Selsyn receiver.....New $4.95

A-81-2 Transmitter selsyn for I82 indicator...$2.45 (Both I82F & Trans. Selsyn for $7.00)

MC 385A—Headset Adapter.....New 49c

Information and Prices on Request

RTA 1B Transceiver
TA 2J24 Transmitter and **MP 10G** Power Pack
SCR 269 Compass Installation
R 5 ARN 7 Compass Installation
MN 26 Compass Installation
AN APR1 Receiver and Tuning Units
ASB7 Complete Radar Installation

IS-185 Weston Voltmeter Model 433—0 to 150 VAC 25 to 2400 cycles. New..... **$24.95**

AS-138/ARN—10 inch streamline loop as used with direction finding receivers. Fixed position, it is ideal for planes, boats, automobiles. New **$1.95**

HEADSETS—MIKES

HS-30 Hi Imp. Headsets	New $1.50	Used $0.79
T-24 Hi Imp. Carbon Mike	New	1.19
T-30 Throat Mike	New	.98
T-45 (or Navy) Lip Mike	New	.98

Microphone and Headgear

This RCA unit consists of Dynamic hand microphone with switch and Dynamic headset with cushioned ear pieces. Complete with cord assembly. Brand New.....$1.59

BC 788 Seventeen Stage Receiver Transmitter designed for Radio Altimeter at 440 MC. Contains 30 MC IF Strip. (6 stage). Excellent internal condition with tubes and crystal removed.....$9.95

R-18 APS3 Receiver-Amplifier containing circuits as follows: Blocking oscillator, CRT gate circuit, Azimuth and Vertical sweep circuit, five stage 30 MC IF strip with AFC circuit.
Used Less Tubes $4.95

COMMAND (SCR 274 N) EQUIPMENT

	Used	New
BC-453	$12.95	——
BC-454	5.95	——
BC-455	7.95	$9.95
BC-456	——	2.95
BC-457	5.95	——
BC-458	5.95	8.95
BC-696	14.95	24.95
BC-450—3 Receiver Remote Control	.89	1.95
BC-442	——	2.95
3 Receiver Rack	1.95	——
2 Transmitter Rack	1.50	——

Complete Command set as removed from aircraft—3 receivers—2 transmitters—Relay unit—control boxes—mounting racks—plugs—modulator and dynamotors—crated Set. **$34.50**

SURPRISE PACKAGE

20 lbs. Ass't radio parts. A $25.00 value for only **$1.95**

1D6/APN4 Scope unit complete with 5CP1 cathode ray tube and shield and all parts except smaller tubes and crystal. Used.....**$9.95 ea.**

MONTHLY SPECIAL

MN 26 Y Compass Receiver, twelve stage superhet covering frequencies of 150 to 325 KC; 325 to 695 KC; and 3400 to 7000 KC in three bands..

These units are brand new but with Dynamotor, Band switch motor and tubes removed. Schematic Furnished. While they last..$4.95 each

PP2 APQ5 Power Supply Chassis less tubes a good buy for salvage purposes.....each $1.49

BC 620

Receiver-Transmitter—2 crystal channels—20 to 27.8 MC FM—13 tubes. Metered, Plate and Filament.....Used $9.95

PE 97 or **PE 117** or **PE 120** Power Supply for above 6-12 volt vibrator type.
Used less tubes, vib. & con.....$2.95
Used, complete.....$6.95

FT 250 Mount for both BC 620 and PE 97 New $1.50

PP12A/APS—3 Power Pack

used to supply many voltages for APS 3 equipment from an 800 cycle source. A good parts buy less tubes.....$1.49

R 4 ARR2 Receiver

used for reception of double AM carrier in the range of 234 to 258 MC. New units less tubes and dynamotor.....$2.95

RT7/APN1 TRANSCEIVER UNIT—

Used as an altimeter, it may be converted for signaling control circuits, etc. Complete with 14 tubes and dynamotor they are in good used condition at the amazingly low price of..... **$6.95**

TS-293/CPA 5 Range Calibrator

designed for testing Radar set AN/CPA5, it contains a good 110 volt, 60 cycle power supply, plus other circuits. Tubes have been removed, but the power supply alone is a terrific buy at .....$3.95 each

O-27 CPA5 Range notch generator is similar to the above described TS/293/CPA5 and will be substituted when necessary.

Note: At this low price we are unable to answer technical inquiries or furnish other information on these two above items.

SN1/APQ 5 Synchronizer Unit chassis consists of resistors, condensers, sockets, relays and other salvageable parts. less tubes.....each $2.95

All shipments FOB warehouse. 20% Deposit required on all orders. Minimum order accepted—$5.00. Illinois residents, please add regular sales tax to your remittance.

ARROW SALES, Inc.
Dept. N
1712-14 S. Michigan Ave., Chicago 16, Ill.
PHONE: HArrison 7-9374

THE AD-VISER

5 DISPLAYING YOUR MERCHANDISE

By IRVING SETTEL

SOME years ago, a radio and television store used a full page advertisement in a local newspaper in an attempt to sell overstocked radios. The advertisement was composed exclusively of copy. No illustration was used. However, the story was readable and offered some very interesting price inducements. The promotion "pulled" but far from anticipated volume. Sorely distressed by the results, the retailer confronted the local newspaper advertising manager. Together, they decided to rerun the advertisement but this time to include a picture of the radios on sale. The results were amazing! The *same* advertisement with the *same* headline and copy in the *same* newspaper "pulled" so well that much of the stock was sold out in a short time.

What was the reason for this great difference in results? Did the picture of the radios make so great a difference? Although there is no way to arrive at a positive answer, it can be assumed that the simple illustrations actually made the difference between success and failure. The radios displayed in the ad attracted the readers' attention to the story of the sale. Once the story had been understood, a potential customer was born.

The importance of illustrations in advertisements has long been recognized by outstanding merchants. Yet there are still a few who make the serious mistake of completely eliminating pictures. The major offenses are committed by retailers who make a poor choice of subject matter and method of presentation.

Your advertisement should be considered your "impersonal window or display case." It is advisable to show the same items which are .currently being displayed in your windows or store. If possible, avoid using stock photographs and drawings unless they *actually* represent items within your store. Lay out the merchandise in your advertisement as interestingly as possible. Use short descriptive copy close by. Wherever you can, use prices. They are always appreciated by present day economy-minded readers.

One problem which often presents itself to the advertiser is the selection of the kind of illustration to use. Among the many types available to you both original and from mat services, are the following:

1. Wash Drawings
2. Pen and Ink Drawings
3. Dry Brush Drawings
4. Photographs

The advertiser is often confronted with the choice of one of the above four. The selection should depend upon the effect desired. Each medium serves its own purpose well.

WASH DRAWINGS are used to portray a subtle gradation of tone. It is a drawing made with black or grey water color, applied with a brush. By varying the amount of lampblack and water, gradations from light to dark grey and solid black may be obtained.

Wash drawings are used in illustrations to portray leather, metal, and other reflecting surfaces for items of all sorts. In many cases, wash is more satisfactory than photographs because the artist can glorify the subject by adding or subtracting certain factors. Wash is excellent for all types of radios. However, there is an added expense since it is necessary to make a halftone engraving to capture the tones.

PEN AND INK DRAWINGS are well adapted to illustrations requiring strong contrasts and sharp outlines. No variation in tone is possible with this technique. Pen and ink is used in drawing many types of radios and television sets. It is excellent for fine details and delicate lines. Because there is no gradation of tone in line drawings, halftone engravings are not necessary and *savings will result.*

DRY BRUSH DRAWINGS are similar in production to pen and ink. No halftones are necessary. Ink, on a partly dried brush, is used to produce a "tonal" effect. Most subjects look good in dry brush and while production is inexpensive, the art work may cost a little more.

PHOTOGRAPHS are best when an impression of realism is required. Faithful portrayal of all merchandise is possible here. Many people believe that photographs are necessarily factual. We know that this may not be true. Modern photographers can perform miracles with their cameras. In addition to realism, a photograph is an excellent medium to use when it is necessary to illustrate a multitude of items. There may be so many that it becomes too expensive and impractical to draw by hand. If, for example, you wanted to show a vast stock of radios

1000 KC crystal BT cut	$3.95
3" scope shield	1.29
2 speed dial drive for ¼" shaft ratios 5:1 1 to 1	.39
ATC 100 mmfd air trimmer screwdriver shaft	.29
Sigma Sens. Relay 8000 ohms	1.98
Centralab 850 S 50MMF 5KV BUTTON COND.	.39
500 watt 12.5 ohm power rheostat	3.49

R·H·S

SPECIALS OF THE MONTH

50 mmfd 5 KV vacuum condenser	$1.49
6v, 12v vibrators any type	.98
Rotary switch Mycalex, 2 deck SP3T	.39
1 mfd 5000v oil condenser	2.98
2 mfd 3000v oil condenser	3.25
3 mfd 4000v oil condenser	3.95
24 mfd 1500v DC 3KV flash. Excellent for speed lamp	3.95

TUBES!! BRAND NEW! STANDARD BRANDS! NO SECONDS! COMPARE! TUBES!!

OA3/VR75	$1.29
OB3/VR90	1.29
OC3/VR105	1.49
OD3/VR150	1.29
1B22	3.45
1B23	12.50
1B24	6.95
1B26	3.95
1B27	24.50
1B29	2.75
1B32	8.95
1B36	24.96
1B38	32.50
1N21 Xtal	1.25
1N21A Xtal	2.25
1N21B Xtal	3.25
1N22 Xtal.	1.35
1N23 Xtal.	2.25
1N23A Xtal	3.25
1N23B Xtal	4.95
1N27	1.69
1N34	1.05
1N34A	1.05
1P23	3.95
1P24	1.79
1P36	2.95
1S21	6.95
2AP1	8.95
2AP5	6.95
2C21/RK33	.69
2C22/7193	.49
2C26A	.49
2C34/RK34	.89
2C39	24.50
2C40	4.95
2C43	14.95
2C44	1.49
2C46	7.50
2C51	5.75
2D21	1.79
2E22	1.95
2E24	4.89
2E26	3.69
2E30	2.29
2J21A	9.95
2J22	8.45
2J26	29.50
2J27	29.50
2J30	39.50
2J31	39.50
2J32	39.50
2J33	39.50
2J34	39.50
2J36	97.50
2J37	12.75
2J38	12.75
2J39	39.50
2J40	39.50
2J46	39.50
2J48	29.50
2J49	39.50
2J50	22.50
2J54B	39.50
2J55	97.50
2J61	49.50
2J62	49.50
2K25/723AB	24.95
2K28	39.50
2K29	24.50
3AP1	9.95
3B22/ELIC	2.95
3B23/RK22	4.85
3B24	5.95
3B24W	7.95
3B25	4.65
3B26	3.95
3B27	3.95
3B28	8.95
3BP1	8.95
3C22	64.50

3C23	$9.95
3C24/24G	2.25
3C30	2.95
3C31/C1B	3.49
3C45	12.75
3CP1	2.25
3CP1-S1	2.95
3DP1	4.95
3DP1A	6.95
3DP1-S2A	8.95
3D21A	1.98
3E29	14.95
3EP1	5.95
3FP7	3.95
3GP1	4.75
3HP7	3.95
4-65A	14.21
4-125A	26.95
4-250A	29.95
4AP10	4.95
4B22/EL5B	9.95
4B24/EL3C	7.95
4B25/6CF	8.95
4B26/2000	8.95
4B28	4.95
4B32	9.95
4C27/CV92	49.50
4C35	29.50
4D22	12.95
4D32	14.95
4E27/257B	17.95
5AP1	3.69
5AP4	3.69
5BP1	5.95
5BP4	5.95
5CP1	4.95
5CP7	4.95
5C22	49.55
5D21	24.50
5FP7	1.95
5GP1	4.95
5JP1	24.45
5JP4	24.45
5J23	12.95
5J29	12.95
5J30	49.50
5J32	99.50
5LP1	13.95
5NP1	5.95
6AS6	3.69
6C21	22.50
6F4	5.95
6J4	5.95
7BP7	8.95
9GP7	14.95
9JP1	14.95
9LP1	19.95
9LP7	14.95
10BP4	18.95
7DP4	17.95
10	.49
12DP7	16.95
12GP7	16.95
12HP7	16.95
12LP4	22.50
15E	1.19
15R	.89
16AP4	42.50
16CP4	42.50
19T8	1.29
23D4	.45
28D7	.98
30 Special	.59
35TG	4.95
45 Special	.39
53A	5.95
75TL	6.95
100R	.89
100TH	9.95
121A	2.98
203A	8.95

204A	$69.50
211	.69
212E	49.50
215A	.19
217C	8.95
227A/5C27	5.95
249C	3.95
250R	12.95
250TH	21.50
250TL	21.50
274A	5.50
274B	2.65
276A	9.95
293A	2.98
294A	5.75
300B	9.95
304TH	27.50
304TL	29.95
305A	34.95
307A/RK75	5.95
310A	8.95
316A	.65
323A/B	24.50
327A/5C37	4.95
328A	13.95
331A	12.95
350A	8.95
350B	2.95
368AS	7.95
371A	1.49
371B	.98
388A	2.75
393A	6.95
394A	4.95
417A	12.95
434A	4.95
446A	4.95
446B	1.79
450TH	47.50
450TL	44.50
527	12.75
559	1.39
562	97.50
575A	13.95
701A	5.95
702A	3.95
703A	7.95
704A	1.05
705A	.89
706BY	39.50
706CY	39.50
706FY	42.50
706GY	42.50
707B	17.95
708A	4.95
709A	3.95
710A/8011	1.75
713A	1.45
714AY	6.95
715A	7.95
715B	12.95
715C	24.50
717A	1.69
721A	2.59
722A	2.95
723A	9.95
723A/B	14.95
724B	3.89
725A	7.95
726A	6.95
726B	29.50
726C	49.50
730A	12.95
750TL	79.50
800	1.95
801A	.49
802	4.49
803	4.49
804	9.95
805	4.49
806	29.95
807	1.98
808	4.49

809	$2.45
810	9.95
811	2.95
812	2.95
812H	6.90
813	8.95
814	3.95
815	2.95
816	1.19
826	.98
828	12.75
829	12.95
829B	14.95
830B	3.95
832	5.95
832A	8.95
833A	37.50
836A	3.95
837	1.69
838	2.95
841	.45
843	.39
845	4.95
849	29.50
851	69.50
852	29.50
860	6.95
861	29.50
864	.39
865	1.45
866A	1.39
866JR	1.29
869B	39.50
872A	2.49
874	1.49
876	.59
878	2.25
884	1.49
885	1.49
902	8.95
905	3.59
908	7.95
918	1.69
919	2.79
922	.98
923	1.05
927	1.59
930	1.05
931A	4.95
954	.39
955	.45
956	.45
957	.45
958	.45
959	.65
991/NE16	.39
1603	3.25
1613	1.25
1614	1.95
1616	.98
1619	.29
1622	1.98
1624	1.98
1625	.45
1626	.35
1629	.25
1630	.98
1631	1.29
1632	.79
1633	.75
1634	.75
1636	3.25
1638	.65
1644	.98
1654	2.39
1665	1.45
1851	1.89
1960	.79
1961	4.99
2050	1.25
2051	.65
8005	5.95
8011	1.75

8012	$3.95
8013	2.95
8014	29.95
8020	1.29
8025	5.95
9001	2.25
9002	1.49
9003	1.49
9004	.45
9005	2.35
9006	.29
C1JA	9.95
C5B	9.95
C6A	7.95
C6J	6.95
C100D	1.49
CK502AX	2.95
CK503AX	2.95
CK505AX	2.25
CK506AX	2.25
CK507AX	2.25
CK512AX	2.25
CK517AX	8.45
CK1005	.89
CK1006	.95
E1148	.35
EF50	.69
F123A	8.75
F127A	22.50
F128A	89.50
F606	37.60
F660	79.50
FG17	3.95
FG27A	8.75
FG32	7.95
FG57	14.95
FG81A	3.95
FG105	8.95
FG172	29.50
FG146	8.95
FG434A	4.95
FG451	.89
FG502A	1.85
GL562	97.50
GL592	14.95
HF125	14.95
HF300	19.95
HY114B	.79
HY115	.79
HY615	.29
KC4	37.50
KU610	6.95
ML101	69.50
REL21	3.25
RK20	9.95
RK25	4.49
RK33	.69
RK34	.89
RK48A	4.49
RK59	1.49
RK60/1641	.98
RK65	24.50
RK72	.59
RK73	.59
RX21A	2.95
RX12D	8.95
V70D	6.95
VR78	.69
VR91	1.49
VR92	.98
VT127A	3.95
VT158	14.95
VU29	2.95
VU111	1.49
WL468	12.95
WL530	12.75
WL531	12.75
WL532	2.95
WL578	1.29
WL616	37.50
WL619	18.95
WL677	34.50
WL681	22.50

0A2
0A4G
0B2
0Z4
01A
1A3
1A4P
1A5GT
1A6
1A7GT
1AB5
1B3/8016
1B4
1B5/25S
1B7GT
1C5GT
1C6
1C7G
1D5GP
1D7G
1D8GT
1E5GT
1E7G
1F4
1F5G
1G4GT
1G6GT
1H4G
1H5GT
1H6GT
1J6GT
1L4
1LA4
1LA6
1LB4
1LC5
1LC6
1LD5
1LE3
1LG5
1LH4
1LN5
1N5GT
1P5GT
1Q5GT
1R4
1R5
1S4
1S5
1T4
1T5GT
1U4
1V
2A3
2A4G
2A5
2A6
2A7
2B7
2V3G
2X2
2X2A
3A4
3A5
3A8
3B7/1291
3D6/1299
3LF4
3Q4
3Q5GT
3S4
3V4
5R4GY
5T4
5U4G
5V4G
5W4
5X4G
5Y3GT
5Y4G
5Z3

DUE TO CURRENT NATIONAL EMERGENCY AND THE CRITICAL RECEIVING TUBE SHORTAGE, TUBES WILL BE SHIPPED AT PREVAILING PRICES. WE WILL QUOTE ON LARGE OR SMALL QUANTITIES.

5Z4
6A3
6A4LA
6A6
6A7
6A8
6AB7
6AC5GT
6AC7
6AD7G
6AE6G
6AF6G
6AG5
6AG7
6AH6
6AJ5
6AK5
6AK6
6AL5
6AQ5
6AQ6
6AR5
6AT6
6AU6
6AV6
6B4G
6B6G
6B7
6B8G
6BA6
6BE6
6BF6
6BG6G
6BH6
6BJ6
6C4
6C5
6C6
6C8G
6D6
6D8G
6E5
6F5
6F6
6F6GT
6F7
6F8G
6G6G
6H6
6H6GT
6J5
6J5GT
6J6
6J7
6J7GT
6K5GT
6K6GT
6K7
6K8
6L5G
6L6
6L6G
6L6GA
6L7
6L7G
6N7
6Q7
6R7
6S7G
6S8GT
6SA7
6SC7
6SD7GT
6SF5
6SF5GT
6SF7
6SG7
6SH7
6SJ7
6SK7
6SL7GT

DUE TO CURRENT NATIONAL EMERGENCY AND THE CRITICAL RECEIVING TUBE SHORTAGE, TUBES WILL BE SHIPPED AT PREVAILING PRICES. WE WILL QUOTE ON LARGE OR SMALL QUANTITIES.

6SN7GT
6SQ7
6SR7GT
6SS7
6ST7
6SU7GTY
6SV7
6T7G
6T8
6U5G
6U6GT
6U7G
6V6
6V6GT
6W4
6W7G
6X4
6X5GT
6Y6G
6Y7G
6Z7G
6ZY5G
7A4/XXL
7A5
7A6
7A7
7A8
7AG7
7B4
7B5
7B6
7B7
7C4
7C5
7C6
7C7
7E5
7E6
7E7
7F7
7H7
7K7
7L7
7N7
7Q7
7R7
7S7
7V7
7W7
7X7
7Y4
7Z4
12A
12A6
12A7
12A8GT
12AH7GT
12AL5
12AT6
12AT7
12AU6
12AU7
12AV6
12BA6
12BE6
12C8
12F5GT
12H6
12J5GT
12J7GT
12K7GT
12K8
12Q7
12SA7GT
12SC7
12SF5
12SF7
12SG7
12SH7

DUE TO CURRENT NATIONAL EMERGENCY AND THE CRITICAL RECEIVING TUBE SHORTAGE, TUBES WILL BE SHIPPED AT PREVAILING PRICES. WE WILL QUOTE ON LARGE OR SMALL QUANTITIES.

12SJ7
12SK7
12SL7
12SN7
12SQ7
12SR7
12Z3
14A4
14A7
14B6
14F7
14F8
14H7
14J7
14N7
14Q7
14R7
19
24A
25L6GT
25Z5
25Z6GT
26
27
28D7
30
31
32
32L7GT
33
34
35/51
35A5
35B5
35C5
35L6GT
35W4
35Y4
35Z3
35Z4
35Z5
36
37
38
39/44
41
42
43
45
45Z3
45Z5
46
47
48
49
50A5
50B5
50C5
50L6GT
50Y6
53
56
57
58
59
70L7
71A
75
76
77
78
80
82
83
83V
84/6Z4
85
89Y
117L7/M7
117N7
117P7
117Z3
117Z6

DUE TO CURRENT NATIONAL EMERGENCY AND THE CRITICAL RECEIVING TUBE SHORTAGE, TUBES WILL BE SHIPPED AT PREVAILING PRICES. WE WILL QUOTE ON LARGE OR SMALL QUANTITIES.

SELENIUM RECTIFIERS
FULL WAVE BRIDGE TYPE

Input 0-20V AC Type No.	Current	Output 0-14.5V DC Price
20D1	1.2 Amps.	$ 2.49
20E1	2.4 Amps.	3.49
20F1	6.4 Amps.	4.95
20K1	13.0 Amps.	8.95
20J1	17.5 Amps.	11.95
20K2	26.0 Amps.	17.95
20K3	39.0 Amps.	24.95
20K4	52.0 Amps.	29.95
20K5	65.0 Amps.	35.95
0-40v AC	**Current**	**0-34v DC**
40D1	.6 Amps.	$ 2.95
40E1	1.2 Amps.	3.89
40F1	3.2 Amps.	5.25
40K1	6.0 Amps.	9.95
40J1	9.0 Amps.	12.95
40K2	12.0 Amps.	18.95
40J2	18.0 Amps.	22.45
40K4	24.0 Amps.	32.50
40K5	30.0 Amps.	34.95
40J4	36.0 Amps.	39.50
0-120v AC	**Current**	**0-100v DC**
40D1A	.6 Amps.	$ 7.85
40E1A	1.2 Amps.	10.76
40F1A	3.2 Amps.	16.65
40K1A	6.0 Amps.	24.75
40J1A	9.0 Amps.	32.95

CENTER TAPPED RECTIFIERS
Single Phase Full Wave Bridge

10-0-10v AC	Current	0-8v DC
10D1	1.2 Amps.	$ 1.89
10E1	2.4 Amps.	2.25
10F1	6.4 Amps.	3.87
10K1	12.0 Amps.	4.95
10J1	16.0 Amps.	7.95
10K2	24.0 Amps.	10.75
10K3	36.0 Amps.	14.75
10K4	48.0 Amps.	17.75
10K5	60.0 Amps.	19.95
10K6	72.0 Amps.	25.57
10K7	84.0 Amps.	27.95
10J6	96.0 Amps.	32.50
10K10	120.0 Amps.	42.50

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TRANSFORMERS—115V 60 CY
HI-VOLTAGE INSULATION

2700v @ 2 MA; 6.3v @ .6A; 2.5v @ 1.75A	$ 4.45
2500v @ 15 MA	3.49
1600v @ 4 MA; 350-0-350v @ 150 MA; 6.3v @ 9A	4.45
1540v @ 5 MA; 340-0340v @ 300 MA	4.35
1120-0-1120v @ 500 MA; 12v CT @ 14A; 2.5v @ 10A; 17v @ 2.5A; 32v @ 25 MA; 115/230 Pri	16.95
925v @ 10 MA; 525-0-525v @ 60 MA; 2X5v @ 3A; 6.3v CT @ 3.6A; 6.3v @ 2A; 6.3v @ 1A	4.85
700-0-700v @ 300 MA	6.49
500-0-500v @ 175 MA	4.55
430-0-430v @ 340 MA; 6.3v CT @ 6.3A; 5v @ 6A	4.85
425-0-425v @ 75 MA; 6.3v @ 1.5A; 5v @ 3A	3.65
415-0-415v @ 60 MA; 5v CT @ 2A; 115/230 Dual Pri	4.25
405-0-405v @ 150 MA; 6.3v CT @ 2½A; 5v @ 3A; 2.5v CT @ 5A	4.35
400-315-0-100-315v @ 200 MA; 2x6.3v @ 9A; 5v @ 3A; 2.5v @ 2A	5.35
500-385-0-385v @ 200 MA; 3x6.3v @ 6A; 5v @ 3A; 2.5v @ 2A	4.75
375-0-375 @ 175 MA, 5v @ 3A, 6.3v @ 5A, 78 v @ 1A	3.79
325-0-325v @ 12 MA; 255-0-255v @ 240 MA	4.25
300-0-300v @ 65 MA; 6.3v @ 2.5A; 6.3v @ 1A; 2x5v @ 2A	3.25
80-0-80v @ 225 MA; 5v @ 2A; 5v @ 4A	2.97
0-17.4/21.6/25.8v @ 400 MA; 6.4v @ .5A; 2.6v CT @ 2.5A Pri 115/230	3.85
13.5v CT @ 3.25A	2.17
12.6v CT @ 10A; 11v CT @ 6.5A	6.35
3x10.3v CT @ 7A..$6.95 6.3v @ 1A	.98
6.5v @ 12A; 6.3v @ 2A; 115v @ .1A	3.50
6.5v @ 8A; 6.5v @ 6A; 2.5v @ 1.75A	4.17
6.3v @ 1A; 2.5v @ 2A..$2.29 4-0-4v @ 1A	.87
6.3v CT @ 3.5A; 2x2.5v CT @ 3A	2.97
5v CT @ 20A; 10 KV INS	8.95
.6v @ 15A RMS	1.47

TRANSFORMERS—220v 60 Cyc

512.5-0-512.5 @ 427 MA	$ 5.35
3x5v @ 6A; 4v @ .25A	2.95
3x6.3v CT @ 3A; 6.3v CT @ 1.6A	2.95
10v CT @ 6.5A; 6.3v CT @ 2.5A; 6.3v CT @ 1.8A 220/440 Pri	3.95
Step Up/Down 110/220, 500 watt	10.95
Step Up/Down 110/220, 220/440 600 watt	14.95

EQUIPMENT SPECIALS

ATR Inverter 12v DC in 110v AC Out 125 w Int. 100 w Cont.	New	$14.95
AN/CRW-2 UHF Receiver Less Tubes	New	5.95
BC433 Receiver	Good	24.94
BC456 Modulator	Good	1.98
BC434A Control Box/BC433	Used	1.95
BC459 Transmitter	Good	10.95
BC778 Gibson Girl	Good	3.95
BC950A-121 Xmitter 100-156 MC	New	69.50
BC1016 Tape Recorder	New	459.50
BC1206B Beacon Receiver, Less Tubes	Good	3.95
CF1 Navy Unit w/200KC Crystal	New	14.95
DM 19 Dynamotor 12v DC in 500v 200 MA Cont. Out	Good	6.95
MN26C Compass Receiver	Good	24.95
M110 Dynamic Chest Mike	New	3.95
PE94 Dynamotor/SCR522	Good	1.98
PE97A Vibrator Power Supply	New	6.95
PE103 Dynamotor	Like New	29.95
R89/ARN5 Receiver Less Tubes, Covers	Good	14.95
SCR518 Altimeter Complete	New	97.50
T17 Carbon Mike	Used	1.59

FILTER CHOKES HI V INS

.025 HY @ 1.36A	$1.98	10 HY @ 250 MA	$3.15
.05 HY @ 15A	7.95	10/20 HY @ 85 MA	1.49
.065 HY @ 2.5A	2.49	13 HY @ 130 MA	1.55
.1 HY @ 15A	6.95	13 HY @ 250 MA	2.95
2 HY @ 175 MA	1.49	14/3.5 HY @ 40/400 MA	6.95
3 HY @ 50 MA	.39	15 HY @ 25 MA	.59
5 HY @ 1A	13.95	15 HY @ 70 MA	1.15
5 HY @ 70 MA/.2 HY 350 MA Dual	2.39	26.5 HY 125 MA	1.98
10 HY @ 700 MA	11.95	200 HY @ 10 MA	2.95
10 HY @ 55 MA	.89	325 HY @ 2 MA	2.95
10 HY @ 100 MA	1.49	600 HY @ 1 MA	2.95

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and television sets, it would be more practical to use photographs.

Photos usually end up a little more expensive than art work. They almost always require retouching and halftone screens are necessary for reproduction.

The use of stock photographs or mats are all right when you can match them up with your own merchandise. Do not illustrate items in your advertisements which you cannot supply to the public upon request. Stock illustration books or mat services may or may not carry your items. If they do, you will save the cost of an artist or photographer.

If it is necessary for you to hire an artist, you can keep your costs down to a minimum by employing some of the following suggestions:

1. Remember that artists differ in techniques and abilities as well as in their prices. Always choose a specialist in a particular field. It may cost a little more at the time but will save you money in the long run.

2. Always give an artist *complete* instructions to avoid mistakes and "re-do's." Always demand first to see a rough so that you can see what you are getting.

3. Try to anticipate your art work requirements in advance. In this way, it will be possible to order art work in quantity and thereby afford a saving. Artists will always charge less for quantity work.

4. Always ask the engraver for the original art work. You may have some use for this in the future and you can use the same work over and over again. This holds true for engravings. Do not hesitate to re-use an old photo or drawing if you have the item in stock. If you change layout and copy, it will appear completely new to the average reader.

Remember that the main function of illustrations is to attract attention through interest, novelty, and contrast. Hundreds of years ago, the Chinese discovered that "one picture is worth a thousand words." This proverb is truer than ever today.

-30-

Technical BOOKS

"TRAINING THE LOCAL ANNOUNCER" by Samuel B. Gould & Sidney A. Dimond. Published by *Longmans, Green and Co.*, New York. 200 pages. Price $2.50.

This little handbook, written by two of the faculty members of the Boston University Division of Radio and Speech, is a practical approach to a problem in professional training that has received very little formal attention from educators and station management.

Since most of the big-name announcers started in a small way with local stations the authors have assumed that those who follow in their footsteps will make their radio debuts in a similar manner. Because of this, the text material covers more than just purely announcing techniques. Most small stations utilize their personnel to the fullest extent by having announcers "double in brass" as disc jockeys, time salesmen, public relations men, etc., so some information on these varied duties is also included.

The book contains a large number of drills and exercises for the tyro announcer, including lists of difficult proper names and unusual words for pronunciation practice.

All-in-all, the prospective announcer as well as those just "trying their wings" should find a lot of down-to-earth advice in this handbook which will be of immediate and practical use.

* * *

"PRIMARY BATTERIES" by George W. Vinal. Published by *John Wiley & Sons, Inc.*, New York. 329 pages. Price $5.00.

While this is a specialized text on a highly specialized subject such a book has long been needed to help round out the technical literature available on batteries.

Written by the Chief of the National Bureau of Standards' Division of Electrochemistry, this authoritative work traces the development of primary batteries from Volta's early experiments in 1800 to the present state of the art.

After an outline of the history of primary batteries, the author devotes a chapter to the discussion of the elementary theory of electric cells. He next discusses dry cells, materials and production; the operating characteristics of dry cells; the effect of low temperatures on dry cells and low-temperature types; standard cells and standards of e.m.f.; air-depolarized and other batteries; copper and copper oxide cells; silver oxide and chloride batteries; lead cells having soluble reaction products; mercuric oxide and vanadium dry cells; and, finally, fused-electrolyte cells.

This book contains a wealth of valuable information written in an easily-understood style. If the tremendous popularity of the author's previous

book, "Storage Batteries," is any criterion, there is no doubt that this newest work will be eagerly sought by engineers, research men, as well as students of the subject.

* * *

"DATA AND CIRCUITS OF MODERN RECEIVER AND AMPLIFIER VALVES" First Supplement. Published by *Philips' Industries,* Eindohoven, Holland. Distributed by *Elsevier Publishing Co.,* New York. 213 pages. Price $1.90.

This publication is Book III in the *Philips'* Technical Library series covering tubes developed during the years 1940 and 1941 by *Philips Industries.*

In addition to furnishing full descriptions and complete data on each of the tubes, the manual contains valuable application and circuit information for users of these tubes. Included in this handbook are complete details on the *Philips* "Miniwatt" key series of tubes, the 1.4 volt battery series, 100 ma. tubes for a.c.-d.c. applications, and data on two special tubes for a.c. operation (the ECH 4 and EL 50). Circuits of a.c. and a.c.-d.c. receivers based on the use of the "Miniwatt" key series, and battery receivers using the new 1.4 v. battery tubes are also given.

A special section of the book describes some of the latest *Philips* test equipment including a signal generator, service oscillator, thermionic voltmeter, stabilized voltage d.c. supply unit, a 500 v. supply unit and projection adapter, and a vibratory converter.

Manufacturers, laboratories, military and government agencies will undoubtedly want to have a copy of this manual handy for reference and study.

* * *

"TELEVISION SERVICE ENCYCLOPEDIA" by The Mallory Staff. Published by *P. R. Mallory & Co., Inc.,* Indianapolis. 204 pages. Price $1.50. Second Edition.

Service technicians who have been using this company's First Edition will find in this Second Edition a consolidation of servicing facts needed for the repair of both television and conventional radio equipment.

The new edition has been designed so that when used in conjunction with the company's 6th Edition of the "Radio Service Encyclopedia" it provides a complete reference library of replacement parts information on virtually all standard AM-FM radio sets, TV sets, TV boosters and preamplifiers, communications receivers, and professional audio amplifiers produced since the start of commercial radio.

This work is divided into two main sections, the first covering television receivers and the second devoted to radio and electronic equipment other than television.

A special appendix lists special servicing notes which could not be included in the tables, 616 control circuit diagrams, and 332 condenser circuits.

Service technicians should find ample use for this handy volume which will more than justify its purchase price.

* * *

"CAPACITORS FOR INDUSTRY" edited by W. C. Bloomquist. Published by *John Wiley & Sons, Inc.,* New York. 242 pages. Price $4.50.

This handbook dealing with the selection, application, and economics of capacitors for power factor improvement in industrial plants is the work of a group of *General Electric Company* engineers.

The treatment of the subject matter is entirely practical and the authors have presented much of the material in easy-to-use tabular and curve form. The information included is designed for the industrial plant engineer and electrician, the utility power salesman, the consulting engineer, and the industrial power application engineer and provides them with an accurate solution to their capacitor application problems. This book should find wide acceptance in the power field.

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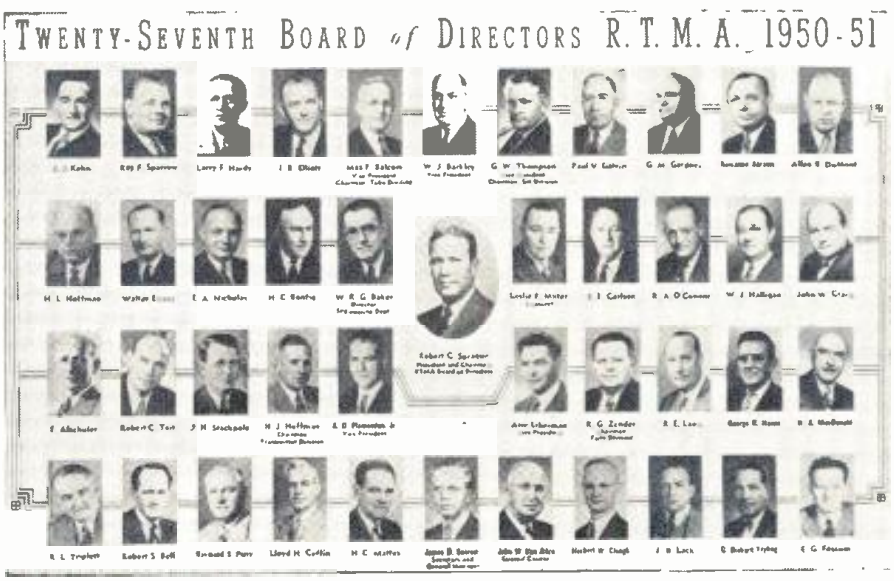

Switches

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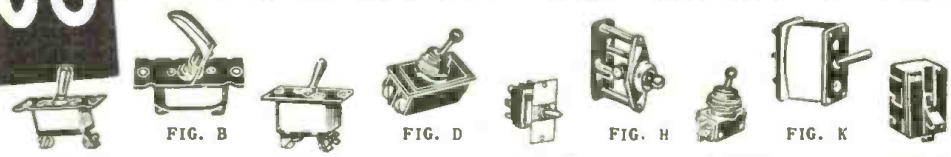


FIG. A FIG. B FIG. C FIG. D FIG. G FIG. H FIG. F FIG. K FIG. L

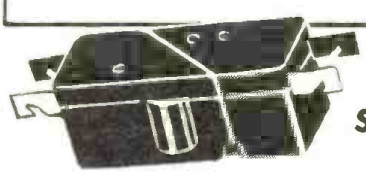
WIDE SELECTION OF ELECTRONIC COMPONENTS AT

WELLS

Tubes • Resistors
Condensers
Wire and Cable
Volume Controls
Co-ax Connectors
Relays • Rectifiers
Transformers • Chokes
Micro Switches, Toggles
Antennas, Accessories
Electronic Assemblies
Dial Light Assemblies

TOGGLE SWITCHES

STOCK NUMBER	FIG.	CONTACT ARRANGEMENT	MANUFACTURER & NUMBER	PRICE EACH
PH-500	A	SPDT.	B1B.	$0.35
PH-503	A	SPDT Center Off Mom Each Side.	B11.	.32
PH-505A	A	SPDT Momentary.	B21.	.30
PH-505	A	SPST.	AN-3022-2B.	.30
PH-506	A	SPDT Center Off.	AN-3022-1.	.35
PH-507	A	SPDT Center Off Mom Each Side.	AN-3022-7B.	.32
PH-513	A	SPDT Center Off.	Cutler Hammer AN-3022-1B.	.38
PH-514	A	SPST.	Cutler Hammer B-5A.	.35
PH-516	A	SPST.	B5.	.35
LT-104	A	SPDT One Side Momentary.	Cutler Hammer B905K568.	.35
309-168	A	SPST.	168553.	.30
309-178	A	SPDT Momentary.	AN-3022-11B.	.35
309-181	A	SPST Momentary.	Cutler Hammer 8211K6.	.35
305-172	A Spcl.	SPST Momentary.	Cutler Hammer 8905K531.	.35
305-182	A Spcl.	SPST Momentary.	Cutler Hammer 8905K630.	.45
370-14	A	SPDT Center Off 1 Side Mom.	Cutler Hammer B-7A.	.30
370-4	A	SPDT Center Off.	Cutler Hammer B-9A.	.35
370-25	A	SPST Momentary.	Cutler Hammer B-6B.	.25
309-169	B	SPST Momentary.	Cutler Hammer B-19	.35
PH-509	C	DPST.	AN-3023-2B.	.45
PH-510	C	DPDT Momentary.	Cutler Hammer 8715K2.	.50
PH-511	C	DPDT Momentary.	Cutler Hammer 8715K3.	.50
PH-512	C	DPST Center Off.	Cutler Hammer 8720K1.	.55
303-65	C	DPST.	Cutler Hammer AN-3023-2.	.45
309-163	C	DPDT Center Off Momentary.	Cutler Hammer C-11.	.55
309-162	C	DPST.	Cutler Hammer C-1.	.45
309-164	C	DPST Momentary.	Cutler Hammer 8711K3.	.40
305-87	D	1 Side DPST Mom, 1 Side SPST.	AH & H.	.95
LT-100	F	SPST.	Cutler Hammer.	.22
LT-101	F	SPST Momentary.	AH & H. W/Leads.	.20
301-51	G	4PDT Momentary.	Cutler Hammer 8905K12.	.75
305-140	H	DT No Make Each Side.	Open Frame.	.25
309-161	K	SPST.	Cutler Hammer 8781K3.	1.95
309-170	K	SPST.	Cutler Hammer 8905K656.	2.25
301-41	L	DPST.	AH & H	.75
305-76	L	DPST.	AH & H—Open Frame.	.75
319-50	L	SPST.	Allied Elec. Mfg. Corp.	.28
305-170	Spcl.	SPST.	Cutler Hammer Type B13.	.40



SWITCHETTES

STOCK NUMBER	MANUFACTURER'S TYPE NUMBER	CONTACTS	TERMINAL LOCATION	UNIT PRICE
303-20	CR1070C103-A3	N.C.	Side	$0.47
301-29	CR1070C103-B3	N.O.	End	.47
303-34	CR1070C103-C3	1-N.O. 1-N.C.	End	.47
303-18	CR1070C103-F3	1-N.O. 1-N.C.	Side	.47
303-19	CR1070C103-E3	N.O.	Side	.47
303-43	CR1070C123-B3	N.O.	End	.47
303-23	CR1070C123-C3	1-N.O. 1-N.C.	End	.47
305-83	CR1070C123-J2	SPDT	End	.47
303-22	CR1070C123-J4	SPDT	End	.47
303-17	CR1070C124-M4	SPDT	Side	.47
303-16	CR1070C128-C3	1-N.O. 1-N.C.	End	.47

LEAF SPRING SWITCHES

STOCK NUMBER	CONTACT ARRANGEMENT	SPEC. INFORMATION	BACK OF PANEL DIM.	PRICE EACH
303-96	HPDT One Side.		3¼x1¾x¾	$1.65
311-58	1A Momentary & 1A.	W/Escutcheon Plate	3¼x¾x¾	1.35
309-167	2C One Side.		3x⅝x1 1/16	1.25
305-183	3A Momentary & 3A Momentary.		3⅛x1⅛x¾	1.50
319-43	DPDT Center Off.	Mossman.	3⅞x2x1⅜	.85
319-42	4PDT Center Off Mom One Side.	Mossman.	3⅞x2x1⅜	.95
309-159	3B.	Mossman.	3⅞x2x1¼	.85
309-158	2D.	Mossman.	3⅞x2¼x1⅜	.85
309-165	1A.	Mossman.	3⅞x1 5/16x1¼	.75
311-96	4PDT.	Bakelite Actuator.	3 1/16x1⅜x⅞	.85
305-164	3A.		3⅛x1 1/16x1 1/16	1.25
319-43A	DPDT Center Off Mom Each Side.	Mossman.	3⅞x1⅜x2	.95
305-165	3A & 3A.	Switchboard Type.	4¾x1½x¾	.95

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What's New in Radio

(*Continued from page 88*)

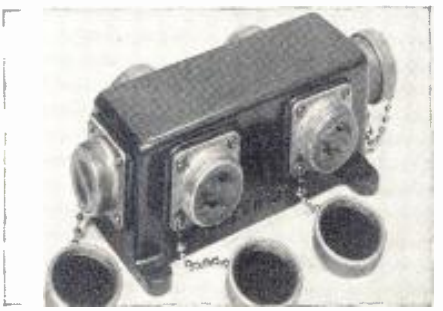
mounting holes to fit most tone arms. It is furnished with an adapter plate to permit mounting in *RCA* and similar 45 r.p.m. record changers.

Output is listed at approximately 6/10 volt at 1000 cycles on a *Columbia* No. 103 test record and 1 volt on the *RCA* 12-5-31-V test record.

OUTLET BOX

Equipment and Service Company of 6815 Oriole Drive, Dallas 9, Texas is currently marketing a new lightweight outlet box which provides five all-weather outlets from a single inlet.

Known as the "Greenbilt" Type 6005, the new box is especially designed for AM and FM remote applications, TV remotes, and for use in service shops and ham shacks. When used with the company's accessory connector Types 106 and 115 the unit



becomes a waterproof, weatherproof, and disconnect-proof power connector. The Type 106 inlet connector is rated for 6000 watts and the outlet connector Type 115 is rated for 1500 watts.

An illustrated bulletin covering the new outlet box is available from the company.

SERVICE TOOL

Rosenberg Brothers of 625 West 55th Street, New York, N. Y., has recently introduced a handy service tool which technicians will undoubtedly find of help in their servicing work.

The unit is a *Rosco* "Flash-Driver," a combination screwdriver and flashlight which features an unbreakable plastic handle, complete flashlight assembly including a light directing tube and clear plastic lens, and a magnetized blade to hold screws. A large knurled switch knob on the handle operates the flashlight.

The "Flash-Driver" is available in two models, one with a ⅛" x 4" blade and the other with a 3/16" x 4" blade. Information on either unit may be obtained from the manufacturer.

PANEL INSTRUMENTS

The Simpson Electric Company of 5200 W. Kinzie Street, Chicago, Illinois is currently in production on a line of modernistic panel instruments which are available in three different sizes.

The new models come in 4½", 3½", and 2½" sizes. The design is identical

on all three sizes. Model numbers are 1029, 1027, and 1127 respectively.

The large, easy-to-read scale provides good readability under all light conditions. Etched faces extend across the entire fronts of the meters and

are protected with unbreakable plastic. Vertical chrome-plated strips are recessed into the plastic fluted cover. The open scale layouts provide space for the use of the customer's name, trademark, or distinctive color combinations.

Full details are available from the company on request.

NEWCOMB PORTABLE

Newcomb Audio Products Company of 6824 Lexington Avenue, Los Angeles 38, California has added an AM receiver to its line of audio equipment.

The Model B-100 is a rugged unit which can be used for schools and other locations where the receiver is subject to abuse. It features a jack for connection of additional amplification to cover larger areas. The jack may also be used for headphones.

A built-in loop makes an external antenna unnecessary in most areas and the 3-gang design eliminates annoying

heterodyne squeals and assures adequate selectivity, according to the company.

The set is of all-a.c. construction, has a 6" Alnico V PM speaker, and an amplifier design which utilizes an inverse feedback circuit and beam powered output. The tuning knob avoids the use of strings and may be turned beyond the range of the dial without damage.

The set is housed in a plywood cabinet covered with washable two-tone fabricoid material. A heavy metal grille protects the speaker. The entire unit measures 7⅝" x 15¼" x 8" and weighs 13¼ pounds.

BASE AND SOCKETS

Alden Products Company of 117 North Main St., Brockton 64, Mass. has recently added the *Alden* "20" non-

interchangeable base and sockets to its line of plug-in components.

The new "20" pin base with matching sockets was designed specifically for plug-in unit construction. There is no molded center boss to break and the pins are strong and stubby. By selecting variations of pin layout of less than 20 pins, critical voltages and frequencies can be isolated and the base can be made non-interchangeable so that it will mate only with the correct socket.

These new units have been suggested for applications in open units, shielded units, relays, filters, or for terminal cards for wiring complete assemblies.

Two types of sockets are currently available, the 400-20 for chassis mounting, and the 400LG-20 designed for rack mounting. The first unit takes a minimum of space and can be eyeleted or riveted to the chassis. The rack units mount on "U" channels side-by-side or in series with overlapping ears.

Data sheets giving all pertinent data on these new base and sockets are available. Address your requests to Norman Curtis in care of the company.

-30-

International Short-Wave

(*Continued from page* 67)

Brazil—ZYK3, 9.565, Recife, noted 1630 on Sunday with "Brazil Calling" (*English*); ZYB8, 11.765, Sao Paulo, heard 1945, easily separated from CKRA. (Bromley, Ontario) *Radio Record,* Sao Paulo, is still using 9.505; noted evenings (EST). (Lane, South Dakota.)

Radio Club de Para, Belem, is on the air daily in Portuguese 1800-2030 on 4.865. (*World Radio Handbook* Bulletin.)

Radio Nacional, Rio de Janeiro, uses a 250 w. transmitter on 6.147 in parallel with PRL7, 9.72, and m.w. and FM outlets; this transmitter was used once on 17.85 relaying m.w. PRE8, PRL7, 9.72, and PRE8-FM, in Portuguese, and feeding the U.S.-beamed antenna. Fine reports were received from the USA. As this is an experimental transmitter, frequency and call are not included in announcements for the 49-m. or 16-m. channels. All reports are welcomed and answered. A *new* Tropical Band outlet is now active in Brazil; it is *Radio Cultura de Bahia,* Salvador, capital of the State of Bahia; call is ZYN22 (first time the Brazilian Government has issued a call with two digits after the letters) on 3.345 with 1 kw., along with two m.w. outlets. Salvador is the principal port of Bahia and is known for its 365 Catholic churches; Bahia's principal products are cocoa and tobacco; the State is situated in northeastern Brazil, is the sixth largest State in the country, and has a population of more than four million. (Serrano, Brazil.)

Bulgaria—Sofia, 7.671, has news 1545 and 1645. (Pearce, England.) The 1645 newscast is heard in Delaware; improved signal lately. (Cox.)

Canada—CBC's International Service is now scheduled—*European Service.* 0915-1130, CKNC, CKCX; 1130-1330, CKNC, CKCS; 1330-1345, CKCS; 1345-1400, CKCS, CHOL; 1400-1420, CHOL; 1420-1730, CHOL, CKLO; 1730-1745, CKLO; 1745-1830, CKLO, CKRZ. *Australasian Service*—2330-0005 (*except* Sat., Sun.), commentaries from the UN, CHOL, CKLO; 0340-0530 (Sun. *only*), *English* for Southwest Pacific Area, CHOL, CKLO. *Caribbean and Latin American Service* — 1850-2235, CKRA, CKLO, with *English* 2100-2145. *North West Territories* (Northern Messenger) *Service* — 2320-2400 (Sun. *only*), in *English* and French, CKLO, CKOB. Channels are CKNC, 17.82; CKCS, 15.32; CKCX, 15.19; CKRA, 11.76; CHOL, 11.72; CKLO 9.63; CKOB, 6.09, and CKRZ, 6.06.

CHNX, 6.130, Halifax, Nova Scotia, still closes 2310. (Grove, Ill.) Noted from 0500 weekdays, from 0800 Sundays. (Dary, Kansas) VE9AI, 9.54. Edmonton, Alberta, noted with news 1500. (Richards, Sask., Canada) VED, 8.265, also Edmonton, heard with music 2240, fair level in Delaware. (Cox.)

Canary Islands — EA8AB, 7.517, heard when tuned 1735; fair level in Delaware. (Cox.)

Cape Verde Islands—Praia's CR4-AA, approximately 5.900. is good level to 1700 sign-off. (Cox, Delaware, and others.)

Ceylon—Radio Ceylon's new "commercial service" noted signing on 2045 on 15.12. (Leary, Indiana.) Carries BBC news relay 2100. (Fargo, Ga.) At the time this was compiled, the schedule for the "commercial service" was 1830-2030 and 2330-0130 on 21.620; 2045-0230 on 15.120 and 9.520, and 0630-1130 on 11.775. BBC programs are relayed by *Radio Ceylon* at 0325-0900 on 17.730; 0325-1205 on 21.620, and 0910-1205 on 15.120.

Chile—CE1174, 11.74, Santiago, noted 2040 with drama in Spanish; continued after 2110 with music. (Russell, Calif.) CE776, 7.660, Santiago, heard 1817 through QRM. (Bromley, Ontario.)

China—A Chinese-speaking station on 9.73 noted 0541-0600 sign-off; believed Nanking. (Winch, Calif.)

Radio Peking appears to use 11.6851 and 15.054V for *English* news 0835; some days the 10.26 outlet carries that program and other days has separate session in Chinese. Cox, Delaware, hears the 10.260 outlet evenings from 1800 or earlier; sign-off varies 1920-1930; all-Chinese.

Colombia — HJCH, 4.895, signs off 2305; HJAG, 4.897, signs off 2303; the 4.797 outlet is HJFY (or I), "La Voz de Commercio," RCN, one of the Radio Cadena Nacional stations, location is Armenia, noted signing off 2220. (Stark, Texas.) HJDP, 4.885, Medellin, heard 1905. (Cox, Delaware.)

"Emisoras Unidas," Barranquilla, is broadcasting in Spanish on 4.785 at 0600-2300. (*World Radio Handbook* Bulletin) HJKD, 6.00, heard with native music 23335; HJFA, 4.86, Pereira, heard signing off 2301 after march-anthem. HJCQ, 11.68, Bogota, heard

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with music 1904-1930, poor level. (Russell, Calif.)

Costa Rica—TIGPH, San Jose, is now on 5.8744; noted 2045; previous measurement was 5.871. (Oskay, N. J.)

Cuba—COCW, measured on *new* channel of 6.318 at 2010; previous measurement was 6.3223. COBZ. 9.0256, heard 1810 with *English* grammar lesson in progress. (Oskay, N. J.)

Cyprus—Limassol, 11.72, noted 0815 with Eastern music; identified at 0900 and continued with music. (Ferguson, N. C.) A good program of dance music is radiated on Sundays 1045-1115 on 6.135, 6.170, 6.790, 9.650, 11.720. (Radio Sweden.)

Czechoslovakia—Prague, 9.55, noted with *English* 1415-1440; announced next *English* period for 1530 on 9.55 (Pearce, England.)

Denmark—Copenhagen is still noted to North America over OZF, 9.52, at 2100-2230; at least last half-hour is *English*. (Arthur, W. Va.)

Dominican Republic—HI1A, 4.980, Santiago, noted with popular music 1915. (Cox, Delaware.)

Ecuador—"Radio Bolivar" or "La Voz de la Libertad," Quito, is radiating in Spanish daily 0700-0930, 1200-1400, 1800-2200 on 4.770. (*World Radio Handbook* Bulletin) HCJB, Quito, recently has tested to the British Isles 1430-1530 daily (*except* Mon.) on 17.890. (Patrick, England.)

El Salvador—YSCF, 6.30, San Salvador, identifies at 2335; continues with native music to at least 0000. (Russell, Calif.) YSBR has moved from 4.795 to 4.785. (Stark, Texas.)

England—BBC recently tested on 9.555 at 0100-0245 for relay of Pacific Service; may be in regular use by now (?). (Cushen, N. Z.)

France—Paris, 17.85, noted 0700-0730 in French. (Stark, Texas.)

French Cameroons—Radio Douala, 9.150, noted with recordings 1400; closes with French march 1517 after a news bulletin in French; signs on 1230.

French Equatorial Africa—Brazzaville, 17.841, noted with news for Far East *ending* 1115, followed by music. (Ferguson, N. C.) Heard on 15.600 at 1820. (Cox, Delaware.)

French Morocco—Radio Maroc, Rabat, is radiating on 6.005 with 2.5 kw., in French 0145-0300, 0800-0930, 1515-1800; in Spanish 0700-0730, 1300-1430. (*World Radio Handbook* Bulletin.)

French West Africa—A *World Radio Handbook* Bulletin says *Radio Dakar* is now scheduled on 11.895 weekdays 0200-0300, 0700-0830 (Fri. to 0845), 1300-1800, and Sundays 0200-0900 and 1330-1800; also daily on 15.347 at 1400-1530; says has news in *English* 1745, news in French at 1630, 2015; however, the *English* news was still reported to me as heard 1400 on both 15.341 (measured) and 11.896 (measured).

Germany — Berliner Rundfunk Deutcherland Sender, approximately 6.115, heard at good strength 0100; "evening" transmission is 1005-1945. According to a German radio program publication, schedules include Baden Baden, 6.315, 2300-1800; Frankfurt,

6.190, 2330-1800; Munich, 6.160, 2330-1900; Stuttgart, 6.030, 2300-1900. (Cushen, N. Z.) Hamburg, 7.290, heard 0056 with music, fair to good level. (Cox, Delaware.)

Greece—Radio Athens, 7.300, noted with news 1045-1100, then French. Greek Armed Forces Radio Station, 6.340, Athens, noted with daily broadcast in *English* 1615-1630; recordings; asks for reports to 3 Zalucosta Street, Athens, Greece. Unknown Greek reported to 1500 near 5.975 or 5.980 may be *Radio Epiros,* Jannina; another Greek station, believed *Radio Macedonia,* is heard afternoons to 1600 sign-off on low-frequency side of Alicante (around 7.950). (Pearce, England.) Larissa, 6.754, heard 0025; weak signal in Delaware. (Cox.)

Guatemala—TGNA, Guatemala City, is now using 9.660 in addition to 6.040; *English* period has been extended to 2200-2230 daily. (Grove, Ill.) Reports are requested to Box 601, Guatemala City, Guatemala; noted signing off with "O, Come All Ye Faithful." (Lane, South Dakota.) Sent two miniature Guatemalan dolls in native costume in reply to report. (Russell, Calif.) Mailbag Program heard 2225. (Richards, Sask., Canada.) TGOA, 6.49, noted signing off 0005. (Russell, Calif.) TGDA, 7.46, Quezaltenango, heard around 0050 with marimba music. (Russell.)

Haiti—The Magloire Broadcasting Circuit, Port-au-Prince, has programs in French, with *English* and Spanish announcements, over 4VCM, 6.165, 0600-1000, 1200-1500, 1700-2300. (*World Radio Handbook* Bulletin.) Has been heard 0430 in *English* by Balbi, Calif. Measured at 0600 by Oskay, N. J., on 6.167; fine musical program then.

The "wanderer," 4VRW, more recently on 9.84 again, closes 2200 on Mon.-Sat.; at 1700 Sun. (Grove, Ill.) 4V2S, 5.95, tuned 2130; signed off 2137. (Russell, Calif.)

Honduras—HRN, 5.87, Tegucigalpa, noted with talk in Spanish 2215. (Russell, Calif.)

Hong Kong—ZBW3, 9.525V, noted signing off 0930 with "God Save the King"; relays "Radio Newsreel" from BBC, London, 0900; then has local weather report. (Neeley, Calif.) Noted with news 0515, poor signal, QRM'd. (Balbi, Calif.)

Hungary—Budapest appears to be using 6.248, 9.833, 11.910 to Europe-British Isles as early as 1145 (tune-in) to 1830 closedown; news 1600 and 1810 (a late, *unconfirmed,* report from abroad says news has been changed from 1600 to 1700—KRB); and 7.2221, 9.833, 11.910 to North America at 1930-2030, 2300-2400, news 1900 and 2300. The 7.2221 outlet is "sandwiched" between Malta, 7.220, and BBC, 7.230. (Grove, Ill., Oskay, N. J., others.)

India—Radio Sweden says Delhi is now radiating to the West Indies 1830-1930 on 9.620, 11.760, 15.160.

VUM2, 4.920, Madras, noted 1030-1045 with news relay from Delhi. (Pearce, England.) Noted in Delaware 0730 with news relay. (Cox.) VUB2, 4.84, Bombay, heard 1030. (Pearce.)

Indo China — Radio France Asie ("The Voice of France in the Far East"), Saigon, noted on 11.78 in French signing off 1030, fair level. (Neeley, Calif.) Has news 0900. Noted by Balbi at 0500 with news on 11.83. Heard in New Zealand on 9.495 in Siamese 0530; verified; stated frequency is 9.524 and *new* schedule for *English* periods as 1730-1800, 1930-2000 on 9.524; 0415-0515 on 11.830, and 0800-1010 on 11.780, according to the *N.Z. DX Times.*

"The Voice of Vietnam," 9.62 and 7.263, now has *English* (news) *only* at 0915-0930 when leaves the air. (Neeley, Calif.) The 9.62 channel noted 0625 in clear; in native. (Cox, Delaware.)

Iran—"Radio Watani el Kurds," The Kurdish National Radio, is now on 7.040 at 1030-1130; no location is given but local news items in Persian seem to indicate is Hermanshah. (Bluman, Israel, via *NATTUGGLAN*, Sweden.)

Israel—Tel Aviv, 9.0108, continues with fair-to-good signal during the *English* news period 1515 (also carried on 6.83) and 1700-1745 sign-off when has the World Zionist Movement program in *English* (on 9.0108 *only*). (Pearce, England, others.)

Italy—Rome continues to "bounce" around the spectrum. Has been reported on many channels in all popular s.w. bands lately.

Noted on 6.010 with news 2145-2200; the announced 15.120 (measured 15.1194) outlet heard with news 0600; noted on 21.560 at 0720, off 0730. (Oskay, N. J.) Broadcasts to N.Z. with news daily 0315 on 15.310, 15.120, 17.772, 21.570; has *English* again 0600. (Cushen, N. Z.) Heard in Italian around 1230 on 5.980 and near 6.260. (Pearce, England.)

Jamaica—Radio Jamaica, 4.950, when signing 2300 with "God Save the King," said would return 0715. (Kroll, N. Y.) Although the 3.480 channel has been reported widely as discontinued, Navarre, Texas, recently reported it at 2130 in parallel with 4.950. Verified by QSL card and letter from Jamaica Broadcasting Co., Ltd., Broadcasting House, 32 Lyndhurst Road, Cross Roads, Jamaica, B. W. I., says Bellington, N. Y.

Japan—JKL, 4.8604, heard 0625, music; JKI, 4.910, heard 0628, talk in native; JKM, 4.940, heard 0630 with music, QRM'd by YVMQ; JKH, 7.2575, heard 0615 with music; JKJ, 7.285, noted 0620 with music; JBD, 9.505, noted 0635 with talk in native, some CWQRM. (Oskay, N. J.) JKL2, 9.605, heard 0115-0130. (Bellington, N. Y.) JBD4, 15.225, noted at weak level 0105, some QSB. (Cox, Delaware.)

The BCOF station, 6.105, Kure, verified with *new* card—red call on white background; schedule was listed 1630-0830, power 1 kw. (Cushen, N. Z.)

Kenya Colony—Nairobi still noted from 1330 to 1500 closedown (closes 1400 on Wed., Sat.) on 4.855 although has been reported on 4.950. (Pearce, England.)

Korea—Seoul's radiophone outlet, HL2, 7.700, is operating by permission of the *International Telephone and Telegraph Bureau* in Seoul; has been heard around 0715-0945 (sign-off varies) with reports to American networks. (Neeley, Calif.) Has been heard on 10.05 around 0815 calling Oakland, Calif., according to Deskins, Calif.

HLKA, 7.933, is audible in Calif. *after* 0530, bad CWQRM and usually has poor signal. (Balbi.) Noted in Texas at poor level around 0745-0800. (Stark.) Organ music heard 0830-0900, weak signal. (McPhadden, Calif.)

Lebanon—Beirut, 8.036, is scheduled 0000-0130, 0600-0730, 1000-1535. (ISWC, London.)

Luxembourg — The 15.35 channel noted 0809; knocked out by VOA carrier at 0810; should be in clear 0700. (Stark, Texas.) Noted testing at 1052. (Navarre, Texas.) The 6.090 outlet noted Sundays 1700 with "Bringing Christ to the Nations" (*English.*) (Pearce, England.)

Madagascar—Radio Tananarive has programs in French on 3.900, 6.172, and 9.515 weekdays 2230-0030, 0400-0600, 1000-1430; Sundays 2300 (Sat. EST)-Sun. 0245, 0330-0600, 0915-1430; news in French is given weekdays 2310, weekdays 0000, Sundays 0015, daily 0400, 1100, 1315; programs in Malgache are radiated on 7.375 and 9.693 (no time given but opens 2230). (*World Radio Handbook* Bulletin.)

The 9.515 channel is good strength in Israel around 1200. (Bluman via *NATTUGGLAN*, Sweden.) Noted in N. Z. signing off 1430. (*N. Z. DX Times.*) And in England 1118 with news in French. (Pearce.)

Malaya—Kuala Lumpur, 6.025, has request program for Forces 0530. (Cushen, N. Z.)

Neeley, Calif., has received word from *Radio Malaya* that the signal he heard last May in the 20-m. amateur band was undoubtedly a harmonic of either the 7.200 or 7.250 outlet of *Radio Malaya.* Other data in the letter included—"Our short-wave senders in Singapore are directed north to the Federation of Malaya and to our stations at Malacca, Kuala Lumpur, and Penang for re-radiation on m.w. for local consumption. We do not intentionally cater to listeners outside Malaya but we are always extremely interested in reports from other territories. The short-wave station at Kuala Lumpur is a general radiator to cover outlying areas in Central Malaya. Next year (1951) will see considerable increase in transmitters, power, coverage, and program time from all stations in Singapore and the Federation of Malaya, and then a general list of transmitter information will be circulated." Listed for Singapore in current use were JT1 , 740 kc., 8 kw.; JT2. 620 kc., 10 kw.; JS2A, 7.250, 8 kw.; JS3A, 6.135, 5 kw., and JS3B, 4.780, 5 kw.; Kuala Lumpur s.w. was listed 6.025, 1 kw.

The 7.200 and 7.250 outlets noted by Cox, Delaware, recently in parallel with news 0630.

Malta—Radio Sweden says FBS, Middle East, is now on the air 2300-0115, 0430-0830 on 7.220, 11.895, 15.125;

NO PICTURES ON THIS PAGE . . .
NOTHING BUT NEW YEARS BARGAINS!

R-9A/APN-4. 160-meter Loran receiver plus high (for scope) and low voltage power supply. Three chans, tunable 1.6-3.3 mc, 1 chan, tunable 7.48-11.75 mc. With schematic and instructions for 60 cy. **Excellent used, less tubes** **$4.50**

VHF TRANSCEIVER. Ideal substitute for SCR-522. Xmtr is crystal controlled, 10 watts. Recvr has two individual RF sections feeding a common 3 stage 10 mc IF. Both RF sections may be operated simultaneously or individually. Recvr uses 13 tubes. Xmtr is straightforward, also 7 tubes, including 832 final modulated by push-pull 6L6's. In our neat case. Excellent used, less tubes, xtals, dynamotor. We furnish complete conversion and power supply instructions. **A steal at only** **$6.95**

EXPERIMENTER'S SPECIAL

A receiver you can do wonders with! Make intermod. analyzer for testing audio amplifiers, convert to FM, etc. Has dual bridge instrument rectifiers, also super AVC system. RF is 108.3 to 110.3. Has 3—7J7A tubes (use as direct replacement for 4—6K7, with much more gain), 2—12SF7, 1—12SQ7, 1—12AU7, 2—12SR7. With original schematic and conversion dope to FM broadcast. **Excellent used** **$9.95**

A-27 PHANTOM ANTENNA. Use on 160 or 80 meters or for marine freq., 2 to 4.5 MC. Contains: 1 Var. Capacitor, xmtg. type, 18-157 mmfd., 2-sized Vitrohm plaque wirewound, non-inductive resistors, 12 ohms (5%), 40 w. In neat metal case with calibration charts and instruction manual. **Brand New** **95c**

BC-366.5 POSITION SWITCH. 150,000 ohm pot with knob, mike jack, phone jack, 11 pt. terminal block and receptacle for standard banana plugs. All in handy aluminum box, 4 3/4 x 3 1/2 x 3". Use this for remote control in audio systems, etc., or rewire for your individual needs, or dismantle for parts. This is a real buy! **New, only** **29c**

VARIABLE CONDENSER. 3.1 to 4.45 mmfd. Steatite mounted ingenious end panels. Spacing .010". Has 1/4" shaft, 3/8" long. Frame 0.21.32" long by 1.29.32" square. Four of these were used in 100 w xmtr BC-653 to tune four present antenna coupling channels from 2 to 4.5 mc. Many of the boys have been splitting the stator of this beauty to use on higher frequencies. **New. Each, 39c; 5 for** **$1.49**

BC-906 FREQ. METER. Here is a laboratory-type precision instrument. Freq. range is 150-225 mc (upper TV channels), or modify for any other use. Use one as is and modify a second to cover lower TV channels. Needs only 2 batts (1.5 and 45 v). Precision vernier dial. Hand calibrated tuning charts. Diode-triode tube. 0-500 DC microammeter. Pick-up from tuned resonant cavity is detected by diode. Negative voltage supplied to triode grid, and dips the plate current. Complete, with plug-in antenna, crackle finish, carrying case (12 1/2 x 8 1/2 x 7 1/2") with leather handle. Schematic inside. In orig. wood storage case. **Like New** **$17.95**

MARINE SPECIALS

G.L. "MARINER" TRANSMITTER. 180 w input, 120 w to antenna, 90% modulated, 4 channel xtal cont. 12 or 24 v input with dynamotor, connecting cord, xtals, tubes, mike, all aligned and ready to operate. (Specify volt. and freq. when ordering). Contains break-in relay for recvr in addition to ant. switching relay. Dimensions: 8 3/4" deep, 17 1/4" wide, 19 1/2" high. Tubes included: 10Y speech amp., two 211 mod., 1625 osc., 1625 DA, two 814 parallel PA. We add over $150 worth of skilled engineering and parts to equipment which cost U.S. over $1200 to start with. How can you lose? With instructions. FCC license approval guaranteed **$275.00**

G.L. "MARINER" RECEIVER. Long wave, broadcast, marine and short wave reception. A beautiful conversion of finest Navy surplus! All controls, vernier tuning, BFO ON-OFF and AVC-MVC on entirely new front panel. Coaxial type antenna fittings furnished. Tagged wires out of rear to battery to power a DC-1 loop, and to kill B+ with xmtr break-in relay. 12 or 24 v DC. Only 15 1/2" long, 8" wide, 6 3/4" high, and self-contained; no plugs needed. With 6 tubes, 2 iron voltage limiters, and dynamotor. Requires an external speaker. Alignment instructions and schematic furnished. Specify voltage **$69.50**

BC-223 TRANSMITTER. 15 to 25 w output, 4 chan xtal control. To modify for FCC approval, just remove a few knobs and put one metal screw into panel to keep channel selector switch from being turned to MO position. WE CHECK THEM OUT! With tubes, 12 v dynamotor PE-55, connecting cable, 4 marine freq. xtals, mikes, and schematic. Don't forget to specify xtal freqs. **$89.50**

Additional plug-in unit for above, with custom-ground 4 mc ship shore band xtal. Get through when lower band is busy. Brand new, specify freq. **$6.19**

NAVY TYPE ARA (SCR-274N) 6-tube receiver, 1.5-7 mc. We rewire it for 12 v, with dynamotor mtd on back, and with phone plug and all controls built into front panel. Furnished with schematic, alignment data, with harness and plug for battery input and for output to power a DC-1 loop. Requires an external speaker or head set. **New, converted** **$32.50**
Same as above, but for 24 v **27.50**

DU-1 Manual Loop Direction Finder. 12 or 24 v. Goes ahead of the G.L. "Mariner," ARA, or any other receiver. We convert it to the Marine band. Still retains lower half of broadcast band, and all the lighthouse and beacon band. 2-tube phasing circuit, no 180° ambiguity. Gives true bearing in 3 seconds! Schematic and complete instructions furnished. **BRAND NEW, specify voltage** **$32.50**

NAVY WATERPROOF BULKHEAD SPEAKER with universal matching transformer, cord and phone, plug. Very hi-fi **$9.95**

We're stuck with a lot of Salt Water Soap! Navy detergent powder in 50 lb. kegs. Clean-out price per keg **$2.95**

TRANSFORMERS

SCOTT HI-FIDELITY. Essentially flat from 20 to 20,000 cy., 25 w, hermetically sealed. Impedances: 5000 ohm primary for single end output, and two CT secondaries, 600 ohm and 60 ohm, thus providing 150 and 15 ohm secondaries also. The 60-ohm secondary was used for inverse feedback. You can also use secondaries to match 600 ohm and 15 ohm. **BRAND NEW** **$1.89**

FIL. XFORMER. HV Amertran type W.S.: 115 v 60 cy pri; sec 5 v CT at 10 a, insulated for 35 kV test. 12 kV DCWV. Built-in socket for 872A, 250T 371, etc. With new 872A **$10.95**

500 OHM LINE TRANSFORMER. Secondary 8 to 10 ohms, tested at 10 watts. Only 3 db down at 15,000 cycles. Essentially flat from 40 to 12,500 cps. **NEW** **89c**

SUPER-MODULATION XFORMER. Get 400% modulation with no distortion. Make amazing voice-power rig described on page 50 of June '49 and Feb. '50 RADIO & TV NEWS, Class A. Good up to 1 KW, 2500 v insulation. Rebuild your present rig **$4.95**

TRANSMITTER INTERSTAGE TRANSFORMER used in BC-191 and BC-375 Couples #10 to push-pull 211's **$1.49**

25 VAC TRANSFORMER, 40 VA. Primary 115 v, 50/60 cycles **$1.79**

CHOKE. 3.7 H, 145 MA, 125 ohms DC resistance. Potted **79c**

SYNCHRONOUS VIBRATOR XFORMER. Peerless, upright, shielded. Primary: yellow, green, black CT, 6 or 12 v. Secondary: red, red-orange, blue CT, 250-0-250 on 6 v, 500-0-500 on 12 v, 50 ma. **NEW.** A steal at only **$1.29**

VIBRATOR. 6 or 12 v. synch, 7-prong. OAK. **NEW** **69c**

TAPPED POWER! Here is the dope&spares replacement main transformer which enabled the RA-34-F and -G receiver to furnish COMPLETELY VARIABLE 0 to 125 ma at 400 ma in steps of 20 v. Variable hi-voltage is obtained by using the coarse and fine taps to feed the primary of a 1:10 hi-voltage transformer. Furnished with 3 heavy-duty tap switches all wired up. In addition, it has outputs to feed dry rectifier which put out 12 v at 2.4 A and an AC output of 12-14 v at 11 1/4 A. Input is 115 or 230 v, 60 cy. With schematic of RA-34-F showing all connections. **NEW** **$17.50**

TU-21 80-meter plug-in tuning unit for xmtr BC-221, 1500-5250 KC. Use as foundation for xmtr or a feast for parts, including ant. coupling, ant. inductance, xtal selection switches, coils, condensers, etc. With schematic. **NEW** **$1.29**

OIL FILLED, OIL IMPREGNATED CONDENSER. .05 at 1000 v, Aerovox, tubular, metal cased, wax cardboard covered, can insulated for mounting. A quality replacement for TV or amplifiers. Immersion proofed, sealed against moisture. Pigtails solidly soldered, can't pull loose. Only 11/16" dia. x 13/16" long. Pre-inflation net was 78c. **our price is Only 39c; 10 for** **$3.00**

SENSITIVE! Relay for plate or cathode circuits, 7500 ohm coil, closes on 2 to 5 ma, opens on 1 to 3 ma, depending on contact-spring adjustments. SPDT contacts rated 5 a. Ideal for photo-cell, capacity-operated circuits, electronic counters, etc. Mfr's net in lots of 500 is $3.20 each. Our price is only **$1.29**

ULTRASONICS!

DZ RECEIVER. 8 tube superhet, 15 through 1500 kc. Requires external B+ of 200 to 250 v. Uses 6 v tubes, rewire in parallel for 6 v AC supply, or furnish 24 v AC. Broad-sharp, CW-MCW, etc. Excellent used, with tubes, schematic, and almost complete reprint of tech. manual **$49.50**

DYNAMOTORS

DM-42-A. 12 v, two outputs: 1030 v, 260 ma; plus 515 v, 215 ma. With schematic of transmitter BC-453, showing schematic and terminals of DM-42 and how they are used. **NEW** **$9.95**

DY-12, 24 v, two outputs: 1050 v 350 ma, plus 400 v 400 ma, with schematic of AN/ARI-1A showing how dynamotor was connected and used. Less filter and 6-7 relay base **$7.95**

PE-73, 24 v, 1000 v 350 ma, with starting relay, filters, etc. With schematic. **NEW, $5.95; FAIR USED** **$4.95**

INVERTER PE-218, 24 v in, output 115 v regulated: 400 cy, 1500 va. **NEW** **$17.50**

DYNAMOTORS for AN/ARC-1. Specify single voltage (27 to 32) or dual (13.5 or 27 v). **Excellent used** **$14.95**

LOOK WHAT $2.65 WILL BUY!

The most versatile dynamotor in surplus! The best dynamotor for conversion to 6V. Multiple windings. After conversion you get choice of 190 or 350 v at 50 MA or 250 v at 100 MA. No brushes to shift around, no mechanical work. Or use it as a 2:1 or 1:2 step-up or -down transformer for DC voltage! Changes 6 to 12, or 12 to 24, or vice versa, up to 3 A. Or use it as a GENERATOR. Turn with motor, get 12 v DC at 12.6 A or 24 v DC at 6.3 A, plus high voltage. Includes easily removable self-contained 800:1 sealed-mount gear reduction unit. Complete dope sheet furnished. **BRAND NEW** **$2.65**

RCA CEILING SPEAKER, 23" dia., 6 ohm **$8.95**

AC VOLTMETER. New, boxed. Weston 476. 0-130 v AC, flush 3 1/2" round **$3.95**

OIL FILLED 4AM mfd. 600 v condenser, in one case, common ground, with mtg hooks, as used in Army Super-Pro power supply. **NEW** **$2.89**

T-30-S THROAT MICROPHONE, NEW **69c**

3-DIGIT resettable Veeder-Root counter with 90 bevel-gear drive, pilot lamp assembly, wafer switch, case. **NEW** **79c**

COMMAND RECEIVERS

With schematic, alignment, and AC power instructions.
BC-454, 3-6 mc. NEW $6.95, GOOD USED **$4.95**
BC-455, 6-9 mc. NEW $12.95, GOOD USED **$7.95**
Make a local control adaptor for your Command recvr. We furnish exact pt. switch, knobs, an etched plate, and instruction data **$1.29**
Spline Tuning Knob for Command recvr **59c**
274N PLUG. 7 prong male plug to fit back of command recvrs and xmtrs. This is the same plug as used in the racks. **NEW, each, 21c; five for** **$1.00**

COMMAND TRANSMITTERS

With Dope Sheet and Schematic
T-19 ARC-5, 3-4 mc, repacks, like new **$10.95**
Excellent used **8.95**
BC-457. 4-5.3 mc, excellent used .. **4.95**
BC-458. 5.3-7 mc, excellent used .. **5.95**
BC-459. 7-9.1 mc, excellent used .. **9.95**
T-22 ARC-5. 7-9.1 mc, repacks, like new **9.95**
MD-7 ARC-5. Push-pull mod., excellent **9.95**
MOD BC-456. Brand New $5.95. Excellent used **2.49**
T-18 ARC-5. 2.1-3 mc (Marine). Like new **14.95**

FREQ. METER BC-436. Easily converted to precision lab. xtal calibrated heterodyne-type freq. meter and sig. gen., 20 to 440 mc., with audio modulation. We furnish simple instructions for conversion and calibration. Has power supply, tubes, and lab. standard xtal. Start where your BC-221 or LM ends. Excellent cond., complete as described. **While they last** **$27.50**

HS-33 HEADSETS. 600 ohm. Used checked out **$1.29**

ANGULAR POSITION Autosyn Transmitter, loop, and drive motor with gear train. Use as beam position transmitter with 1-82 indicator, or build a rotating display table or a light-duty beam rotator. Schematic and data furnished, including schem. and connections for 1-82 for 60 cy, also shows how to connect and use the motor on 60 cy **$3.79**
1-82-F Autosyn Indicator. New **5.95**

TUBE SPECIALS
3FP7 C.R. Tube **98c**
5BP4 C.R. tube. Same as 5BP1 but white screen, ideal for TV **$2.95**
6L6G checked out **$1.95**
211 New **49c**
316A New **29c**
832 checked out **$4.95**
884 New **$1.49**
1625 New **49c**
RX-21 New Mercury rectifier, peak inverse 11 KV, 2.5 V, 10 A Fil., 1.5 A output for 2 tubes, **EACH** **$1.49**

WILLARD Wet Cell Batt. 2 v 20AH. **NEW** **98c**

TUNING UNITS FOR BC-375 (except TU-5, sold out). Specify freq coverage desired. Exc. condition. With schematic and parts descriptions **$1.95**

CITIZEN'S BAND ANTENNA with director, radiator, reflector, hardware and cords. Two complete sets. **New** **98c**

Angular Position Transmitter of the Eastman-Kodak Mark-18 gunsighting system. Orig. pack **49c**

VHF TAXI SETS AND WALKIE-TALKIE. Complete with antenna, handset, etc. Less xtals. New, postwar. Write for description and schematic. **Only** **$79.50**

3-DIGIT resettable Veeder-Root counter w/pilot lamp assy, wafer switch, case. **NEW** **79c**

MN-26-C Manual Direction Finder and Communications recvr, 150 to 1500 KC. With schematic and dope sheet which also covers accessory units listed below. **New, $24.95. Exc. used** **$19.95**
MN-28-C Master Control Box for MN-26-C **$9.95**
MN-20-E Loop. New **7.50**
IN-4A Left-Right homing indicator. **NEW** **9.95**
MN-52 Manual Loop Drive with azimuth scale. **NEW** **$4.50**
MN-26-S, 150-1500 KC, for use with MN-31 ADF, 24 v, sold only with matching control box MN-28-P, which has loop L-R switch. Both units in excellent used condition. Combination price **$47.50**
MN-36-C. ADF loop with original name plate. **NEW** **$95.00**

TS-10 Sound Powered Handsets. Speak up to 25 miles with no external power. No batts. needed. Parallel connect as many as you wish. Checked out, guaranteed. **Each, $8.95. Per Pair** **$17.50**

R-89/ARN-5A with orig. schematic and FM broadcast conversion instructions. With tubes. **Exc. used** **$9.95**

AERONAUTICALS: Write for price on new R-89/ARN-5A and new BC-733-D.

APS-13 Tail-warning Radar xmtr-recvr, 410-420 mc, 5 stage 30 mc IF. Brand new, with schematic, less tubes **$9.95**

BC-788 Airborne pulse radar altimeter xmtr-recvr, 420-460 mc, 6-stage 30 mc IF. Less tubes and xtal. Excellent used, with schematic **$9.95**

RF AND AF SIGNAL TRACER SZ-5. Tiny dual vibrator gives beat of 1400 cy. Tone with harmonics to 40 mc. **NEW, with schematic and instr** **79c**

10-METER FM TRANSMITTER-RECEIVER complete. Very compact. Semi-portable. 27 to 28.9 mc. With vibrapack for 6, 12, or 24 v. Use either of two preset xtal-controlled channels. Effective transmission coverage of 10 to 15 miles with a minimum of power consumption. Built-in speaker. Built-in meter for checking voltages of various circuits. Schematic and complete instructions furnished. Here is communications equipment for Industrial, Commercial, or Amateur use. In excellent condition. Complete installation consisting of BC-659, PE-120 vibrapack, telescoping antenna **$24.95**

BABY WINCH. Geared motor. Dozens of uses around home, boat, or shack. Just the thing for operating garage doors, gates, etc. Makes excellent beam rotator or barbecue drive. Has two low-speed, high torque outputs, both reversible by electrical switching. One is a sprocket toothed wheel, the other is a notched coupled cable drum. Both or other are stopped and/or reversed by adjustable limit switch or remote electrical control. 24 v DC Universal motor runs perfectly on 8 to 24 v, 60 cy AC, geared down to nice, easily controlled low speed. With simple instructions. **Only** **$4.95**

BC-347-C Booster Amplifier, especially useful as mike-input amplifier to boost modulation or as phone pre-amplifier. Compact, only 5 3/4"x4"x2 1/2"; contains dual power tube 6FS6 and two hi-fi ouncer transformers, one for mike to push-pull grids, one for push-pull output. These transformers net for over $7.00 each. With schematic. Requires external power source. Orig. use was as interphone amplifier. **Good used, special** **$1.29**
Brand new **$3.45**

ZA-TEST OSCILLATOR CDE 6050. Used to feed 30 and 150 cy. modulation to recvr. input. Contains 12 v vibrator which also works on 6 v. Two vibrating reeds give two tone outputs. In black plastic case with mtg. plate, instructions and schematic. Has switch, capacitors, choke, pot., octal socket, etc. **Brand new, orig. pack** **49c**

CMX AUDIO AMPLIFIER. Contains three 12A6 tubes and transformers with following impedance ratings: Input—1:676 or 1:169. Output—25:1 or 100:1. Both are Magnavox hi-fi, hermetically sealed. Also sealed filter choke 4.1 h 60 ma and assorted cond., resistors, sockets, etc. Nice case and cover. Use as is or for parts. With simple schematic. **Less dynamotor. NEW, with tubes** **$2.95**

ID-6A/APN-4 LORAN INDICATOR. Correct to test scope, panadaptor, etc. Double deck chassis, lots of octal sockets, lots of room for any scope circuit you can dream up. Contains 22 pots, loads of switches, conductors, transformers and small parts. Used, less small tubes and crystal but with schematic **$7.95**

BC-375-E TRANSMITTER, 200 KC to 12.5 mc with tuning units. With schematic showing complete parts description for use with dynamotor PE-73 and also with conversion instructions to 12 v for operation with AC power supply with 12 v for heaters, mike and relay. **Brand new, export packed, complete** **$75.00**

WANTED!

Your Spare Surplus Equipment and Tubes, Dynamotors, Recvrs, Xmtrs, Test Equipment. Send list, stating condition and rock bottom price.

G. L. ELECTRONICS

905 S. VERMONT AVE.
LOS ANGELES 6, CALIF.

ALL PRICES F.O.B. LOS ANGELES. CALIFORNIA BUYERS ADD SALES TAX
MINIMUM ORDER $2.00

1100-1700 on 6.020 with 11.895 parallel at 1100-1200, and 7.220 parallel at 1200-1700. However, 6.015 has been widely reported in parallel with 7.220 in the 2300 period, heard in USA.

The 15.125 channel noted 0830-0900 with QRM from Rome's 15.120 outlet; relays "Radio Newsreel" from BBC, London, 0900. (Cox, Delaware.)

Mauritius—Noted on 15.060V on Sunday with all-French program around 1050. (Pearce, England.)

Monaco—Monte Carlo, 9.785 and 6.035, noted 0300 with news in French. (Cox, Delaware.)

Mozambique—According to ISWC, London, Lourenco Marques has *English* broadcasts daily 2300-0100 on 11.764, 9.766, 4.925, and 1100-1530 on 9.766, 4.925.

The Portuguese program was noted recently 0000 on 9.817. (Stark, Texas.) Lourenco Marques has returned to 15.196V from approximately 15.370, noted 1200 to 1500 sign-off; all-Portuguese; good level. (Grove, Ill.) Noted in Brazil; asks for complete reports on all stations. (Serrano.) Call is CR7BG. (Peddle, Newfoundland.) Heard in Britain as early as 1215. (Pearce.)

New Caledonia—FK8AA, Noumea, measured 6.0346 recently; previous measurement was 6.0384. (Oskay, N. J.)

New Zealand—Radio New Zealand now has a DX program on the first Tuesday of each month; it is called "This Radio Age" and is carried on ZL3, 11.78, and ZL4, 15.28; time of broadcast has not been learned but is presumed to be during the 0200-0530 period.

ZL4, 15.28, is now used parallel ZL3, 11.78, from 0200, replacing ZL8, 9.62; also noted from 2100 onwards. (Balbi, Calif.) Cushen, N. Z., lists schedule to February 17 as 1300-1545, 0200-0530 on 11.780; 1600-0145 on 15.220, and 1300-0530 on 15.280; however, by this time the sign-off may be 0630 if restrictions on electricity use have been removed as expected.

Nicaragua—YNOW, 6.8396, heard 1921; gave call in Spanish followed by American recordings; previous measurement was 6.8497. YNLAT, 7.6185, Granada, heard with music 1935; previous measurement was 7.6156. YNDG, 7.6445, Leon, heard with music 1845; previous measurement was 7.6486. (Oskay, N. J.)

Outer Mongolia—A station heard mornings on approximately 4.96 is believed Ulan-Bator. (Balbi, Calif.) Also heard in Texas. (Stark.) The 8.400 channel noted in Delaware 0645 in native, weak-to-fair. (Cox.)

Pakistan—The 9.645 outlet is fair in Chicago at 2100 with news. (Grove.) Noted on this channel as late as 2200. (Lane, South Dakota.) And as early as 2015 (in native). (Navarre, Texas.) Heard with news on 15.335 at 2100. (Fargo, Ga.) The 41-m. outlet measures 7.1402; noted 0700 with news, parallel measured 11.5782 and 11.845. (Oskay, N. J.) The 9.645 outlet noted 0800-1000, news 0825; QRM'd by VOA. (Dary, Kansas.) Heard on 11.5782 with news

A NOVEL LAMP

By JAY J. LUCAS

WHILE shopping at a surplus radio supply store, my XYL spotted a 304TL and exclaimed: "Now isn't that cute!" She wasn't referring to its characteristic curves, either. Aside from its filament requirements, I agreed that, for the price, it was plenty cute. So, with utter disregard for our financial conditions, I laid out the best part of a buck and carried out a 304TL.

Considering the filament current requirements, it was quickly decided that the best way to "light it up" was to use a 60 watt bulb. A little more inspiration of this kind led to the design of this unique lamp. But after reading Guy Dexter's article, "Putting the 304TL to Work," the 304TL was carefully stored for future use and a 304TH which had previously died from "kilowattitis," was withdrawn from the scrap pile.

A 2 x 2 x 4 metal utility box serves as the "chassis." The top cover plate was drilled to take the base pins. The tube is held in place by soldering the pins to the cover plate. To mount the socket, a heat-dissipating plate connector was modified by sawing most of it away, leaving only the small shoulder with the set-screw. This forms a bushing to mount the socket onto the plate connection. The connecting wire was run into the socket by drilling a hole through the side of the cap. The wire was passed through this hole, and along side the tube through a hole in the base cover plate, close to the tube. The line cord enters the base through a hole in the rear. A s. p. s. t. rotary switch, fitted with a National HRS-1 knob, eliminated the need for a switch-type socket. (Using a switch-type socket might put undue strain on the glass during "on-off" operation). A 60 watt bulb and a shade with a bulb-clamp completed the construction.

Although it is advisable to handle the lamp carefully during construction, it is fairly rugged and will withstand the usual handling without danger of "letting the vacuum out."

—30—

Over-all view of the novel "ham shack" lamp built from surplus xmitter tube.

1015; on 15.27 at 0110 with news for E. Bengal. (Pearce, England.)

Peru—OAX4Z, 5.898, Lima, noted 2050 with classical music; previous measurement was 5.894. (Oskay, N. J.)

Philippines—DZH6, 6.030, and DZH8, 15.300, Manila, "The Call of the Orient," closedown 1015; frequently asks for reports. (Neeley, Calif.) DZH8 is heard in Calif. signing on 1800 to 2000; announces DZH6, 6.03, in parallel; signal fair; mostly religious programs. (Balbi.)

Radio Philippines, 9.500, Manila, noted in England 1040-1100 when has news and signs off 1107 after program preview for next day. (Pearce.)

Poland—Warsaw is reported on a *new* channel of 7.205 to 1600 closedown. (Radio Australia.) The 9.525 outlet recently was audible around 1920 in Texas. (Stark.)

Portugal—Lisbon, 6.374, is excellent nightly to 2100 closedown. (Leary, Indiana.)

Portuguese Guinea—A *World Radio Handbook* Bulletin says CQM7, Bissau, is operating over 6.993 daily 1630-1800; power 1 kw. However, Bellington, N. Y., and Oskay, N. J., have heard Bissau recently on approximately 5.839 to 1800 when closes with "A Portuguesa." Was measured by Oskay as 5.8392.

Portuguese India—Radio Goa operates on 9.610 daily *except* Sunday 2030-1230; Sunday schedule is 2130-1230; *English* on weekdays is 2030-0430, 0730-0930, and Sundays 2300 (Sat. *EST*)-0330, 0530-0730. Reported heard in England on 9.608 to 1215. (Radio Australia.)

A *new* 10 kw. transmitter soon will be put into service. (Radio Sweden.)

Roumania—Bucharest, 9.252, noted afternoons; news 1500; leaves the air 1600. (Maurice, N. Y.) Has improved signal lately. (Cox, Delaware.)

Saudi-Arabia—Djeddah, 11.950, is heard at good strength at 1300, closing time varies 1340-1400. (Radio Sweden.) Still noted in Arabic nightly around 2300-2330 on 11.95, 11.75 (best). (Bellington, N. Y., Stark, Texas.) Heard in Britain on 5.975 in Arabic 1230. (Pearce.)

South Africa—Radio Australia lists these current SABC schedules—Johannesburg "A" (*English*), 2345-0130, 0900-1130 on 7.220, 0315-0710 on 9.870, 1140-1605 on 4.800. Johannesburg "B" (Afrikaans), 2345-0130, 0900-1150 on 7.270, 0315-0710 on 9.520, 1200-1605 on 4.890. Cape Town "B" (Afrikaans), 2345-0130, 1200-1605 on 5.890, 0315-0710, 0900-1145 on 9.610. Pietermaritzburg carries "B" (Afrikaans) programs on same schedule as Cape Town. Johannesburg "C" (commercial—*"Springbok Radio"*), 2345-0145 on 7.290, and same channel 0900-1100; 0145-0900, on 9.600, and 1100-1600 on 4.940.

This list may not be complete as on Sundays most transmissions start 0155 rather than 2345; Saturday closings usually are 1645 rather than 1605.

Southern Rhodesia—Salisbury is now scheduled 0400-0615, 7.280; 1000-1500, 3.320, 6.018, 9.490. (Radio Australia.)

(*Continued on page* 151)

AFCA NEWS

CHAPTER NEWS

Augusta-Camp Gordon

Ralph S. Grist, General Coordinator of Military Services for the *Southern Bell Telephone and Telegraph Company*, was guest speaker at the chapter's October 19th meeting. He described the many problems incurred in meeting the large scale communication demands made on his company by the armed forces during World War II. The quest to solve these problems led to the establishment of a "Coordinator's" office. Mr. Grist also cited several interesting incidents whereby the services of his office were employed in furnishing communication demands.

A nominating committee was appointed by Chapter President Henry J. Hort as follows: Col. Kenneth F. March, Sgt. John W. Owen, Henry A. Wright, Lt. Col. William W. Rakow, Maj. Norman J. Kinley, and F. A. Saxon.

The chapter's November meeting was devoted to the subject of photography and its industrial and military applications. Capt. Roger L. Leonard and Lt. William F. Rockar, photographic experts from Camp Gordon, discussed combat photography.

Baltimore

A tour of the Aberdeen Proving Ground featured the Baltimore Chapter's October 25th meeting. Following luncheon in the post cafeteria, Colonel T. K. Vincent, Deputy Commander of the Post, welcomed the group and outlined the routine for the afternoon.

Highlights of the tour were visits to the Ordnance Museum, the Ballistic Research Laboratories, and the Supersonic Wind Tunnel.

Boston

Maj. General Francis L. Ankenbrandt, USAF, Director of Communications, United States Air Force, was the principal speaker at the chapter's October 19th meeting at the Boston Naval Shipyard, Charlestown. Special guests of the chapter were members of the Volunteer Air Reserve Training Squadron, USAFR, and the Volunteer Electronics Company, 1-3, USNR.

After dinner, the meeting was opened by Chapter President T. F. Halloran who introduced the two guest units. A round robin of self-introductions was held to introduce members of AFCA. Announcement was made of the appointment of Edward A. Johnson, vice-president of the *Barry Corporation*, as the new Chairman of the Membership Committee.

Capt. A. R. Taylor, USN, Chairman of the Communications Committee, reported the formation of a subcommittee on Civil Defense Communications with Myron D. Chase, of the *New England Tel. & Tel. Co.*, as chairman. A prospectus outlining preliminary plans for Civil Defense communications with a preamble listing data on trained personnel and facilities available, and offering the talents of AFCA members in the New England area, has been submitted to the Director of Civil Defense, Massachusetts.

Program Chairman Raymond B. Meader, *New England Tel. & Tel. Co.*, introduced General Ankenbrandt who addressed the meeting on "Air Force Communications—Electronics Problems in Korea."

This Association is a patriotic non-profit organization, with chapters in most of the larger cities, dedicated to developing and maintaining efficient personnel, commissioned, enlisted, civilian, for the supply (including design and development), installation, maintenance, and operation of communications and electronic equipment for Army, Navy, and Air Force and their supporting civilian activities. It publishes a magazine "SIGNALS" at its national headquarters in Washington. Every American interested in any way in communications is eligible and invited to join. Dues are $5.00 per year. Application should be submitted to the secretary at 1624 Eye St., N. W., Washington 6, D. C., who will furnish details upon request.

Decatur

The Decatur Chapter met on October 12th at the Decatur Signal Depot. The Board of Directors presented the revised constitution of the chapter to the membership, which was adopted unanimously.

The speaker of the evening was Lt. Colonel Jack N. Nahas, Deputy Commanding Officer of the Decatur Signal Depot. His talk, illustrated with motion pictures, covered the geographical, political, and economical aspects of the Kingdom of Yemen. Colonel Nahas had represented the Army as a member of an eleven man diplomatic mission to this small country of the Arabian League.

New York

A very interesting and colorful demonstration-lecture by C. N. Hoyler of *RCA Laboratories Division*, Princeton, N. J., was the feature attraction of the chapter's October meeting.

In his talk on "A Glimpse into a

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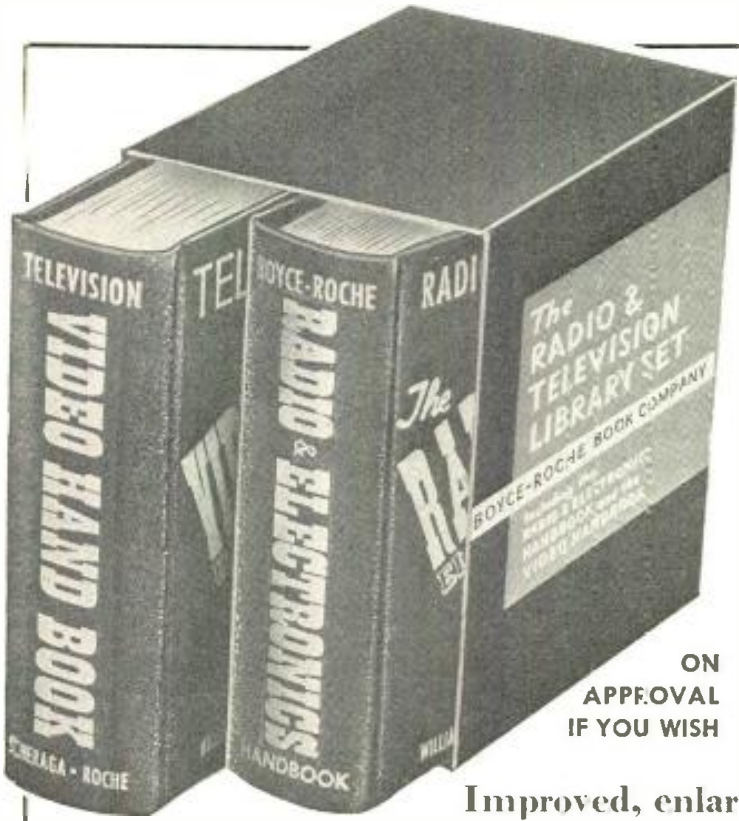

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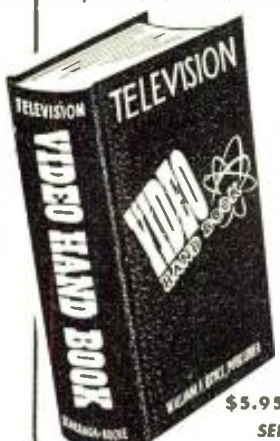

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Research Laboratory," Mr. Hoyler first reviewed the various steps in the development of modern electronic computers. He demonstrated some of their applications by means of laboratory models. Next was shown an improved electronic computer utilizing a crystal controlled oscillator. With this device, it is possible to ascertain electronically speeds of very fast moving objects such as shells fired from a gun or guided missiles. As a demonstration of this effectiveness, Mr. Hoyler let a small metallic ball roll down an inclined plane between two coils of wire separated about a foot apart. The electronic computer showed on lamps the exact intervals in thousandths of a second required for the ball to travel the distance between the two coils.

The basic elements of color television were shown in another laboratory model by Mr. Hoyler. The field sequential method of producing television was first demonstrated by means of a mechanical laboratory model followed by the *RCA* method. It is believed that all those present learned a great deal about the advantages and disadvantages of color television.

Pittsburgh

Plans for the year, designed to attract additional individual and group members, were made at the Pittsburgh Chapter's October 10th meeting in the *Bell Telephone Company* auditorium. The program schedule, submitted by Sylvester C. Stoehr, chairman of the arrangement committee, includes the following: tour of the *Copperweld Steel Company* plant at Glassport; address by Colonel Arthur Pulsifer, Chief Signal Officer, Second Army; demonstration-lecture by Dr. J. O. Perrine, assistant vice-president, *AT&T Co.*; discussion of military procurement by a representative of the Department of Defense, Washington; tour of the new *RCA* plant at Canonsburg.

Donald Phillips of *Western Union Telegraph Co.* gave a most interesting resume of plans being made by the communications division of the Civilian Defense Organization.

Washington

The first of a series of meetings scheduled by the Washington Chapter took place on October 18th with Major General Spencer B. Akin, Chief Signal Officer of the Army, as the guest speaker. Rear Admiral Stanford C. Hooper, "father" of Navy radio, addressed the chapter at a luncheon meeting on November 16th. The January meeting will feature a discussion of controls, allocations and priorities by H. B. McCoy, Assistant Administrator of the National Production Authority for Industry Operations.

In his address on "Communications in Korea," based on his recent survey at the front and in the area of Signal Corps operations, General Akin emphasized that the imperative need of the Army Signal Corps in combat military communications is to have enough trained specialists who are familiar

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- What does color television mean to me?
- Am I missing out on any of the newest developments in AM-FM-TV?
- Can I honestly say I am ready to cope with that new amplifier — oscillator — receiver — calibrator — converter — ?
- Where can I get designs for lowest cost building of my own rig?
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with the capabilities and limitations of the electronic, radio, and wire communications equipment supplied to the war theater.

With enough trained communication specialists available, the Chief Signal Officer told the group of approximately 250, his observations in Korea showed communications for the Army operations both in the front lines and in the divisional and rear echelons had operated successfully, both in the use of short-range handie-talkies and walkie-talkies and the higher-powered SCR-300, 193, and 399 stations, and in the installation of radio relay systems which overcame the transmission obstacles of the mountainous terrain.

"No major changes are indicated in our present long-range Signal Corps research and development program," General Akin stated, bringing out that the Signal Corps equipment had met all tests of combat in Korea. "The new equipments that are now coming out of this program or already rolling off the production lines (to join the new military field wire WD-1 which proved so successful in the Korean fighting) will insure that our troops will continue to have the most modern and effective type of military signal communications that can possibly be devised," he said. Providing enough highly skilled personnel, which had been greatly limited during the previous peacetime "economy" period, "is our big problem," the Chief Signal Officer reiterated, and the training of technical specialists for the Army in the Signal Corps schools is imperative.

The Signal Corps plunged into action immediately upon the outbreak of hostilities in Korea, General Akin related, and shipments over the tremendous 10,000-mile supply route began at once, after he had asked the Far East Command for its supply needs. There was "complete coordination of all communication facilities available to the Army, Navy, and Air Force, the Chief Signal Officer emphasized.

At the luncheon the national directors of the AFCA, who held a special meeting during the day to make plans for the next national convention in Chicago at the Drake Hotel April 19-20, were the guests of honor. Theodore S. Gary, vice-president of *Automatic Electric* and national AFCA president, was at the head table at the luncheon. Other head table guests were: Maj. Gen. K. B. Lawton, Deputy Chief Signal Officer; Rear Admiral S. C. Hooper, USN, Ret.; Brig. Gen. Wallace B. Smith, who commands the AACS; Capt. W. D. Ammon, Deputy Chief of Naval Communications; Vice-President and General Manager J. R. B. Crigler of the *Chesapeake & Potomac Telephone Co.;* Col. W. W. Watts, *RCA Engineering Division* executive vice-president and AFCA national vice-president; and Col. George Dixon, AFCA executive secretary. Francis Engel, *RCA Victor* Washington manager and president of the AFCA Washington Chapter, presided at the luncheon.

Other national AFCA directors at the affair included Russell Cunningham, *United Air Lines* communications superintendent; Rear Admiral Earl E. Stone, of the Joint Chiefs of Staff; William H. Mansfield, secretary of the *Southern Bell Telephone & Telegraph Co.;* former FCC Commissioner E. K. Jett; David Hull of *Raytheon Manufacturing Co.;* and General Counsel Frank Wozencraft.

-30-

Pretty Shirley Stolper poses with a DuMont television receiver which was the largest set displayed at the 3rd annual Television and Electrical Living Show held recently in Chicago. The screen is 30 inches and the set stands 7 feet high and is 5 feet wide.

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Extremely light but strong!!! Chrome Molybdenum alloy steel. Made for use in cargo plane airframes. Enormous load carrying capacity—in comparison with ordinary steel. We will not ship more than 12 masts to any dealer, as the quantity available is limited and no more steel of this quality is available, even at many times this price. All tower hardware, except guy wire, is furnished including large mast base adjustable to any angle. Base suitable for mounting on sloping roofs or on a concrete block set on ground. Total price for 30 ft. tower—$15.00. Total price for 40 ft. tower—$20.00. Double Stack Antenna as shown—$15.00 extra.

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TYPE "B" Heavy duty line filter consisting of 2 condensers and R. F. choke in plated steel case. Conservatively rated at 4 amps and 600 volts. Perfect for refrigerators, oil burners, power supply input of signal generators or to block out almost any interference you can think of. Super special $.75 each or 10 for..... **$5.00**

NEW G-E TRANSMITTER

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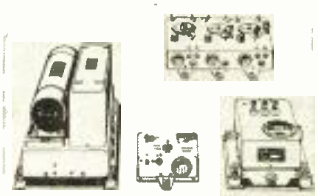
BC-312, BC-348 or BC-224 receivers, sold with the above transmitters (omit for 40m). 1000-mile range **$125.00**

Universal 4 lead broadcast band oscillator coil (can be converted to 3 lead type by addition of jumper). Ten for.....$1.00

SCR 274N Command Set (Made by Western Electric) THE GREATEST RADIO EQUIPMENT VALUE IN HISTORY



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4"	$1.15	6 for	$6.60
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6"	$1.50	6 for	$8.70
6"x4" Oval	$2.10	6 for	$10.80
7" (Car Radio Size)	$4.50	6 for	$21.50
8" 10 oz	$3.95	6 for	$20.50
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10" 21 oz	$5.50	6 for	$30.00
12" 21 oz	$7.95	6 for	$42.00

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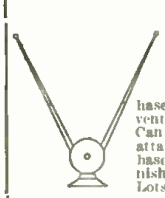
3. **CARBON MIKE** with Push-To-Talk Switch and Gold Plated Carbon Lapel Mike. Combination offer on both mikes $1.75

SCR610 portable 6, 12, and 24 Volt crystal controlled transmitter receiver with built-in loudspeaker on receiver. Complete **$59.95**

SCR-522 Transmitter-receiver in guaranteed condition complete with remote controls, antenna and mike. No conversion necessary to license for taxicab use. A natural for any 2 meter use. **$100.**

REMOTE CONTROL UNIT—Aluminum case 4 x 3 x 2 containing revolution counter, 2 potentiometers, triple pole switch, 4 knobs, phone jack, and gear mechanism. Including 8 prong JAN connector to fit box—$1.39.



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RT1463 12 Stage Electronic Brain containing 3—7F7, 1—7Y4, 3—7N7, 4 potentiometers, numerous resistors, filter and bypass condensers, filter chokes, power and audio transformers, and six sensitive plate relays. A military development that provided amazing stepless control proportional to correction required, in the original application. This phenomenal unit, with its 3 multistage push-pull amplifiers and six 5,000 ohm relays in bridge circuits, will accurately control any 3 operations, related or unrelated, in minutely adjustable infinitely quantitative variations in either forward or reverse directions. 9"x7"x8" black crackle aluminum case. Brand new in original carton.....$9.95

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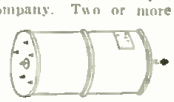

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Record-Reproduce
(*Continued from page 49*)

at one end only. Patch cords should be checked as many come from certain manufacturers with "both ends grounded."

Another system, used by *CBS* and by certain recording studios, is a "single jack" system. Its only difference lies in the mechanical construction of the jacks and plugs, and will not be discussed in this article.

To further illustrate the action of the jacks, we refer you to Fig. 9A. Here the secondary of the transformer is shown in its "normalled" position to the line amplifier. When connected in this fashion, the signal will flow as indicated by the arrows. Fig. 9B is the simplified version of the same circuit, with only one side of the line indicated. This same technique is used throughout the diagram of Fig. 5 to show the jacks and their use in the entire system.

When the double plug is inserted

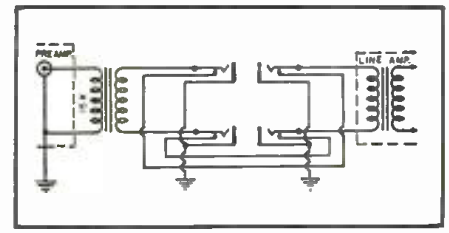


Fig. 8. Detailed wiring of two pairs of double jacks (in "normalled" position).

from the patch cord the action illustrated in Fig. 9C will take place. Here the swingers are lifted from contact with the normal springs and the circuit is broken, as far as the normal springs are concerned. By inserting a double plug the program would continue if one end of the patch cord were inserted into the output jack of the preamp and the other end into the line amplifier input jacks. There are many cases where it is desirable to break the circuit at this point, either for measurements or to introduce the signals from an audio oscillator, etc. Another use is found in the inclusion

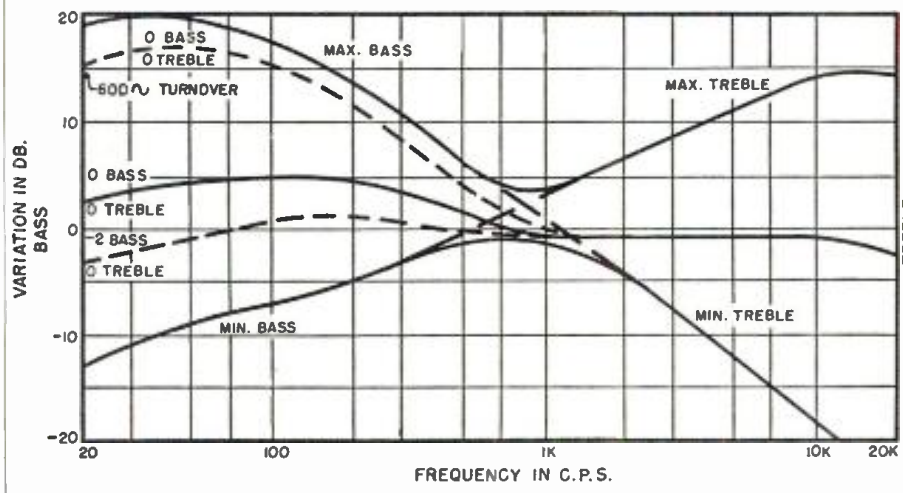
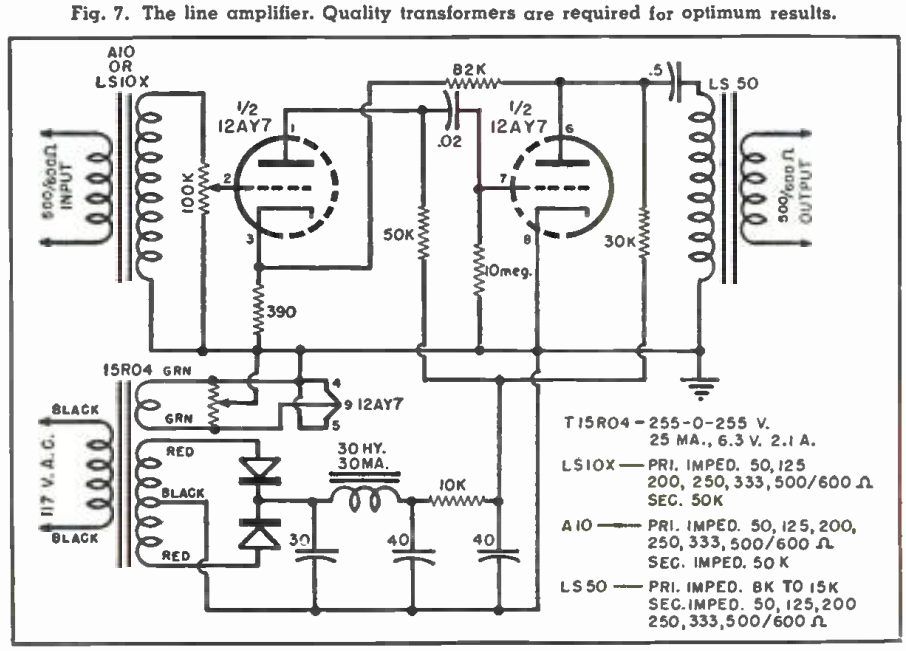


Fig. 6. Frequency response curves for the AE-2 equalizer. Dotted curves are obtained when using channels 3 and 4, and the solid curves when using channels 1, 2, and 5.

Fig. 7. The line amplifier. Quality transformers are required for optimum results.



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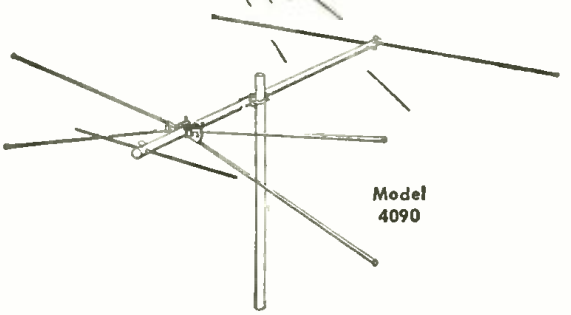
WALSCO

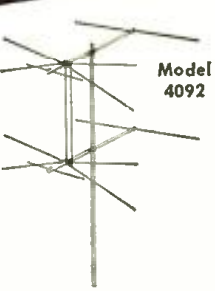
—in any climate, anywhere . . .



Model 4090

INSTALL IT and FORGET IT

new WALSCO SIGNAL-KING

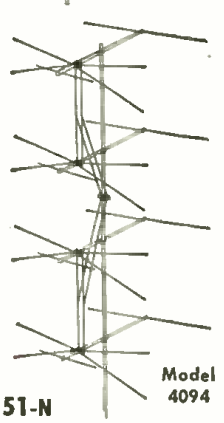


Model 4092

No fear of costly "call backs" that eat up a dealer or installer's profit. In any climate, *anywhere* . . . the new WALSCO Signal King antenna provides sharper, clearer response over entire TV spectrum. Rugged aluminum alloy construction for elements, cross-arm and mast. Corrosion resistant. All steel parts are cadmium plated to AN specifications.

NOTHING LIKE IT ANYWHERE . . .

- **High gain on all channels—no weak spots. Excellent for fringe areas.**
- **Entirely *new* insulator *guaranteed unbreakable* under all operating conditions. Outstanding and lasting dielectric properties.**
- **Marine type aluminum alloy elements, reinforced and closed ends.**
- **Assemble in a jiffy (less than 2 minutes).**



Model 4094

Write for Information Bulletin No. 51-N

WALTER L. SCHOTT CO. Beverly Hills, Calif. • Chicago 6, Ill.

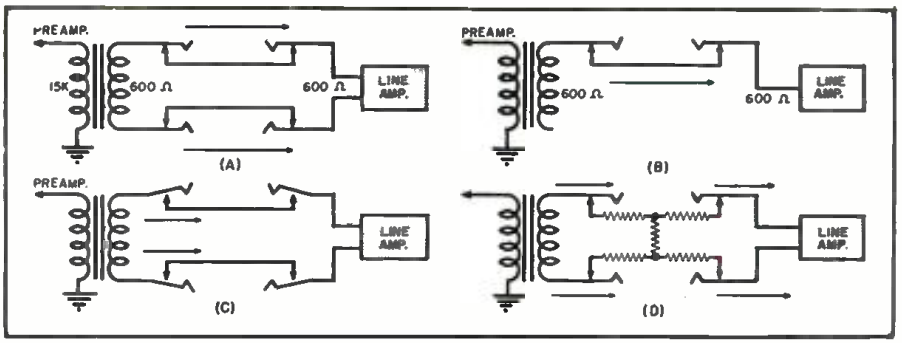


Fig. 9. Functional diagrams of the double jack system referred to in the text.

of a loss pad which affords isolation between the preamp and the line amp. Such a loss pad may be purchased or home-constructed to provide any fixed loss. It may be connected permanently in circuit with the normal springs as shown in Fig. 9D or it may be made up into a separate unit and patched into the line at the point shown.

Note that grounds are not shown except on the individual pieces of equipment on the diagrams. Each unit is grounded to the ground bus at only one point in order to prevent ground loops. Actually, the grounding system comprises a pair of #8 copper wires, securely connected to a cold-water system and terminating in a special terminal block within the racks of the audio bay. Circuits are usually grounded in order of their level. For example, the most direct connection through the grounding bus to the cold-water system is from the phono input, microphone inputs, preamp, line amp, etc., in that order.

It is of extreme importance in audio work that a good return-to-ground be made on all equipment to reduce the normal residual hum and noise of the system. Waterpipes which are buried underground are probably the most effective for average use.

The physical layout of the jack field must receive due consideration. Program circuits of low level should be widely separated from those of power circuits, especially when they carry signal levels that differ by approximately 20 db. In the layout shown, nearly all of the low-level inputs are located at the left hand side of the jack panels, as shown in Fig. 4. All power level circuits are situated at the extreme right of the jack panels. Shielded 2-wire cable of low loss is used to connect the various units in the entire system. Those of low level circuits are grouped together and brought in at the left side of the rack while those of high level are brought in from the right side of the rack. They are all 2-wire, cotton-covered shielded cable and after having been dressed in place, they are covered with spaghetti tubing. This eliminates shorts in the cabling and permits grounding of each cable at one point only, usually at the jack of the circuit.

Identification strips are removable. Several were made since the photo of Fig. 4 was taken and therefore do not agree entirely with the diagrams.

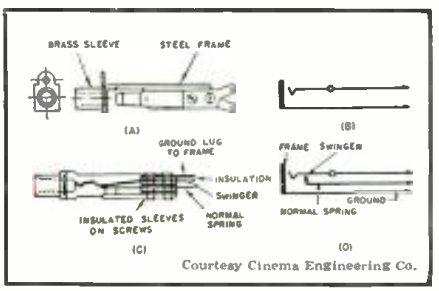


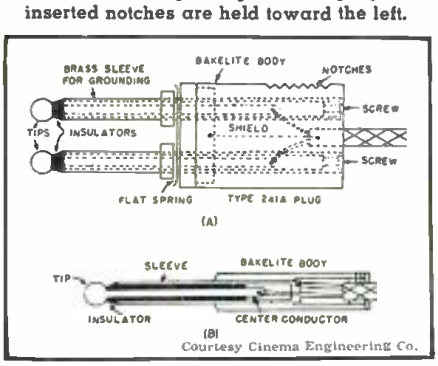
Fig. 10. Construction of standard jacks of the types widely used in sound studios.

It is advisable, when laying out the jack fields, to locate them so that they will be conveniently located for insertion of the patch cords and so that the identification of each jack may be easily seen. It will be obvious to the reader that great flexibility is afforded by use of the jack field. With it we can make insertions or connections either into or from various circuits and components for purposes of tests or for monitoring. Furthermore, by providing multiple jacks on commonly used circuits, such as the bridging bus, to be described in later chapters, we are able to substitute or to bypass certain units when desirable. The multiple jacks are nothing more than parallel connections which do not employ a normal spring. They are simply a convenient means for reaching a circuit by means of a patch cord.

When the jacks are properly normalled and when the impedance of the bridging bus is held to 600 ohms (±10%) the entire system is operative without any patch cords inserted. Changes in circuitry may then be made without materially changing the loads.

(To be continued)

Fig. 11. Construction of double plug. Notches show polarity. When plug is inserted notches are held toward the left.



Within the Industry

(*Continued from page 26*)

which to build a plant to handle the expanding military demand for the products of the company's electronics and x-ray divisions . . . **GENERAL ELECTRIC COMPANY** has announced the reopening of its radio tube plant in Utica, New York. The factory will be converted for the manufacture of emergency radio communications equipment . . . **SIMPSON ELECTRIC COMPANY** of Chicago has opened its fifth factory at 932 Benton Street, Aurora, Illinois . . . **C.G.S. LABORATORIES, INC.,** has moved to 391 Ludlow Street, Stamford, Conn. . . . **AMERICAN ELECTRONEERING CORPORATION** has recently taken over new and larger quarters at 5025-29 West Jefferson Boulevard in Los Angeles . . . **CORNISH WIRE COMPANY, INC.,** has moved its general executive offices to a new address at 50 Church Street, New York City . . . **RADIO CRAFTSMEN, INC.,** Chicago manufacturer of custom-built television and radio chassis and electronic equipment, has acquired 12,000 feet of space at 4401 N. Ravenswood, Chicago, which will be used in the production of television chassis . . . **RAYTHEON MANUFACTURING COMPANY** has recently set up a new plant at Quincy, Massachusetts, for the manufacture of electronic tubes of the subminiature and miniature construction for military requirements . . . **STEINER PLASTICS MFG. CO., INC.,** has taken over a new plant at Pratt Oval, Glen Cove, New York. The company forms and fabricates thermoplastic sheets, rods, and tubes used in the electronics industry.

* * *

INSTITUTE OF RADIO ENGINEERS has just announced the winners of four of its annual awards for 1951.

Robert B. Dome, electrical consultant for the *General Electric Company* has been named recipient of the Institute's Morris Liebmann Memorial Prize which is awarded annually.

Mr. Dome's award was made for his contributions to the intercarrier sound system of television reception, wide-band phase shift networks, and various simplifying innovations in FM receiver circuits.

The Browder J. Thompson Prize was awarded to Alan B. MacNee, assistant professor of electrical engineering at the University of Michigan, for his paper "An Electronic Differential Analyzer." The award is given annually to the author under thirty years of age for the paper recently published by the Institute which constitutes the best combination of technical contribution to the field of radio and electronics and presentation of the subject.

The Harry Diamond Memorial award, given annually to a person in government service, was awarded to Marcel J. E. Golay of the Signal Corps Engineering Laboratories, Fort Mon-

mouth, N. J., for his contributions in the over-all Signal Corps research and development program and particularly for his accomplishments leading toward a reduction in the infrared-radio gap.

Willis W. Harman, associate professor at the University of Florida, received the Editor's Award, established to stimulate the use of good English in technical writing, for his paper "Special Relativity and the Electron" which appeared in the November 1949 issue of the *"Proceedings of the I.R.E."*

* * *

DR. HARRY STOCKMAN has been named director of research of the *Tobe Deutschmann Corporation* of Norwood, Massachusetts.

Prior to accepting his new post, Dr. Stockman served as consulting engineer and scientist to several industrial firms in the greater Boston area. During 1945-48 he was associated with the USAF research program in Cambridge and taught the 1941-45 pre-radar and other courses at Harvard University.

Active in electronics research and development for more than twenty years, Dr. Stockman served on the Communications Panel of the RDB during 1947-48. He is the author of numerous scientific and experimental papers, reports, patent communications, and textbooks. He is a senior member of the IRE.

* * *

GEORGE F. WUNDERLICH and **HAROLD E. SORG** have recently been named vice-president and general manager, and vice-president in charge of research, respectively, for *Eitel-McCullough, Inc.*, manufacturer of transmitting tubes and TV picture tubes . . . **BILL ROLLINS** has been promoted to the post of vice-president in charge of production and purchasing for *Crescent Industries, Inc.* He has been with the firm since 1939 . . . **THOMAS G. BANKS** has assumed the post of director of research and development at *Gates Radio Company* of Quincy, Illinois. The position is a newly-created one . . . The Radio and Television Division of *Sylvania Electric Products Inc.*, has named **HOWARD RIORDON** as general manufacturing manager for that division . . . **WALTER A. BUCK**, vice-president and general manager of the *RCA Victor Division*, has been elected to the Board of Directors of *Radio Corporation of America*. He succeeds **EDWARD J. NALLY**, who retired because of age . . . **BEN MILLER** has resigned his post as general sales manager of *United Transformer Company* to "go fishing." **HANK RUSSELL** has taken over the duties of the retiring official . . . **SIDNEY A. JOFFEE** has been elected president of *Pathe Radio and Television Corporation*, succeeding **A. H. STOBBE** in the position . . . **WILLIAM D. LOUGHLIN**, prominent radio engineer and chairman of the board of directors

of *Boonton Radio Corporation*, passed away recently at the age of 57 after an illness of several months . . . **GEORGE R. SIEGRIST**, executive vice-president, treasurer, and director of the *Acheson Colloids Corporation*, retired recently because of ill health. He was associated with the company for thirty years . . . At a recent stockholders meeting of *Herman Hosmer Scott, Inc.*, **VICTOR H. POMPER**, sales manager of the firm, was elected a director of the corporation . . . **JOHN F. BYRNE** has been named associate director of research for the Division of Communications & Electronics of *Motorola, Inc.* . . . **SHANNON C. POWERS** is the new general sales manager of the *Russell Electric Company*, a *Raytheon* subsidiary located in Chicago . . . **DR. IRVING LANGMUIR**, the recently-retired associate director of the *General Electric Research Laboratory*, was awarded the John J. Carty Gold Medal of the National Academy of Sciences. The medal, together with an accompanying certificate and honorarium, was presented at a recent meeting of the Academy. -30-

Spot Radio News
(*Continued from page* 18)

instance sufficient protection may be obtained if the service areas do not overlap. As an added factor, it was pointed out, it was believed that channels to be received in any given area should be grouped insofar as possible so that the frequency range, for which receiver antennas will have to be provided, could be minimized and receiver tuning simplified.

The plan, offered by John Preston, chief allocations engineer of the *American Broadcasting Company*, on behalf of the association, was soundly criticized by FCC Counsel Harry Plotkin who said that the proposal was purely a theoretical one without substantial support. His fire was directed particularly on the association's assumption that the intermediate frequencies would be adopted, whereas no official word had been received that such a move had been approved, industry-wide. The thought that radiation would have to be tolerated also irked the Commission's attorney who declared that such interference might have a serious effect on other services, some of which might involve public safety. This blast recalled to many the seething letter Major Armstrong had sent to the Commission on radiation. In the Major's opinion, the radiating receiver problem in FM and TV was . . . "a disgrace to the engineering profession." He believed that the present conditions were the result . . . "of the disregard of rules of engineering that were known twenty years ago . . . In both TV and FM these rules have been and are now being flagrantly violated by a large part of industry, perhaps to their immediate profit, but certainly to the ultimate detriment of the public."

The hearings were also sparked by a blistering exchange between consulting engineer Paul A. DeMars and Plotkin, as well as Commissioner Webster, when DeMars questioned the qualifications of K. A. Norton, the Bureau of Standards' propagation specialist, whose advice had been sought by the Commission on several occasions. DeMars said that Norton had not only erred in many instances, but reversed his opinions. Norton's statement of 1944 was cited as one illustration. At that time, according to DeMars, Norton said that the very-high stations at high power operating on 80 megacycles, in such places as South America and Australia, during times of high sun-spot activity would interfere with the TV and FM stations in this country. When queried in '47 during another proceeding by Major Armstrong, whether the frequency of 80 megacycles was correct, Norton was said to have admitted that he was wrong and that 40 megacycles should have been specified. Several other instances during which Norton changed his mind were cited by DeMars who declared that . . . "here is a man who has contradicted himself." In his opinion this was a serious affair which tends to "cast serious doubts" about his abilities. Quizzed on this serious charge by Commissioner Webster and asked specifically whether Norton should be disbarred from appearing before the Commission, DeMars replied that the answer could be yes, insofar as the subject of propagations is concerned. Plotkin then asked DeMars if honest admission of an error could disqualify one as an expert, and the consulting engineer replied it all depended on the number of times such mistakes might be made. When the word battle ended, Plotkin said that . . . "Nothing has been shown in any way which impairs the qualifications of . . . K. A. Norton."

As the barrage of testimony continued to accumulate, it looked as if the record set during the color marathon of speeches might be seriously challenged. In any event, it was felt that the hearings would last and last, and '51 would see many phases of the subject still to be covered.

WHILE WASHINGTON BRISTLED with problems of TV and Federal jurists deliberated on the finality of the Commission's decision on color, the FCC became a target of hostile criticism, with the members being hounded for answers to an endless parade of questions from everyone on the buying or selling fronts.

An eloquent answer to the mountainous task which faces the ether guardians was provided by Commissioner E. M. Webster, in an address before the Kansas City section of the IRE. Explaining the important phases of the policy-making processes involved during a hearing, and particularly during the recent color session, Webster said: "As an engineer, I was expected to have an opinion as to the technical competence of the various color television systems that were presented to the Commission. My role in the final decision, however, went beyond evaluating the system from solely the technical viewpoint. For instance, consideration of the economic impact of a new system on the several million persons in this country who now own black and white television sets had to be balanced against the 40-million potential new set owners and the ability of the television manufacturing industry to meet the needs of both groups. It was also essential for me to consider legal limitations under the Communications Act, our responsibilities to the Congress and interests of military, industrial, and other specialized groups, before our decision could be crystallized. All of this and the weight to be given to each element enters into the determination as to what constitutes—'public interest, convenience and necessity.'"

Discussing the problems of personal issues involving integrity of engineers which were so prevalent during the hearings and continue to be in the present channel sessions, Webster said that . . . "when personal biases or prejudices of one sort or another are thrown into a situation only havoc, resulting in the gravest consequences can result. This fact was forcefully brought to my mind while I was listening to engineering testimony during the recent color television hearing. An attorney for one of the major broadcasting interests attacked the integrity of the engineer who was then testifying. This radio engineer is a fellow of the IRE and a highly respected member of our profession. While the attack did not appear to me to have succeeded, I was somewhat shaken by the fact that the attorney had made the effort. I realized then, as at no other time, that engineers who are called upon to represent private interests must be doubly careful to maintain their integrity, so that they do not subject themselves to a valid claim that they are selling out on their profession. The Commission, which is so dependent upon the advice of private radio engineers, must have complete confidence that the information it is receiving from them is thoroughly reliable; otherwise we will fail in our duty to render decisions in the public interest."

THE SINCERE INTEREST which the Commissioners have in rendering decisions was also aptly described by Madame Commissioner Frieda Hennock before the New York Women's Advertising Club. Pointing out that of the possible 2000 new stations that might be assigned in the new upstairs band, she was urging that twenty-five per-cent should be reserved for the use of educators for non-commercial and non-profit broadcasting. In Miss Hennock's opinion educators . . . "cannot overlook or ignore television . . . for TV is here to stay just as surely as the electric light, automobile, or airplane."

She felt that the potentialities of visual education by way of TV offer new and almost unlimited horizons to teachers. Television channels assigned to educators will be an investment in the future of America, culturally as well as commercially, she emphasized.

In a prior talk before the National Association of Women Lawyers in Washington, Miss Hennock also hammered away at the obligations which she felt she had to meet as a member of the Commission. Disclosing that, in fulfilling the statutory mandate under the Communications Act to study . . . "new uses for radio, provide for experimental uses of frequencies, and generally encourage the larger and more effective use of radio in the public interest . . ." the Commission has a duty to look into the future. "Accordingly," she said, "we . . . cannot be content with what is here today, but we must look to see what may be tomorrow, what new developments radio may bring which may make us more secure, more happy, and more comfortable."

Explaining that the Commission's role is not merely a technical one, Miss Hennock said that Congress has been quite explicit in defining the function of the body, to see to it . . . "that the use of the valuable domain of the airwaves, the property of the people of the United States, shall be in the public interest, which means nothing more or less than that it shall be for the benefit of the people of the United States."

Citing that the burden for the . . . "improvement of the quality of America's broadcasting lies squarely on the shoulders of the public and the broadcasters," Miss Hennock declared that every citizen must take broadcasting seriously. She felt that none of us can ignore broadcasting . . . for it will . . . " in any event have a great effect on our lives and futures of us all."

Her comments at these two meetings were particularly interesting in view of her opinions on the color decision which called for a delay in final action until June 30 of '51, when she felt that all proponents would have had an opportunity to display what they might have to offer to meet the criteria established by the Commission. Hastening the ruling and demanding that a decision must be made now, did not, in her opinion, provide for a fulfillment of the obligation to encourage the larger and more effective use of radio in the public interest, as cited in the Act.

TEXAS has received the first grant for a reactivated State Guard Radio Service providing for the use of twenty base stations and seventy-two mobile units, operating on 2726 kilocycles. The State Guard, distinctive from the National Guard, has established communications headquarters at San Antonio and will begin an active training public-safety program. Congratulations to the alert radiomen of the Lone Star State. . . . . L.W.

NEW TV PRODUCTS on the Market

THE "MARKA-SWEEP"

Kay Electric Company of Pine Brook, New Jersey has recently introduced a new all-electronic i.f. sweep and

marker generator designed especially for the production alignment of TV receiver i.f. systems.

Designated the "Marka-Sweep," Model IF, a three-position switch in the unit selects the 20-30, 30-40, or 40-50 mc. range with overlap. The sweep width is approximately 15 mc. All carriers are oscillator fundamentals. The instrument produces a true zero amplitude reference baseline on the oscilloscope display. The output level may be varied between approximately 50 microvolts and 250 millivolts across the 70 ohm unbalanced output. A panel switch narrows the sweep and recenters it to make it suitable for sound channel measurements.

Provisions are made for simultaneous injection of picture carrier, resulting in a 4.5 mc. swept signal at the second detector which is suitable for aligning intercarrier receiver sound channels. Up to nine extremely narrow crystal-positioned, pi-type markers are available at i.f. frequencies specified by the customer. There is an individual "on-off" control for each of the nine marks.

TV MICROPHONE

The *RCA* Engineering Products Department has developed and is currently marketing a new ribbon-

pressure microphone which has been designed especially for the television industry.

The "Starmaker" is a slender and unobtrusive microphone which will not hide the faces of singers, speakers, or others using it. The 15 ounce mike is inconspicuous not only because of its size and shape but because of its special "TV gray" finish which makes it appear to fade into studio backgrounds or blend with the clothing of entertainers.

The Type BK-4A is suited for sound reinforcement and radio broadcast pickup, and has an output comparable to larger conventional studio microphones. It has an output of 110 μv. per dyne/sq. cm. for an output impedance, in accordance with RTMA standards, of 30, 150, and 250 ohms. The microphone is non-directional and provides uniform frequency response between 50 and 15,000 cycles. Its effective output level at 1000 cycles is —50 dbm. Special transformer design results in a low hum pickup level of —125 dbm.

G-E SERVICE PARTS

General Electric Company of Syracuse. New York has announced a com-

plete line of television receiver parts, applicable to *G-E* and many other receiver makes.

The new line includes 70 degree deflection yokes for magnetic deflection circuits, horizontal sweep output and high voltage transformers, and other components such as EM-PM focus coils, width and linearity controls, ion trap magnets, etc.

A new catalogue which gives a complete description of the various components may be obtained from the Parts Section of the company's Receiver Division.

BRACH ANTENNA

The Brach Manufacturing Corporation of 200 Central Avenue, Newark, New Jersey has developed a new television antenna known as the "Bow-Tie V Antenna."

The new Model No. 452 antenna does not require directors or reflec-

tors. It is a closed circuit "V" antenna in which three antenna rods of the same electrical length emanate from each side of a non-hygroscopic insulator and joined at the ends by means of shorting bars. The shorting bars provide more surface area and raise the gain of the antenna, proportionately higher than would the adaption of directors or reflectors, especially on the upper channels, according to the company.

As there are no free vibrating elements and the antenna uses seamless tubing and a high impact insulator the new antenna is said to be able to withstand virtually all wind velocities and ice loading conditions.

LIGHTNING ARRESTER

LaPointe-Plascomold Corporation of Unionville, Conn. is now constructing

its "Vee-D-X" four-wire lightning arrester of a high dielectric, double phenolic material.

The new RW-204 arrester is designed for installation in accordance with the National Electric Code and is also approved by *Underwriters' Laboratories*. The unit will accommodate four-wire rotator line as well as the regular 300 ohm transmission line.

ANTENNA HOIST

The Haugen Mfg. Co., 412 S. Front Street, Mankato, Minnesota, has developed a unique television mast and tower hoist which will erect and lower towers up to fifty feet in height.

The new "Jiffy-up" unit permits one man to make the antenna installation on any type of rooftop. The base, which is permanently installed on the roof, is especially designed so that the mast hoist can be easily attached for raising or lowering the mast or tower. The base is extra heavy in construction, will work on any type of roof, and will accommodate large masts. The installer needs one hoist for all of his installation work and a base unit for each installation.

Descriptive literature on the new hoist is available from the company.

7-INCH SCOPE

A new 7" cathode-ray oscilloscope, especially designed for general use in radio and television receiver testing and in laboratory and production applications, has been announced by the Radio Tube Division of *Sylvania Electric Products Inc.* of 1740 Broadway, New York 19, New York.

The new instrument incorporates a multivibrator sweep circuit for linear internal sweep from 10 to 30,000 cycles which may be synchronized to 60 cycles, an external signal, or signal ap-

plied to its vertical input terminal. Balanced, non-astigmatic sweep is assured by push-pull deflection. Terminals are provided for direct connection to horizontal and vertical deflection plates and to the control grid of the cathode-ray tube for intensity modulation.

The vertical deflection amplifier provides a sensitivity of .1 volt r.m.s. for one inch peak-to-peak deflection, sine wave frequency response at full gain flat within 3 db. of 1000 cycles value from 7 to 70,000 cycles free of peaking and usable to much higher frequencies, and an input impedance of ½ megohm and 34 $\mu\mu$fd.

Designated the Type 132Z oscilloscope, the new unit measures 17 1/16" high, 11⅜" wide, and 17¾" deep and weighs 39 pounds. The sale of this new scope is being handled by the company's authorized distributors.

REPLACEMENT BALLASTS

JFD Manufacturing Co., Inc. of 6101 Sixteenth Avenue, Brooklyn 4, New York is currently offering its line of air-cooled TV ballast tubes as replacement items.

Employed as original components by several TV set manufacturers, the ballast tubes are available in seventeen different models. Heavy resistance elements and large insulating surfaces are designed to provide efficient operation. The black enameled shell is perforated for greater heat dissipation.

Further information and literature is available direct from the manufacturer, its representatives, and distributors.

"TENNA-SCOPE"

The Alliance Manufacturing Company of Alliance, Ohio has added a new TV booster to its line as a companion item to its "Tenna-Rotor."

Known as the "Tenna-Scope," the new unit is a booster which features a single tuning control for all channels, an automatic "on-off" switch which operates when the television set is turned on or off, high and low band

amplifiers on separate circuits, and each circuit designed to give maximum performance on its own channels.

The new booster uses a dual 6J6 with selenium rectifier. The unit is housed in a walnut plastic cabinet with a gold and maroon dial and comes equipped with an 8 foot cord. The unit will match both 72 ohm and 300 ohm impedances.

Additional details on the new "Tenna-Scope" are available from the company.

TV SCREEN POLISH

The Jim Robbins Company of 1555 E. Eight Mile Road, Hazel Park, Michigan has begun the national distribution of a new polish designed specifically for cleaning the outer screens of television receivers.

Known as "TV Care," the new polish leaves the plastic tube protector clean,

scratch-free, and conditioned against many of the future scratching hazards. Investigation has shown that almost 90% of the scratching of such screens is due to the tiny dust particles, which are attracted to the plastics, being ground into the surface under the pressure of normal cleaning or wiping. These particles are negatively charged and cling to a positive static-charged screen.

The new polish uses a grounding agent to completely eliminate the static charge while another ingredient cleans the plastic surface. Thus, the plastic is left clean, scratch-free, and virtually dust-resistant by being conditioned against future recharging.

WALSCO "SIGNAL KING"

The *Walter L. Schott Company* of 9306 Santa Monica Blvd., Beverly Hills, Calif., has just announced the availability of a new television antenna, the *Walsco* "Signal King."

According to the company, the new unit is a universal antenna capable of receiving all channels. A special signal "director" has been added to improve gain on high band channels and eliminate ghosts. Ease of stacking makes the new antenna suitable for fringe area applications, in the opinion of the manufacturer.

Catalogue information on the new antenna is available from the company.

INPUTUNER

Mechanically and electrically designed for replacement of switch-type TV tuners, the new Series T3A Inputuner just introduced by the Electronic Parts Division of the *Allen B.*

Du Mont Laboratories, Inc. of East Paterson, New Jersey provides reception of FM as well as TV channels.

This new and improved continuous tuner is available to both jobbers and set manufacturers. It employs a *Mallory-Ware* three-section spiral Inductuner plus antenna tuning. The company claims that this combination provides good sensitivity and selectivity. The space required is identical with that of most leading switch-type tuners. Standard mounting holes further facilitate interchangeability. Electrically, the new Inputuner is designed to work into the i.f. system of TV receivers using a separate sound i.f. It is available with variations in the mixer plate network, making it adaptable, without alteration, to various types of separate sound i.f. receivers.

TWIN-DRIVEN ANTENNA

A new all-driven-element antenna has been announced by *Technical Appliance Corporation* of Sherburne, New York.

This new "Taco" antenna has been designated as the 1700 series and is known as the "Twin-Driven Corner Antenna." With all of the elements driven, the directivity of reception has been narrowed, thus minimizing ghosts caused by reflected signals. The front-to-back ratio is high. Both high and low band lobes coincide due to the phase relationship controlled through feeding.

Mechanically, the new unit offers low wind resistance and is rigid when assembled. Assembly is accomplished by means of the company's "Jiffy-Rig" type of construction. The antenna elements are merely swung into place and wing nuts tightened to prepare the antenna for installation.

These new units are available in single or stacked models depending on the requirements of the installation.

SWEEP GENERATOR

The Triplett Electrical Instrument Co. of Bluffton, Ohio has recently introduced a low-cost TV-FM sweep signal generator in response to the demand for accurate test equipment priced within the range of the average technician.

According to the company, any good AM signal generator can be used with the new unit as a marker thus making it possible for the service technician to reduce his investment in sweep signal generator equipment.

The Model 3435 provides continuous range coverage to 240 mc. for all TV carrier and i.f. frequencies. There is no gap in frequency and continuous tuning is provided over all of the TV and FM bands. The main frequency dial is marked with channels as well as frequencies.

The instrument features continuously variable sweep width, effective from 500 kc. to 12 mc., with "Off" position; phase controlled sweep voltage for scope horizontal input; and a standby switch for the temporary silencing of the generator during other work on equipment under test.

The February issue of **RADIO & TELEVISION NEWS** will be on sale January 30. Be sure to reserve your copy with your Newsdealer.

The unit is copper-plated steel construction throughout. All critical circuits are inclosed and the power transformer is static shielded.

V.T.V.M. KIT

Approved Electronic Instrument Corp. of 142 Liberty Street, New York,

New York is currently offering a new v.t.v.m. kit, the Model A-220K.

Suitable for television servicing applications, the new instrument has 5 a.c. ranges and 5 d.c. ranges. 5 resistance ranges cover from 0-100, and 0-10,000 ohms and 0-1, 0-10, and 0-1000 megohms.

The unit incorporates a balanced bridge circuit, a zero-center reading for FM-TV discriminator alignment, and has a d.c. input impedance of 26 megohms. The instrument uses three tubes, a 6H6, a 6SN7 and a 6X6. The meter used is a 4½" 0-200 microampere unit with an open-face, non-glare calibrated meter scale. The meter circuit is "burn-out proof."

The power supply is 110-120 volts, 60 cycles and the power consumption is 15 watts. The power transformer is electrostatically shielded.

The kit comes complete with a heavy gauge steel cabinet in a battleship gray crackle finish, three standard brand tubes, all parts including the power supply, operating instructions, pictorial and circuit diagrams, and a guarantee.

Complete details are available from the company.

TV BOOSTER

Television Equipment Corporation of 238 William St., New York 7, has developed a new television booster which is said to be particularly effective in fringe areas.

AN INEXPENSIVE DIODE PROBE

By SAMUEL T. WALTON

SEARCHING for non-standard hardware to construct test equipment is, in general, a time-consuming process.

The main part needed in the construction of this diode probe was a suitable metal tube with a dielectric end in order to house the condensers, resistor, and diode crystal as well as hold the metal probe.

A pencil flashlight with a plastic end, such as those sold in the five-and-ten cent stores for thirty to forty cents, met my requirements satisfactorily. The condensers, resistor, diode crystal, test prod pin, coaxial lead, and the jack may be obtained from an electronic accessories store.

In building this unit, first remove Parts A, B, and D as shown in Fig. 1B. Parts A and B may be removed by means of a long screwdriver after Part C has been unscrewed. This is best accomplished by standing the penlight on end and pressing down Part A, then giving the screwdriver a sharp rap with the palm of your hand. Part D is the penlight bulb. This may be retained and used in your absorption wavemeter as it is a low-current lamp.

Next, assemble the condensers, resistor, and diode crystal as shown in Fig. 1C, using varnished cambric tubing (spaghetti) where insulation is needed. This assembly is completed while the components are out of the penlight tube. This assembly is then wrapped with low-loss insulating tape. This wrapping should be done carefully in order to provide sufficient insulation and hold the assembly in place.

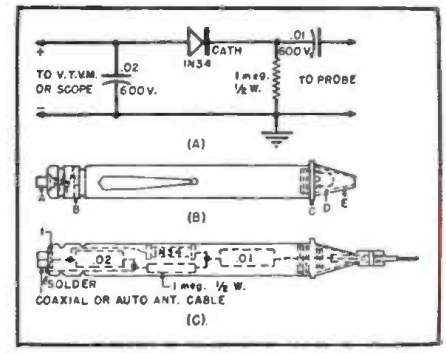
The next step is to dress the coaxial or auto radio lead in the cable to the correct length and attach to the components. Attach and solder a bare wire, 8 to 10 inches in length, to the shield at Point 1 in Fig. 1C. This wire is laid back along the cable and fed through the opening in the end of the penlight tube. It is used for making the ground after the components are installed in the penlight tube. Pull and slide the components into the tube and solder the ground wire to the case. Be sure the lead of the .01 microfarad condenser is long enough to attach easily to the test pin prod.

Finally, install the test pin prod in the plastic cap and feed the wire of the .01 microfarad condenser through the hole of the test pin prod and screw the plastic cap in place. Pull the wire of the condenser tight and secure it with the nut of the test pin prod, taking care not to over-tighten lest the plastic cap be damaged.

There are several circuits for diode probes, published recently in radio magazines, which may be used in place of the one shown in Fig. 1A. The one shown worked well with a v.t.v.m., however. A clip and lead can be attached to the probe case for a shorter ground connection, a condition which is often desirable when testing some circuits.

—30—

Fig. 1.

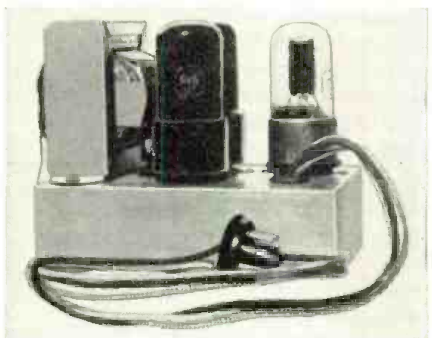


Known as the S-505, the new unit includes a gain control for reducing the gain of the booster on strong signals, and two untuned broadband amplifiers for both low and high bands. This latter feature is said to be especially applicable to intercarrier type television receivers inasmuch as it gives equal amplification to video and audio signals.

AUDIO AMPLIFIER

A new audio amplifier, designed by *N.J.R. Electronics Company* for TV applications, is now being distributed nationally by *Milo Sound* of 200 Greenwich Street, New York 7, New York.

The new Model 10MT can be used either with the receiver's existing speaker or with a higher quality reproducer. With the set's own speaker,



a 75% aural improvement is obtained, according to the distributor. With a quality speaker, the amplifier delivers its full range of 100 to 13,000 c.p.s.

The amplifier plugs into most of the existing single-ended amplifiers. It uses two 6K6's or 6V6's in push-pull and a 6J5 driver. The harmonic distortion is less than 3% and power output is 6 to 8 watts.

Because the unit measures only 3"x 5" it can be fitted directly onto most television chassis. It comes complete with tubes and a 2-foot extension.

Details are available from *Milo Sound*.

UNIDIRECTIONAL ANTENNA

Tricraft Products Company, 1535 North Ashland Avenue, Chicago 22, Illinois is currently in production on a unidirectional antenna for FM and television applications.

The new P-38 is a single bay incorporating seven elements. The design of the antenna is such that in the high television band three colinear elements are fed with in-phase equal currents, which single element group gives a gain over a half-wave dipole of approximately 6 db.

Behind the three elements are placed two colinear reflectors cut for the high television band and a third longer reflector that is active in increasing the forward gain in both the high and low television bands. The resultant high band antenna gain is nearly 10 db. over the entire high TV band, according to the company.

When operated in the low TV band, the three fed element group of the high band becomes a single half-wave dipole with the approximate sinus-

oidal current distribution of any thin half-wave dipole. Behind this dipole is placed the reflector, cut to give maximum forward gain on Channel 2 and in front of this dipole is placed a director cut to give maximum forward gain on Channel 6. As a result, the antenna gain is nearly constant over the entire low TV band at approximately 6 db. over a half-wave dipole.

The company will forward a data sheet giving complete details and reception patterns to those requesting one. —30—

NEW SERVICE GROUP

A MEETING of independent service technicians has been called for January 28th in Washington, D. C. for the purpose of organizing a new national service group to be known as the National Association of Electronic Technicians.

At a recent meeting held in New York City, delegates from 29 different technicians' organizations passed a resolution calling for a national association. Any service group interested in being represented at the Washington meeting are asked to contact Norman Chalfin, 545 Fifth Avenue, c/o ARSNY, New York 17, N. Y. —30—

"GREAT EAGLE"

WHEN the Simpson Electric Company held its annual sales conference late in September at Lac du Flambeau, Wisconsin, Ray Simpson, the past president and present chairman of the board, acted as host to the group.

The Indian headdress Mr. Simpson is wearing in the picture is no gag. It signifies his new status as honorary chieftain of the Chippewa Tribe. His official name is "Me-gese" or "Great Eagle." The Indians at Lac du Flambeau accepted him into the tribe at a ceremony, complete with war dances, which was held during the sales conferenece. The honor was conferred on Mr. Simpson in recognition of his rehabilitation work among the Indians, made possible by his employment of members of the tribe at the Simpson factory opened there four years ago. —30—

Ray Simpson, chairman of the board of the Simpson Electric Company, shown wearing his ceremonial headdress to which he is entitled by virtue of his recent acceptance as an honorary chieftain of the Chippewa Tribe.

Corner Speaker
(Continued from page 55)

45 degree conic section will result. Small finishing nails can be driven into the edges for securing the aluminum.

To avoid possible flexing of the aluminum when reflecting sound, the cone can be filled with paster of paris or fine sand. A top section should now be fitted to conform to the outlines of the cone and screwed into position.

The writer was content to paint the reflecting arrangement black and leave it open. It is suggested, however, that if this offends other eyes, the top piece can readily be extended in dimensions so that grille cloth can be fixed to the entire top portion, enclosing reflector and all. A vertical piece in front of the speaker would allow a square corner for mounting the grille cloth.

Bass response is as good as the speaker itself can provide. The fact has previously been established by competent authorities that the reflex type box gives pronounced bass boost. If such boost is desired, a suitable port can be cut near the top of the enclosure. —30—

GOOD NEWS FOR HAMS

IN HER article, "21 Years a Ham," in the September 1950 issue, Helen Cloutier, W8GJX happened to mention that she was awarded a box of oranges for working fifteen Orlando stations.

According to a letter received from Jess R. Leach, W4CMI, this offer was discontinued as of May 1, 1950, leaving a considerable number of disappointed hams throughout the country who had twelve, thirteen, or fourteen of the Orlando stations logged.

According to Mr. Leach, the offer has again been renewed as of November 10, 1950 on the same basis as previously. In other words, all postwar Orlando contacts are valid so that the hams who have worked a number of the Orlando group do not have to start from scratch but may add to the list until they have fifteen.

The offer, as it stands now, is this: The Orlando Amateur Radio Club will ship prepaid a box of select tree-ripened Central Florida citrus fruit upon receipt of proof that the ham has worked fifteen different ham stations in Orange County. Mr. Leach stresses that there are no strings or catches to this offer. "Proof" consists of a list of the stations worked since the band opened after the wartime ban, with the date of the QSO, time, and the operator's name, if possible.

Mr. Leach explains that the reinstatement of the offer was made after the club members decided that the cost of the project was incidental compared with the pleasure the group derived from its contact with hams throughout the United States.

Hams who already have several QSO's recorded will be happy to hear of the reinstatement of the offer and the hams who haven't entered the "orange sweepstakes" will want to try their hands at winning their morning orange juice. —30—

MARS Station of the Month

MARS OPENS RANKS TO CIVILIAN HAMS

The Department of the Army has announced that it will accept civilian members in its MARS program. Civilians interested in joining the system are invited to contact the Signal Officer of their nearest Army installation. Authorization for civilian membership in MARS-Army insures the continued use of the net as a back-up communication system if activities and reserves of the Army are mobilized. MARS membership does not affect draft status, the Army emphasized.

Civilian members must be 21 years of age or older and must hold a valid FCC amateur radio station license. They must also agree to operate their stations in accordance with rules and regulations prescribed for the MARS by the Army. Only amateurs who own stations, in operation at time of application for MARS membership, can be considered. No radio equipment can be furnished civilian amateurs under existing law.

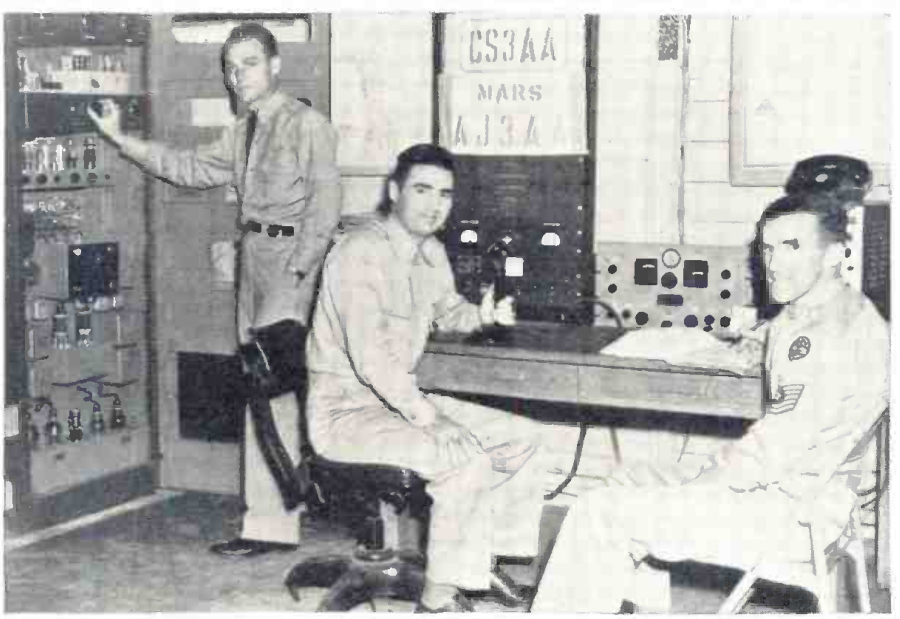
AJ3AA-CS3AA at Lages Field, Terceria Island, in the Azores Archipelago, has been named "MARS Station of the Month" by Major Rawleigh H. Ralls, Chief, MARS, U. S. Air Force. The station has proven a big morale factor to Air Force personnel stationed on the "rock" by permitting them to talk to the folks back home via 10 and 20 meter phone. Daily contacts with AIR at the Pentagon and with AK2AA at McAndrews Field, permits informal handling of a lot of squadron affairs.

Lt. Col. Sidney Nutt, "Sid," is the licensee, MARS Director, station custodian, and Commanding Officer of the 1936th AACS Squadron. Sid does just about everything as can be seen from his titles and he does spend some time at the mike. Master Sergeant Nick Pozarich, W6ZGB-AF6ZGB/CS2 (boy, what a c.w. call) is chief radar mechanic for the squadron. Nick keeps all the radar gear in tip-top shape so that maintenance does not interfere too heavily with his skeds. Myron Kisselburg, W6ZNA, a civilian employee of the *Gilfillan Corporation,* also does his bit of brass pounding.

The prefix Charley Sugar coming from the Azores rather than the accustomed Charley Tare has thrown many DX men and SWL's for a loss but it has helped the gang at CS3AA to work all continents in record time and get well along the road toward WAZ and DX Century Club certificates. The station was granted an experimental license by the Portugese government and is permitted to operate in the amateur bands and on MARS frequencies. It is the experimental aspect of the license that accounts for the "Sugar." For those looking for an exclusive QSL, CS3AA roosts right around 14.350 kc. most of the time.

The station layout consists of a TDO transmitter. This is a 10-channel remote control job manufactured by *Collins Radio.* It produces 350 watts of r.f. from a pair of 813's and is modulated by 805's. The receiver is a "Super-Pro," BC 779. The antenna is a long, long wire aimed at St. Louis,

The gang at CS3AA-AJ3AA. From left to right are Myron Kisselburg, W6ZNA. Lt. Col. Sidney Nutt, Jr., and M/Sgt. Nick Pozarich, W6ZGB who operate this MARS station in the Azores.



Missouri and loads up nicely on all frequencies.

Chief MARS played Santa Claus to the Gang and sent them a new MARS package station consisting of a *Collins* 32V2 transmitter, *Collins* 75A2 receiver, a *Gordon* dual 10-20 beam and a v.h.f. 152 converter. The West Lages Antenna Erection Society spent the Christmas holidays building a tower and erecting the beam which accounts for a boost in the signals.

Nick and Myron are currently building a six-meter gear and if the results are encouraging they threaten to go in for two meters. It does offer potentialities for some v.h.f. DX records. European v.h.f. men please copy.

-30-

International Short-Wave

(*Continued from page* 127)

Spain—EDV10, Madrid, noted on approximately 7.167 signing off 1903 with "Arriba Espana" and two pieces of music after program summary in Spanish. (Stark, Texas.) Oskay, N. J., recently measured this one as 7.190 at 1550; previous measurements included 7.1695 and 7.1802.

Surinam—Paramaribo, 15.405, noted signing off 2035. (Stark, Texas.) Noted in California with musical program 2000 with announcements in both Dutch and *English*. (Russell.) PZH5, 5.758, parallel with 15.405, now announces as "Radio Surinam, Avros" (in Dutch); closes 2100; the 15.045 outlet usually joins 5.758 at 1645 (generally without announcement); 5.758 fades in around 1730; "Bringing Christ to the Nations" (transcribed in *English*) is a Sunday feature 1730-1800, followed by "The Lutheran Hour" (also transcribed in *English*). (Grove, Ill.)

Sweden—"Sweden Today" (*English*) has been heard well lately 0815-0830 over both 11.705 and 15.155. A Danish DX broadcasts says *Radio Sweden* now is using 6.065 and 10.780 for the 1900-2030 and 0015-0235 broadcasts.

Tahiti—Radio Tahiti, Papeete, sent mimeographed verification via airmail two months after report was sent; asked for further reports and suggestions. (Richards, Sask., Canada.)

Taiwan—Winter schedule of "The Voice of Free China" is 2300-0100 on 15.235 and 11.735, first hour is *English;* 0500-1130 on 6.040, 7.135, and 11.735, news 0630-0640; best time to listen on 6.040 is *after* KCBR leaves this channel 1000. (Neeley, Calif.) Balbi, Calif., says the second transmission signs on 0430 and not 0500. Oskay, N. J., measures the 41-m. outlet as 7.1338.

Taipeh on approximately 7.334 has fair signal mornings (EST); call appears BCSF or BCFS. (Neeley, Calif.) Heard in N. Z. at 0530 onwards at fair strength. (Cushen.) Dilg, Calif., says this one is directed to Occupied China; believes call may be BCSS; frequency varied considerably last spring around 7.450 but seems now set on approximately 7.334. He believes call of the Chinese Air Force Station on approxi-

mately 8.995 may have been changed from BCAF to BED32. This Air Force outlet noted by Cox, Delaware, at 0645 recently with Chinese singing, very weak level.

Tangiers—Radio International is radiating on 6.110 with *English* 0600-0630; French 0630-0715; Spanish 0715-0800; French and Spanish 0800-1000; "Bringing Christ to the Nations" (in different languages) 1000-1200; Arabic 1200-1400; French 1400-1515; Spanish 1515-1635; French and Spanish 1635-1800 closedown. (*World Radio Handbook* Bulletin.)

Patrick, England, says *Radio Africa* is now on 7.130 with improved signal.

Pan American Radio heard on 15.048 around 0700-0740; opening and closing announcements are in both Spanish and *English.* (Pearce, England.)

Thailand—Bangkok appears to be using 6.24, 11.91, 15.91 for its overseas transmission daily 0500-0630 and for the native period 0700-1000 or later; news 0515, 0615.

Trans-Jordan—The Hachemite Broadcasting Service has an *English* transmission daily 1000-1100 on 7.058; says "This Is Jerusalem Calling" but studios and transmitters now are located at Ramallah, north of Jerusalem. (Radio Sweden.)

Turkey—TAS has been measured 7.2863 at 1605; according to schedules just received, *English* programs from *Radio Ankara* are on TAP, 9.465, and TAS, 7.285, 1600-1645; news from Turkey 1602-1612; on Sundays at 1630-1645 has Mail Bag; on Sundays and Thursdays, programs in *English* continue to 1700, the final minutes being devoted to selections of recorded music. (Oskay, N. J., others.)

USI—Ambon, 3.380, Maluccas, heard to sign-off 1030 when clock strikes 2300 local time; appears to relay Djakarta transmissions. (Cushen, N. Z.) Menado, 9.845, Celebes, is good signal 0800 with variety of songs, announcements in Dutch. (Cox, Delaware.)

USSR—Moscow's evening schedule to North America remains 1820-2300 on (announced) 15.23, 15.18, 15.11, 11.96, 11.82, 9.69, 7.29, and 7.24. (Kroll, N. Y.) Mailbag Program is Saturday 2100. (Sams, Oregon.)

Soviet, 9.340, heard in native 2015; parallel 9.380. (Oskay, N. J.) Moscow noted 7.245 good level 1745 with *English;* parallel 7.295; heard on 6.110 at 1535 with talk in *English;* also noted on 6.000 at 1630 with *English.* (Cox, Delaware.)

Moscow II, the cultural program which includes interesting popular music by Russian composers, is also relayed on s.w., according to announcements, on 7.329 and 11.830 at 1000-1700. (Radio Sweden.)

Venezuela—"La Voz del Tachira," San Christobal, is broadcasting in Spanish on 4.830 at 0700-0900, 1000-1300, 1600-2200; output 5 kw. (*World Radio Handbook* Bulletin) YVQF, 6.20, Ciudad Bolivar, noted 2130 with news, very heavy QRM; noted in Spanish 2145. YVKB, 4.89, Caracas, noted with music 2310, (Russell, Calif.) Caracas,

6.168, has been heard on Monday at 2130 with news; on Tuesday at 2200 with news; strong signal in Calif. (Balbi.) Station heard on 9.700 at 1710-1800 and later seems to be harmonic of Venezuela's 4.850 outlet. (Stark, Texas.) YVRK, 3.500, Caracas, good level 1840 with music. (Cox, Delaware.) Station "battling" with Bogota, Colombia, on 4.960, is YVQA, *Radio Sucre*, Cumana. (Stark, Texas.) YVKF, 4.880, Caracas, still has news daily 1845-1900. (Cox, Delaware.)

Yugoslavia—Belgrade, 6.100, noted in foreign language 1525; identified with four chimes 1530; completely jammed 1531. (Cox, Delaware.)

* * *

Last Minute Tips

Here are some late tips on Mexican radio stations. "Radio Universidad Nacional," operated by the autonomous Mexican National University, has programs in Spanish daily 1100-1800 over XEYU, 9.600; works on a cultural, non-commercial basis. (*World Radio Handbook* Bulletin.) Grove, Ill, others, report strong signal from XEX, 11.90, from *before* 0900 to *after* 0000; Bellington, N. Y., has heard this one signing off 0100. Cushen, N. Z., says XECC, 15.205, a *new* short-wave relay, 500 watts, was to have started operations in August to relay XEMC continuously; QRA is Apartado 22717, Mexico City, D. F., Mexico; had not been reported as heard, however, when this was compiled. Grove, Ill., reports XEBT, 9.625, Mexico City, noted with relay of commercial programs of XEB in *English* at least from tune-in 0820 to tune-out 0840.

A news dispatch recently stated the Navy will build one of the world's most powerful transmitters at Tangiers. (Leary, Indiana.) Will operate on short-wave?

Deskins, Calif., reports an Oriental station signing on 0100 on approximately 11.440. Who?

Radio Australia reports the Forces Broadcasting Service, East Africa, is currently using 6.117 to 1500 close-down; may sign on as early as 2300. Location is not definite but it may be Mombassa. The *N. Z. DX Times* reports this one closing 1500 and says has some sideband QRM from Berlin (6.115) and Finland (6.120).

Stark, Texas, is hearing a station on 7.125 fading in 0845 and running to *after* 0915 that may be *Radio Somali*, British Somaliland. He recently noted *Radio Splendid*, Buenos Aires, on 5.987 to after 1900; may be last year's listed LRS, 6.065, a 5 kw. job, back near its old 5.896 channel. Adds that a station fading in around 2200 (using French) on approximately 15.060 may be Mauritius.

DZB2, 3.320, Manila, Philippines, Far East Broadcasting Company, "The Call of the Orient," heard 0530-1130 sign-off; announces "This is F.E.B.C., Stations DZAS, 680 kc., medium-wave; DZB2, 3.32, Tropical Band; DZH6, 6.03, 49-meter band, and DZH8, 15.30, 19-meter band." DZH8 suffers background interference from BFEBS,

Singapore; has news 0500. (Cushen, N. Z.)

Surinam recently noted on approximately 2.460 (perhaps the listed 2.313 moved?), parallel 5.010, at 1915-2132 sign-off; may run later some days. (Stark, Texas.)

The *new* 100 kw. SIRA transmitter is located at General Pacheco, near Buenos Aires, and is reported to be the most powerful transmitter in South America; is to operate in the 49-, 31-, 25-, 19-, and 16-m. bands; several antennas are beamed to various parts of the world covered by SIRA programs in at least 7 languages. (Serrano, Brazil.)

At the time this was compiled, Lisbon's 19-m. channel apparently had been changed from 15.018 to approximately 15.380; noted 0800 and at greater strength than when was using 15.018; bad QRM, however. (Stark, Texas; Oskay, N. J.)

Pearce, England, confirms that Damascus, Syria, is now using 6.000, 7.145, 12.000, having dropped its 31-m. outlet for the present; *English* 0600, 1630.

Serrano, Brazil, flashes that *Radio Quitandinha* in Petropolis, State of Rio de Janeira, had started tests around the time this was compiled; operates with a 10 kw. Philips transmitter on 5.045; *will appreciate all reports in any language* and assures that they will be answered; mail should be sent *only* to the Rio offices—Radio Quitandinha, Avenida Rio Branco 311 s. 924, Rio de Janeira, D. F., Brazil. Serrano has asked this one to use *English* at opening and closing and the matter is being taken up by the Board of Directors of the station. When on regular schedule—perhaps by now—will operate 0600-2200 and sometimes to 2400; will have a FM outlet and later a TV outlet.

* * *

Press Time Flashes

Bangkok, 6.24, 11.91, 15.91, noted 0515 with news; YDQ3, 11.080, Makassar, Celebes, USI, noted 0600 with program for Dutch Forces; *Radio Makronissos,* 7.965, Greece, heard 1445 with Western music, then news in Greek; CR7BU, 4.932, Mozambique, noted 1115 with good signal in request program; ZPA5, 11.945, Encarnacion, Paraguay, noted 0615 with news in Spanish. (Sanderson, Australia)

World Radio Handbook and *How to Listen to the World,* published by O. Lund Johansen, Copenhagen, Denmark, in *English,* are now available direct from the American representative, Ben E. Wilbur, 32 Whittlesey Ave., East Orange, New Jersey. (Sutton, Ohio)

TIFC, 9.645, San Jose, Costa Rica, "Lighthouse of the Caribbean," verified with letter and beautiful QSL card; schedule was given as 1600-2400, *English* on Sundays 1600-1700, and 2300-2400, and Mon.-Sat. at 2330-2400. (Cohn, Ill.)

OAX4B, 6.530, Peru, noted 2200 in Spanish. (Denneny, Ill.)

Brazil went on *Summer* Time on

December 1; will return to *Standard* Time around March; Rio de Janeiro Time now is *three hours ahead of EST;* Manaus Time is *two hours ahead of EST.* (Serrano, Brazil)

The Florence-Repallo High Frequency Broadcasting Conference ended without reaching agreement on an assignment plan. The Hague Conference, which was to have set the implementation date for the Atlantic City Allocations, has been postponed indefinitely, so it may be a long time before these allocations—which include expanded high-frequency broadcast bands and the *new* 21-megacycle amateur band—come into effect. (Legge, N. Y., via *URDXC*

Radio Athens, 9.607, noted testing daily 1430-1445 in *English.* (Boice, Conn., Ferguson, N. C.) Also noted testing 2000-2058, in *English* 2000-2015; asks for reports. (Stark, Texas)

Vancouver's CBRX, 6.160, heard signing off 0300 after news and weather report. (Alcock, Ky.)

Grove, Ill., says LRA, 9.69. Buenos Aires, has news daily 1905, 2050, 2105, 2250, 2300, 2345; Mailbag is Sundays 2245; gives detailed schedule 1900, 2100, 2300.

Radio Jamaica, 4.950, Kingston, announces 4.950 and m.w. 800 kc. daily at 2300 closedown; says will re-open 0630 Mon.-Sat. and 0715 on Sun. (Grove, Ill.)

CE1180, 11.99, Santiago, Chile, noted 1930 with news in Spanish. (Russell, Calif.)

HRXW, Comayaguela, Honduras, verified but did not send schedule; gave frequency as 8.990. (Ferguson, N. C.)

BFEBS, Singapore, noted on 11.88 at 0745 when announced 15.300, 11.880, 9.690, and a 49-m. outlet.

The *new* Mexican outlet on 11.90 which relays m.w. XEX, Mexico City, announces *only* as "La Voz de Mexico." (Ferguson, N. C.)

In verifying, Prague, Czechoslovakia, listed schedule to North America as 1900 on 15.230; 2100 and 2230 on 11.84, 15.23. (Maurice, N. Y.) Prague, 6.010, noted with *English* 1715-1730. (Bellington, N. Y.) *English* programs for Europe now are listed for 0645-0730 on 11.840; 1415-1445 and 1530-1545 on 9.504 (may mean 9.55?); 1715-1730 on 6.010, 9.504, and 1800-1845 on 6.010. (Radio Sweden)

YNAS, 6.300, Managua, Nicaragua, noted to 2100 or later. (Stark, Texas)

The station heard around 1730-1800 on approximately 9.430 is *Radio France Asie.* Saigon, Indo-China; has *English* 1730, then French and usually signs 1800 with "La Marseillaise." (Stark, Texas) Claims is on 9.524.

ZAA, 7.845, Tirana, Albania, noted 1515 with news; signs off around 1615. (Bellington, N. Y.)

Ponta Delgada, Azores, is on the air 1500-1600 on 11.094, and at that time on Thur. and Sun. on 7.015; at 1700-1900 daily on 4.845. (Arnold, Bermuda)

Budapest, Hungary, definitely now has news 1700 instead of former 1600