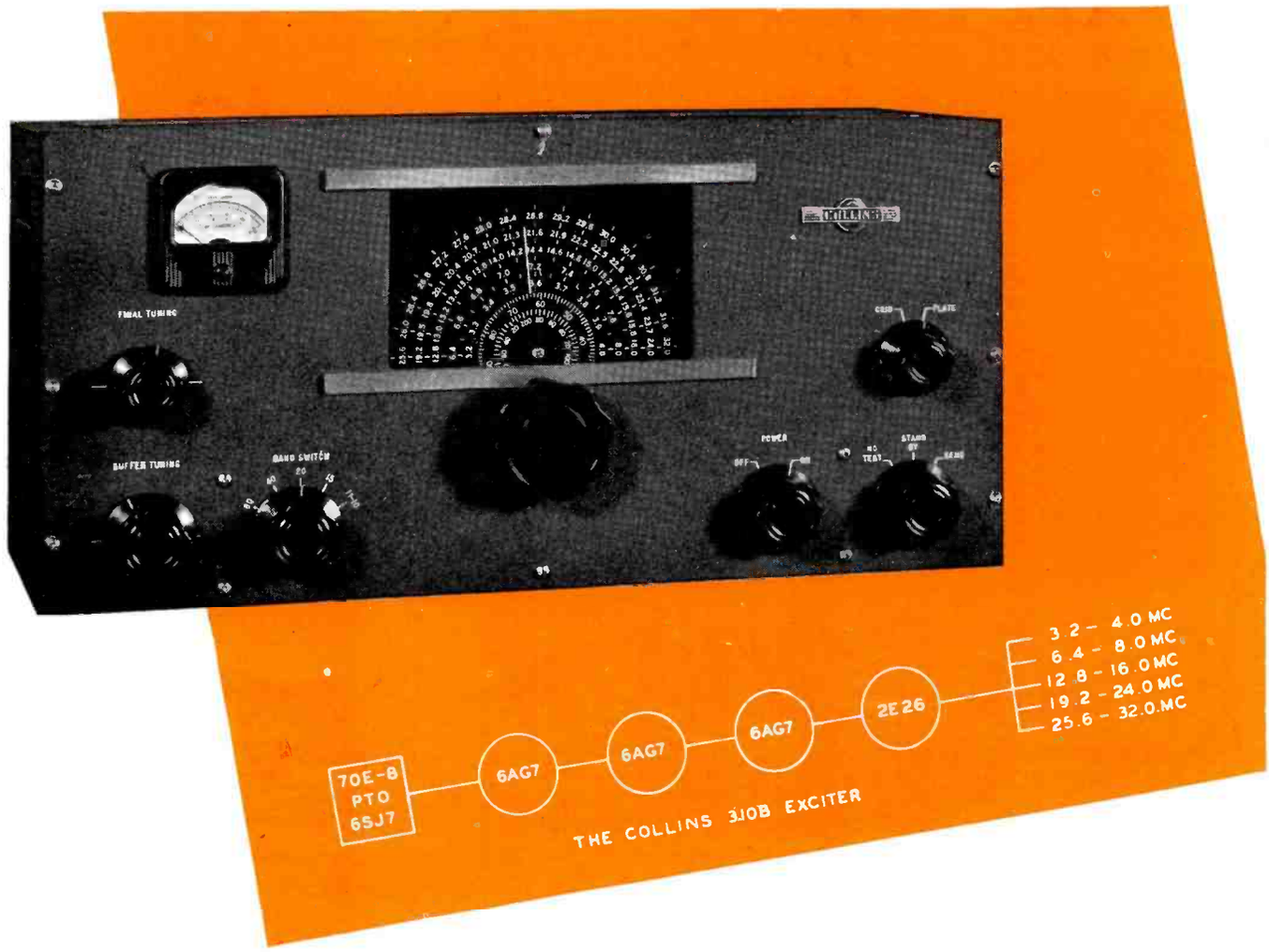
RADIO NEWS.

MAY
1947
35c

2 Tube Ham super using 2 6J6's

RTS SHOW
MAY 13-16



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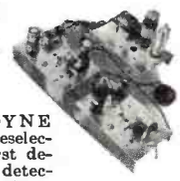

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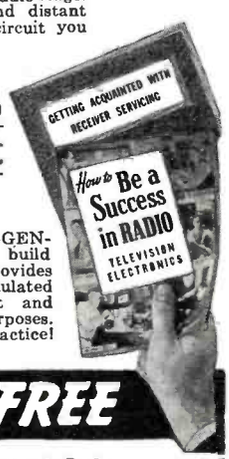

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RADIO NEWS

Reg. U. S. Pat. Off.

MAY, 1947

FOR THE SERVICEMAN-DEALER

FOR THE AMATEUR

OF GENERAL INTEREST

DEPARTMENTS

RADIO NEWS is published monthly by the Ziff-Davis Publishing Company, 185 N. Wabash Ave., Chicago 1, Ill. Subscription Rates: in U.S. and Canada $4.00 (12 issues), single copies 35 cents; in Mexico, South and Central America, and U.S. Possessions, $4.00 (12 issues); in British Empire, $5.00 (12 issues)—all other foreign countries $5.00 (12 issues). Subscribers should allow at least 2 weeks for change of address. All communications about subscriptions should be addressed to: Director of Circulation, 185 N. Wabash Ave., Chicago 1, Ill. Entered as second class matter March 9, 1938, at the Post Office, Chicago, Illinois, under the Act of March 3, 1879. Entered as second class matter at the Post Office Dept., Ottawa, Canada. Contributors should retain a copy of contributions and include return postage. Contributions will be handled with reasonable care but this magazine assumes no responsibility for their safety. Accepted material is subject to whatever revisions and by-line changes that are necessary. Payment made at our current rates, covers all authors', contributors', or contestants' rights, title, and interest in and to accepted material, including photos and drawings.

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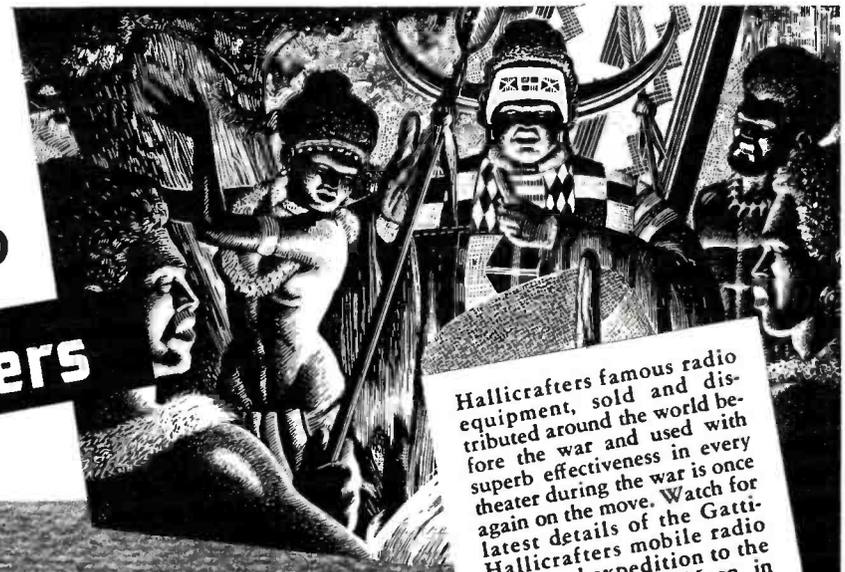
hallicrafters



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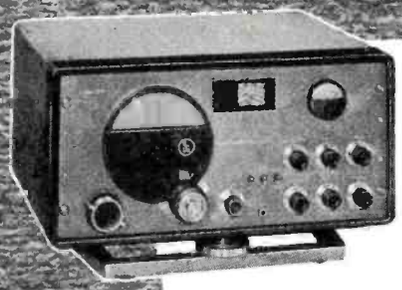

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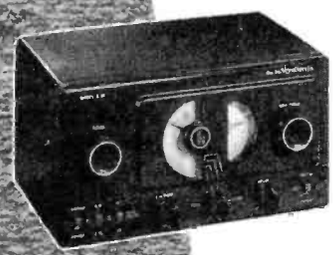

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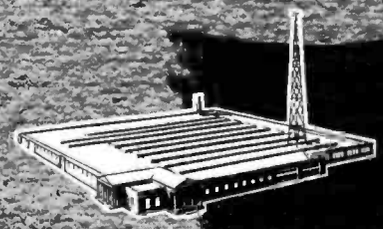

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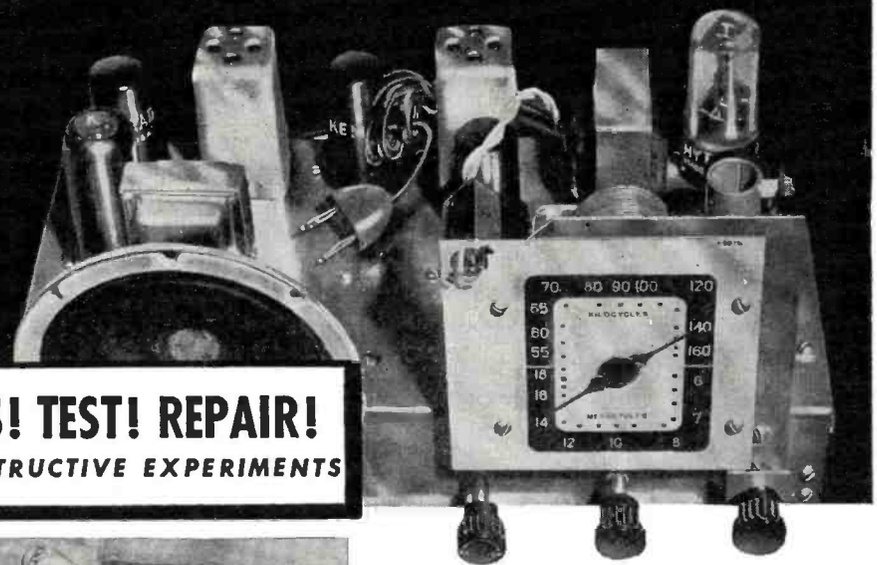

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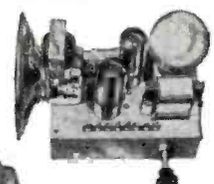

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For the RECORD

BY THE EDITOR

IT HAS been a long time since we have discussed the matter of conduct of amateur radio operators. We feel that we are not amiss in sounding off a bit on this subject especially since FCC Chairman, Charles R. Denny, Jr. struck an ominous note during his address at the IRE banquet recently in New York.

Denny said that the FCC has been undertaking widespread revisions in the Commission's standards and rules for all radio services throughout the United States. Mr. Denny further emphasized that, "It is our objective that one by one the technical requirements and operating requirements for each of the different individual radio services shall be completely overhauled and brought up to date. In making these revisions we are seeking to do a great deal more than simply codify the existing rules."

Mr. Denny then went on with what might well be a somber warning to the amateur by pointing out that the frequency spectrum between 4 and 25 megacycles is very much in the revision spotlight. These frequencies, said Mr. Denny, are those including the international channels and best suited for world-wide communications. "We are carefully reviewing each rule and each standard for the purpose of insuring that we retain only such requirements as are really essential for the proper functioning of the service in question."

That brings us to the topic at hand; the "conduct" of many amateurs who are, in many cases, abusing their priviliges to operate. Interference is at an all time high and the QRM situation becomes worse with each passing day. Many 500 watt transmitters can be heard on the air emitting strong DX signals when many of them are merely talking "cross town." Such operators are doing little, if anything, to enhance the art of amateur radio and when the chips are down they will only have themselves to blame if they come out on the short end of the deal.

So important is the matter of frequency allocations to international communications that a special World Telecommunications Conference is to be held at Atlantic City beginning this month. Among the many subjects likely to come up for review and evaluation are the present amateur allocations. We know, for example, that there will be much pressure from some of the foreign representatives to have certain amateur frequencies reassigned to other services. In most cases the countries that will favor further restriction of amateur frequencies are those that allow little or no personal freedom. Many of them do not believe in freedom of the press and it is the wish of certain governments that no information be printed or transmitted outside of their own borders for the world to see or hear.

In view of the pressure that will be brought to bear, it becomes vitally essential that every amateur take careful stock of his own operating practices and to make certain that he is not open to criticism. One of the worst and most common of all violations of good operating ethics is the interference presently affecting established traffic nets. At times the interference is of such proportions that the nets are forced to cease operations and close down.

There has been a lot of general griping about this and that on the air by amateurs. In many cases these gripes have been justified but in others they have not. But regardless of whether these complaints have been in or out of order, the fact remains that those responsible for the conduct on the ether are not just sitting by and not taking notice. No organization is perfect in itself but the principles it represents, if sound, must be maintained by those whose very existence on the air depends upon loyalty and support of its tenets.

It is the personal responsibility of each amateur to look jealously upon the safety of his hobby. If amateurs are to preserve their rights it becomes their responsibility to avoid needless interference and to be a bit "prestige conscious." It takes but little time to listen in on the operating frequency before transmissions and to size up the general situation before proceeding. This will avoid much unnecessary QRM.

While we don't feel that the future of amateur radio is in present danger, we do take cognizance of the fact that there are many interests seeking any type of ammunition which would help destroy our hobby. We feel that the matter of *conduct* may have much to do in furthering our position as a necessary and vital part of communications particularly when disaster strikes or when, if ever, we again need a large backlog of skilled operators.

.....O. R.

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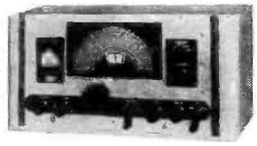

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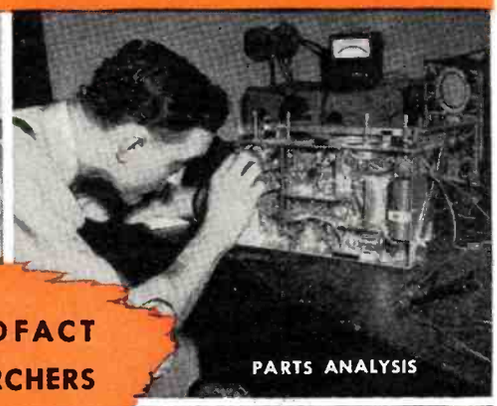

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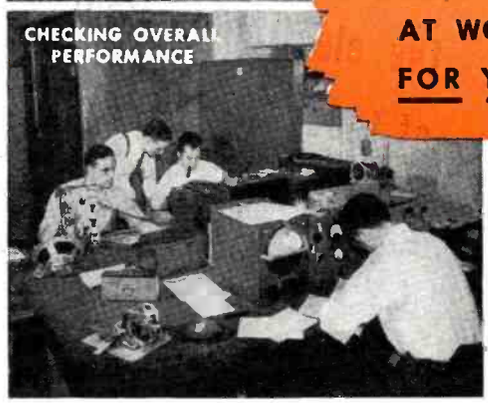

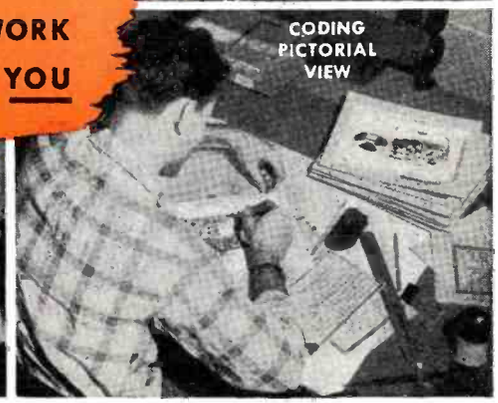

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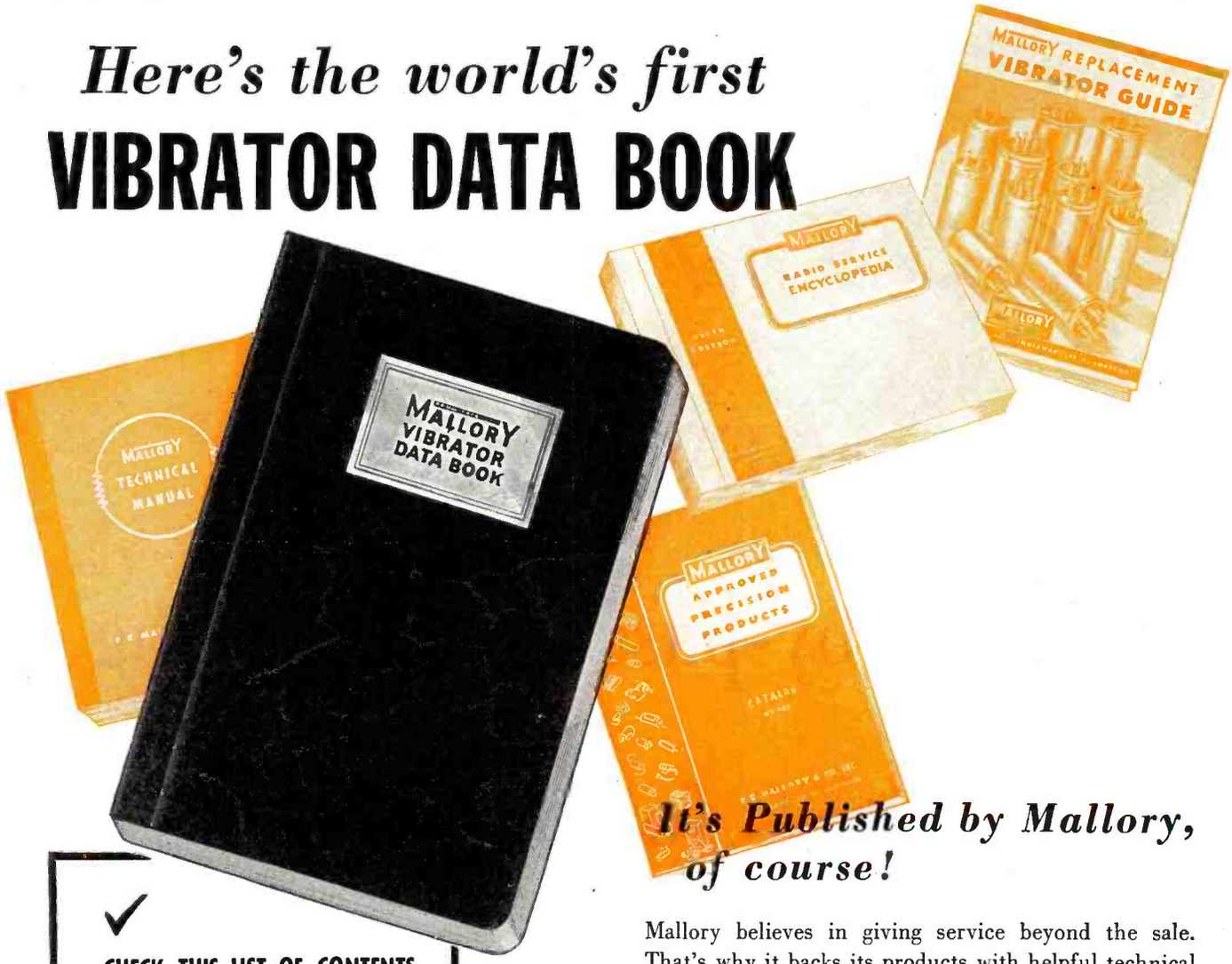

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The price? Only $1.00. The supply? Limited at present. Better order *now* from your Mallory Distributor before the first edition runs out.

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- Power Transformer Characteristics
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- Examples of Transformer Design
- Design Considerations for Other Applications
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Are you satisfied with the external appearance of your equipment? Perhaps you're handicapped by stock cabinets that look like those used twenty years ago.

Utilizing our long experience in manufacturing cabinets for mass-production users, we are now making a completely new line for smaller consumers. Some types are already in stock for prompt shipment; others will be ready soon.

Because all the dies are brand new our stock cabinets have up-to-the-minute appearance. They are Clean-Cut, Tasteful and Modern. They are well-made and sturdy. The color schemes are new and attractive. All are made of aluminum, the modern metal. They have many mechanical features that will interest you. May we send our descriptive literature?

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INCORPORATED
Formerly Crowe Name Plate & Mfg. Co.

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May 13, 14, 15, 16, 1947

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You may send me literature on your stock cabinets.

Name_____

Firm_____

Position_____

Address_____

City_____ Zone_____ State_____

V Please Check V

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___Custom Builder
___Designer
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___Manufacturer
___Serviceman
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WEBSTER ELECTRIC meet demands for an All-around *Good* Cartridge

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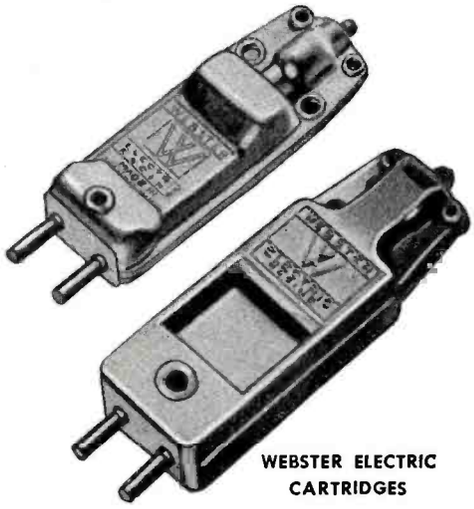

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Designed to Meet Varied Requirements Depending Upon Tone Arm and Equipment

● The wide selection of Webster Electric cartridges offers a cartridge with correct characteristics for replacement use. Correct weight, response, voltage output and other requirements so necessary for top performance.

Webster Electric cartridges are GOOD cartridges of balanced construction that produce maximum output at designated tracking pressures with minimum distortion and minimum mechanical reproduction. All models offer exceptionally uniform response over the desired range of frequencies, with low distortion and minimum needle noise.

Complete tone arm assemblies of improved design, in a wide selection of models are also available for the replacement market.

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Established 1909

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The Smart **NEW** 3-way Portable

MODEL A-510

AIR KING® *Royal Troubador*

THE 3-WAY PORTABLE WITH TRIPLE SALES APPEAL

You can wrap the whole sales story of the Air King "Royal Troubador" in three words — Price, Performance and Eye-Appeal. It is a 3-way portable designed for beauty and tone with sales potential to match.

Your customers will be proud to own the new Air King "Royal Troubador"—proud as you will be to show it. Highly sensitive . . . critically selective . . . playable anywhere. The "Royal Troubador" can easily be the fastest moving portable you've so far seen.

The Royalty of Radio Since 1920

SELLING FEATURES

- Latest design, high-performance miniature tubes (4) plus metallic selenium rectifier
- Superheterodyne with automatic volume control
- Special Alnico V PM Speaker
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The Royal Family of Radio

"Twenty-Six Years of Specialized Electronic Skill Behind Every Air King Radio"

Spot Radio News

★ ***Presenting latest information on the Radio Industry.***

By FRED HAMLIN
Washington Editor, RADIO NEWS

OUR EARS were slightly red on hearing that the Federal Communications Commission denied Columbia Broadcasting System its color television application—and for just the reasons which, last month, we predicted would make the decision exactly the opposite. We said that FCC would favor CBS because FCC policy favors competition and new developments. FCC denied CBS on almost identically those grounds. CBS wanted to colorcast in the 480 to 920 megacycle band. FCC denied this request on the grounds that if CBS broadcast in that band, there would not be much room for competition. As for new developments, the Commission said that "there may be other systems of transmitting color which offer the possibility of cheaper receivers and narrower bandwidths that have not been fully explored." In other words, they are open-minded toward further developments, even from CBS, which, the Commission rules, hadn't made enough field tests "for the Commission to be able to proceed with confidence that the system will work adequately in practice."

ONE FCC OBJECTION was that to achieve brightness and absence of flicker, CBS needed channels so wide that only 27 could be accommodated on the present band. FCC emphasized that this would cut competition down to a point that might become monopolistic, while "it was the Commission's hope . . . that in this band it would be possible to provide for a truly nation-wide competitive television system." This led the Commission to re-emphasize the need for further development: "Every effort," it ruled, "must be made to narrow the bandwidth required for color television. It is quite possible as a result of wartime discoveries," the Commission added, "improvements can be made" all along the color television line. "Furthermore, wartime developments may show that there is an entirely different method from either the sequential or simultaneous system which is superior to both. Before standardizing television in the upper band, we should be sure that all of the wartime electronic developments have been explored to determine whether they can be applied to the advantage of television." In sum, FCC favors more and more development—more and more competition. But the CBS proposal doesn't seem to offer enough of either. . . . We like to think that in predicting a CBS victory, we were betting on the right jockey, but picked the wrong horse.

GOOD RADIO JOBS are still available for qualified candidates. Latest indication is more than sixty civilian openings recently listed by the U. S. Navy, many of which featured radio experience. Typical are two, one for an electronics engineer, the second for a graduate radio engineer. To quote the Navy on qualifications for the electronics job, the candidate must be a "project engineer for programs such as radiological instruments and detection devices for harbor defenses, industrial electronic systems, radio control devices, and similar control applications." The radio engineer must, "under general supervision, serve as project engineer on specialized radar equipment." If you are interested in either of these, or other Navy openings, the trick is to go to the nearest post office, get a Civil Service Form 57, fill it out, and mail it to the U. S. Navy, Department Civilian Personnel Branch, Code 612, Main Navy Building, Washington, D. C. You will be notified if the Navy is interested enough to interview you and chances are—assuming you're qualified—that they will be. They report difficulty in filling the radio jobs, of which there are more than a dozen open as this goes to press. . . . And *puhleeze* don't write us—we haven't the vaguest idea of competing with the U. S. N. in the project business.

WE'VE JUST CHECKED around the circuit on the FM stations and how they're doing. The answer is—okay. Biggest question mark of the spring concerned advertising, with two problems at the top of the list. There was the problem of getting advertisers; beyond that, there was the problem of getting the advertisers to live up to FM's promise of high-level advertising copy. . . . If spot checks with FM stations already active are any indication, both problems are being worked out successfully. FM time is selling nicely, although at rates roughly one-third lower than comparable AM stations. They are bargain rates—one

RADIO ELECTRONICS

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IT IS THE WELL TRAINED MAN WHO WINS

In the prize ring, as in the bigger contest of making a livelihood for ourselves and families, *training* makes the champion . . . brings the real PAY OFF!

You can prepare for bigger winnings, too, by training for one of America's great championship fields—RADIO and ELECTRONICS—the billion dollar opportunity-packed industry that is *on the march*.

Mail coupon below right now, for late facts about the exciting events in F.M. Radio, Broadcast Radio, Motion Picture Sound, Electronics, Sound Recording, the future developments in Television, Radar and other branches. See, too, how *you* may score a *knockout* against low pay, uninteresting work, an uneventful future.

You don't have to know a thing about Radio and Electronics at present. Over a period of 15 years, DeFOREST'S TRAINING, INC. has perfected a championship method of home training that GETS RESULTS QUICKLY!

We provide you, for use in your own home, with a BIG FOUR training method that includes (1) commercial type Radio Electronic parts and assemblies for valuable "LEARN-BY-DOING" experience, (2) a 16 mm. Motion Picture Projector and 12 reels of action-packed "LEARN BY-SEEING" instructive movies to speed your understanding of important principles, (3) many easy-to-read loose-leaf lessons illustrated with handy fold-out diagrams, and (4) an effective EMPLOYMENT SERVICE to help you get started toward a good Radio Job when trained—or to assist you in starting your own Radio Business where you can be your own boss.

This championship method has started many men toward Real Pay, Fascinating Work, and a Grand Future—see HOW it may do the same for you. Mail coupon today for big free book that shows you the way.

DeForest's Training, Inc. Wins Coveted "Certificate of Merit".

DeForest's Training, Inc. is the first school of its kind in the country to win the "Certificate of Merit" of the New York Museum of Science and Industry. This award is granted "in recognition of outstanding achievements in the pioneering, development and use of home study and laboratory courses to train men for the fields of Radio and Electronics."

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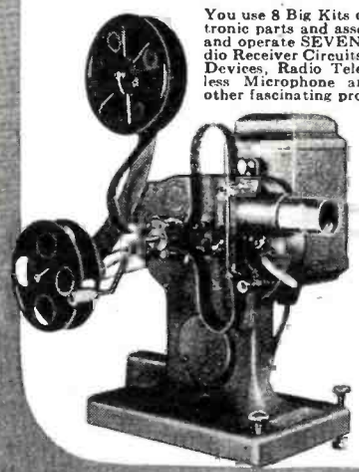
FREE EMPLOYMENT SERVICE . . . When you complete your course, our free employment service goes to work to help you get started

YOU CAN BUILD 133 FASCINATING EXPERIMENTS

You use 8 Big Kits of Radio-Electronic parts and assemblies. Build and operate SEVEN different Radio Receiver Circuits, Electric Eye Devices, Radio Telephone, Wireless Microphone and dozens of other fascinating projects.



YOU USE A 16 MM. MOTION PICTURE PROJECTOR with 12 reels of instructive movies to help you grasp important fundamentals faster, easier. You enjoy one of today's most modern, effective training aids, **right in your own home.**

LEARN FASTER AT HOME WITH MOVIES

Without obligation, send for our valuable, information-packed book, "VICTORY FOR YOU".

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Send me both your big book "VICTORY FOR YOU" and Kit Supplement, showing how I may make my start in Radio-Electronics with your modern home training plan. No obligation.

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

☐ If under 16, check here for special information.

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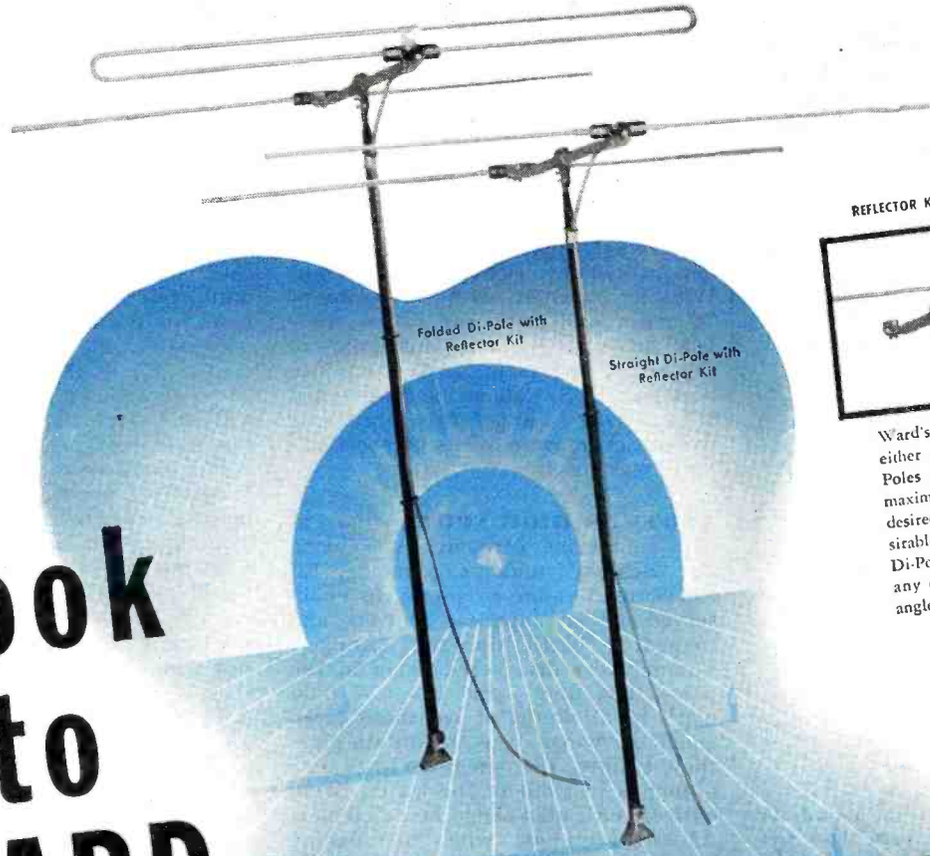
Both the Home Study and Chicago Laboratory courses of DeForest's Training, Inc. are approved for your training. If you qualify under the "G. I. Law", you can obtain this training without cost.

SPOT RADIO NEWS

metropolitan station in the East, for example, is quoting Class A time at as low as $15 an hour. But if the rates are bargain, the customers are definitely not bargain-counter. FM salesmen are emphasizing that their listeners are quality buyers. They want quality programs—including the commercials. To give them mine-run instead of institutional commercials is to lose their interest. Advertisers are heeding this advice with the result that FM plugs continue at a comparatively high level. So does the audience. In the words of Martin Schadi, sales manager of WASH, Washington, D. C., "Owners of the 5000 to 8000 FM-AM consoles sold in the Washington area to date are in the high income bracket and constitute a class audience."

LOOKING AHEAD, FMers anticipate that sales of sets will make possible increased rates, in many cases by mid-1947. Interest by advertisers and advertising agencies brightens this hope. That advertisers are aware of FM potentialities was illustrated recently in Washington when, for the first time in history, an advertising agency bought time for a program for themselves on an FM station. Said R. Willoughby Williams, head of the Williams, Stark and Hinkle advertising agency, in announcing purchase of half an hour of time once a week: "The future of FM is limitless, as the world is beginning to realize. We plan to make full use of it both for our clients and ourselves." . . . While we're on the subject, another thing to watch as a rapid and significant development in the FM field during the next few months is the growth of networks. First big hook-ups will probably be mostly in the East, but others will blossom across the country as more and more stations go into operation. It's more than passing significant that, while not mentioned on the program, one of the chief problems facing delegates at the first FM Association regional meeting in April was networks. . . . Chief goal: to keep network programs and plugs on the same high level now being achieved by the station broadcasts.

INVITE AN ADMIRAL TO SPEAK before the Institute of Radio Engineers and the odds should be heavy that you'll get yourself bored stiff, but such was not the case when Vice Admiral Charles A. Lockwood recently spoke to the Institute. His audience had all the elements of six movie thrillers wrapped into a super-production, yet not once did he get off his basic topic—electronics. Without dramatics—he didn't need them—he told of radar's role in submarine warfare. Three factors which made the submarine the deadly weapon it was, he said, were the personnel, improved underwater equipment, and electronics. . . . Especially in submarine-vs.-submarine



REFLECTOR KIT MODEL FMR-63 LIST $5.25

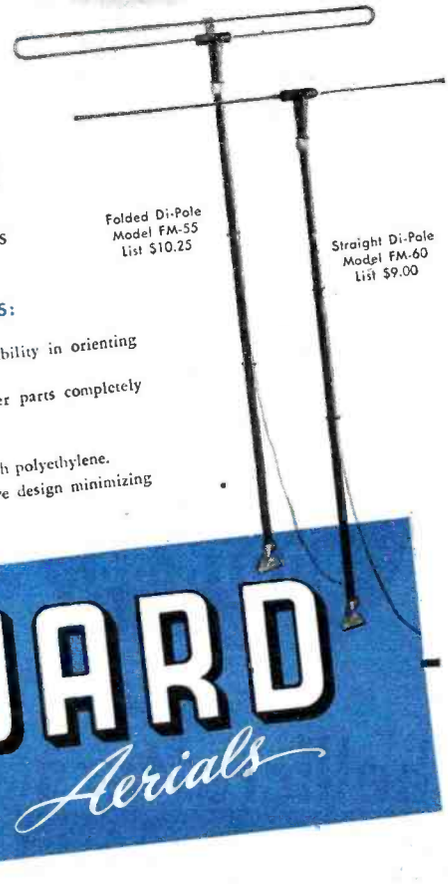
Ward's Reflector Kit combined with either the Straight or Folded Di-Poles as shown at left, provides maximum directional gain of the desired signal and eliminates undesirable and interfering reflections. Di-Pole elements can be rotated to any direction and tilted for any angle to facilitate orienting.

Look to WARD for Greater FM Values!

Ward, world's largest producer of aerials, now offers you leading values in FM with antennas completely adaptable to the varying requirements of each installation. They provide maximum electrical efficiency needed for finest FM reception. The ease with which they may be securely installed, plus strong weather-proof construction assures trouble-free operation—and extra profits for YOU!

The Straight and Folded Di-Poles shown at the right operate in a range of 88 to 106 mc. The Folded Di-Pole model provides broader antenna tuning and matched impedance to the 300 ohm transmission line for maximum response and energy transfer.

The Ward Reflector Kit can be combined with either of the two Di-Poles as illustrated above.



NOTE ALL THESE OUTSTANDING FEATURES:

- Universal base mounts on any roof or wall angle.
- Sturdy vertical element revolves or tilts in base allowing complete flexibility in orienting Di-Pole for maximum gain.
- Di-Pole element constructed of corrosion-preventive aluminum. All other parts completely weather-proofed inside and out.
- Ring provided for attachment of guy wires assuring secure installation.
- Sixty feet of dielectric 300 ohm colinear transmission line is insulated with polyethylene.
- Stand-off insulators guiding transmission line to receiver are of exclusive design minimizing capacity to ground and eliminating reflections on the line.

WRITE FOR FREE CATALOG

THE WARD PRODUCTS CORPORATION
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IN CANADA: Atlas Radio Corp., 560 King St., W., Toronto, Ontario, Canada
EXPORT DEPT.: C. O. Brandes, Mgr., 4900 Euclid Ave., Cleveland 3, Ohio

WARD Aerials

warfare, the Admiral pointed out, electronics "demonstrated the tremendous advantage our fighting men were afforded." Perhaps most dramatic underwater battle was staged by the "Batfish," under Commander J. K. Fyfe of Seneca Falls, N. Y. Fyfe was assigned to keep Jap subs from taking emergency supplies to land troops under attack by General MacArthur. Working by night, within a period of 76 hours, and using radar, the "Batfish" nailed three enemy subs going to the rescue of Japs in Luzon. Not once was the U. S. submarine threatened with attack — apparently the Japs weren't even aware of its presence until it was too late. . . .

ANOTHER HIGH SPOT in the Pacific submarine campaign was when the "Sealion", under Commander Eli Reich, used radar to sneak up unobserved on a Japanese flotilla and tagged a battleship, the "Kongo." Commanders discovered early in the game that they — and radar — could work in all kinds of weather. Even when the waves were mountain-high, they stalked the enemy with radar antennas just out of the water, firing entirely on radar range and direction. At other times, with the enemy blinded by poor visibility, they made surface approaches. One bold commander approached a Jap convoy without submerging and at one point was so close that he was almost run down, accidentally, by an enemy ship. He got away untouched. Another, Commander Dick O'Kane of the "Tang", broke all records for a single patrol in October, 1944, by sinking 110,000 tons of enemy shipping, abandoning the attack only when one of the "Tang's" own torpedoes went bad and circled to sink the sub which had fired it. A third, the "Sailfish", under Commander Bob Ward, went after a Jap convoy in a typhoon—40-50 knots of wind with mountainous seas. The wind and waves were so strong that Ward even had difficulty making headway against them, but when he sighted his prize—an aircraft carrier —he fought through and sank it. Even the Japs used to cite this one as an example of daring and determination when they were lecturing new sub recruits. . . .

GETTING BACK TO EARTH, it's not too late to mention a heroic ham hook-up in the East Coast area during the last big snow of the winter in early March. One of the hardest hit towns was Cobleskill, N. Y., some forty miles west of Albany, with a population of 2300. Telephone and power lines went down under a twenty-six inch snowfall and the town was completely cut off from the outside world by 2 a.m. one bitter cold morning, save for a 100-watt ham station, W2DBX, operated by Stanley D. Conklin. He stuck to his set till 6 a.m. before establishing contact with the outside world in the person of Corporal Albert Martin at Ft. Monmouth's 900-watt station, W2OEC, who picked up Conklin's weak signals asking that the Signal Corps relay messages to the New York Telephone Company and the New York Power and Light Company to get rescue crews on the job. Repairmen fought their way through drifts from Oneonta, N. Y., thirty miles away, finally restoring normal communications and power lines at 6 p.m. Conklin stayed on the job to that point—more than 24 hours without sleep and with a record of sixteen hours without rest at his radio. . . . Other ham stations throughout New England and the Middlewest did emergency work during the storm, with the result that no community hit by the snowfall was long out of touch with the outside world.

ON THE PRODUCTION FRONT, the promises of spring seem to be rocketing toward record fulfillment. Both industry and government sources are agreed that 1947 is going to be a banner year in all departments. "Radio manufacturers," reports the Civilian Production Administration, "are expected to gear their production to increased output of combination or radio-record player models and television sets. Production of table sets has already reached a record monthly rate almost twice the average of 1940-41, and current demand is now being met. Increases in car radio production will be possible as fast as steel is made available for cases, mountings, and parts." These will undoubtedly figure in the fall market, as will FM-AM receivers, already showing good production totals by late spring. FM sets have the backing of the industry, which declared early in the spring through the Board of Directors of the Radio Manufacturers Association that it was "doing everything in its power to expedite the production of FM-AM receivers." Results had already begun to show as early as January, when FM-AM set production totals jumped to 51,318 from the December score of 40,903. Television sets were also up almost two thousand units from December's 3561, reaching a January high of 5437. Table models featured in the television output but the FM-AM sets showed a heavy trend toward consoles. RMA member survey showed a total set output of 1,564,171.

FOREIGN PRODUCTION continues to be miniscule when contrasted with that in the United States. Reports from abroad, some delayed, most sketchy, would seem to indicate that U. S. manufacturers interested in export should find little competition so far as production is concerned for some time to come. Reports indicated that full-scale production might be expected by only two foreign manu-

(*Continued on page* 168)

Grasp the NEW OPPORTUNITIES in RADIO ELECTRONICS AND TELEVISION NOW!

Modern Radio — FM Broadcast and Reception — Television — Industrial Electronics; Power, Control, Communications — new equipment and methods demand new technical ability and experience. Keep up to date with the latest.

MODERN RADIO EQUIPMENT FOR YOU TO USE AND KEEP

The very essence of National Shop Method Home Training is EXPERIENCE. You get actual experience by working with modern Radio and Electronic equipment—building many types of circuits. You may build a fine, long distance MODERN SUPERHETERODYNE, signal generator, miniature radio transmitter, audio oscillator, etc.—many other standard actual operating pieces of equipment—conduct cathode ray and other experiments. This practical work advances with your training—YOU LEARN BY DOING!

Shop Method Home Training

By a Real Established Resident School with its own FM Studios, Shops and Laboratories.

TRAIN WITH ADVANCED TECHNIQUE

The good jobs in Radio Electronics now go to the men who are equipped to handle them. It takes training and experience. National Schools, one of the oldest and largest trade schools in the country, makes it possible for you to get this training right in your own home IN YOUR SPARE TIME.

National maintains modern resident training Studios, Shops and Laboratories where instructors and engineers are working constantly to improve training methods. SHOP METHOD HOME TRAINING is a logical extension of this practical system.

A FREE lesson that shows you how practical and systematic this new training method is will be sent you without obligation. You may keep and use this lesson to prove to yourself just how practical National Training really is.

Get one of the many NEW JOBS that demand new techniques and methods in Modern Radio. Get your share of the NEW BUSINESS that servicing the new sets and equipment demands. Experts agree that Radio, Television and Electronics present opportunities much greater than ever before!

Radio is expanding with far-reaching improvements in reception. No one knows yet how great the Television market will be. Electronics will touch almost every walk of life—in industry and in the home.

TURN YOUR INTEREST IN RADIO INTO A CAREER THAT WILL ASSURE YOU SUCCESS AND SECURITY.

FIND OUT WHAT NATIONAL TRAINING CAN DO FOR YOU

Where do you stand today in modern industrial progress? What does the future hold for you? You owe it to yourself to investigate this opportunity. With National Training YOU GET AHEAD FAST—you may step into a good position or start a business of your own, with little capital, even before you complete your National Course.

Fit yourself for a career of independence, good earnings, success and security in one of the fastest growing fields in industry. For full information, just send your name and address on the coupon and mail it TODAY.

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This big book presents the facts about the field of Electronics and your opportunities in it together with full information about the advanced National Training. Read it and make up your own mind that National Training will equip you for a great future. No salesman will call on you from National. The book is FREE with your sample lesson. Clip and mail the coupon TODAY!

See What National Training Has Done For These Men

National Shop Method Home Training wins good jobs, independence and security. Take the word of National men who have established records in their favorite Radio, Television, or other branches of Electronics.

Clifford Hannah, Portage La Prairie, Manitoba, Canada, writes: "My training has brought results as I'm in line for another raise thanks to National's encouragement and thorough training."

From O. K. Ivey, Washington, D. C., comes this endorsement: "I believe National offers the best course to be had . . . Keep up the good work."

Joseph Michel, Jr., Granite City, Illinois, writes: "I am enthused with National training. I am now earning $225 a month as a radio operator and technician and $20 a week more in my shop at home.

Here's a statement from R. R. Wright, Blackfoot, Idaho: "Due to my training at National I was selected to instruct in the laboratory work of Navy and Marines."

Read what other enthusiastic students have written about National Training in the big 40 page book we will send you.

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(Mail in envelope or paste on penny post card)

Mail me FREE the two books mentioned in your ad including a sample lesson of your course. I understand no salesman will call on me.

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Include your zone number

☐ Check here if veteran of World War II

Start Your Own RADIO SERVICE SHOP

$99.50 $179.50 $350.00

Choose one of these 3 GREAT NEW DEALS

Includes TEST EQUIPMENT, TUBES, PARTS, TOOLS

3 complete going-in-business packages. (If necessary they can be changed to suit your needs.)

There never was a better opportunity than now to start a profitable business of your own. No fuss, no worry. Here's everything you need. Details upon request. Write, wire or phone!

Featherweight Miniature TEST INSTRUMENTS

Compact — Accurate — Priced Right!

- **Jeweled Meter • Range Selector Switch**
- **All multipliers bridge tested for 1% accuracy**
- **Zero adjustment—built in batteries**
- **Molded bakelite case only 3-15/16" x 2-7/8" x 2"**

MODEL 450A
Volt—Ohm—Milliammeter

A fine instrument having a sensitivity of 1000 ohms per volt.
Ranges: Volts DC, 0-5/10/50/500/1000;
Mills DC, 0-1;
Ohms full scale, 0-5000/50,000/500,000;
Ohms center scale, 30/300/3000.

NET complete with batteries **10.90**

MODEL 451A AC-DC
Volt—Ohm—Milliammeter

A dependable instrument of wide utility—sensitivity 1000 ohms per volt.
Ranges: Volts AC, DC, and Output Ranges, 0-10/50/100/500/1000;
Ohms full scale, 500,000.
Ohms center scale, 7200.

NET complete with batteries..... **14.90**

MODEL 451B

Same instrument as above but has 2500 ohms per volt sensitivity.

NET complete with batteries..... **16.60**

MODEL 452A
Volt—Ohmmeter

A superb instrument—100 microampere meter gives 10000 ohms per volt sensitivity.
Ranges: Volts DC, 0-10/50/100/500/1000;
Ohms full scale, 0-2000/20,000/200,000/2 Megs;
Ohms center scale, 30/300/3000/30,000.

NET complete with batteries..... **14.90**

MODEL 312
Volt—Ohm—Milliammeter

An economy pocket meter featuring a 2" moving vane meter.
Reads: AC-DC volts, 0-25/50/125/250;
Mills AC-DC, 0-50;
Ohms, 100,000;
mfd. .05-15.
Jacks provide range selection.

NET Complete with cord and plug..... **6.75**

TEST LEADS (Removable Needle Points).....**.59**
Excellent for above instruments.

TURNTABLE STAND

$3.91

FREE

With each stand we send a stroboscope free.

All steel—adjustable—holds turntable 15" above bench—tilts to any position—speeds work—saves time—prevents damage to parts—pays for itself on first job—you need several at this low price.

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Selenium cell only, no holder, postpaid... **$1.80**
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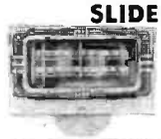
Hallicrafters S-38..... **$47.50**
S-40 (Replaces S-20R)..... **89.50**
SX-42 (Replaces SX-28A)..... **275.00**

SELENIUM RECTIFIERS

Direct permanent replacement for 117Z6—117Z3, etc. No filament—no socket—no trouble.

1 to 5 net **1.08** 6 to 49 net **98c** 50 or more net **90c**

SLIDE RULE DIALS



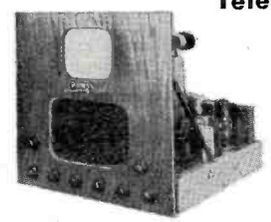
Crowe No. 534—direct ratio drive—antique bronze escutcheon 2⅜" x 4"—pointer travel 3¾".
NET with pilot lamp bracket... **$1.74**

V. M. AUTOMATIC CHANGER

A Two Post Changer with well-made mechanism—plays 10" or 12" records intermixed. Low pressure crystal pickup. Size 14" x 14". Packed two to a factory-sealed carton, factory guaranteed.

SPECIAL EACH 15.95 CARTON OF TWO **29.95**

TRANSVISION Television Kit



- Proven Circuit
- 7" Picture Tube
- Pre-tuned RF
- Special Antenna
- 100% Complete

Famous Television Kit as advertised by *Transvision, Inc.* complete with all tubes, panel, everything—now available from our stock. Another Radio Supply "First"..... **$159.50**
When ordering, specify station channels needed.

JEWELLED PILOT LIGHT ASSEMBLIES

- Candelabra screw base for 110 volt lamp.
- Mount in 1" hole.
- Lamps removable from front of panel.
- Available marked 1-2-3 or 4 on back of lens.

YOUR CHOICE net **19c**

Include full remittance with orders of $3.00 or less. Include 25% deposit with all C.O.D. orders of $3.00 or more. Prices subject to change without notice.

SEND FOR FREE CATALOG

RADIO SUPPLY & ENGINEERING CO., Inc.

129 SELDEN AVE. DETROIT 1, MICH.

RADIO TUBES

Monica Lewis, popular singing star, in this 21" by 26" window card, draws attention to the fact that YOU install and sell G-E radio tubes. Handsomely lithographed in four colors, varnished, backed and easeled, the display is a "traffic-stopper". Like the *many other G-E sales helps for 1947*, it will make your cash-register ring to the tune of G-E product-popularity.

Write for your free copy of the General Electric sales-helps Booklet ETR-51, illustrating and describing the big, elaborate array of G-E 1947 display, advertising, and promotion material available to radio servicemen and tube dealers. Also tells how to use each item best and most profitably. Filled with marketing hints! Send for Booklet ETR-51 TODAY!

In dealer displays and sales helps— as in *quality*— G-E TUBES LEAD!

EVEN THOUGH you're handling a product known to be the finest of its type, *it pays to advertise!* That way lies the path to profits! So when you install and sell General Electric radio tubes, the public still should be told and re-told that your shop is local sales headquarters.

Stunning displays like the one shown here, spark an aggressive campaign of G-E tube advertising and sales helps created for one purpose only: to acquaint radio owners in *your* area with *your* facilities to serve them. Thus your circle of customers widens; your income grows.

Many of the G-E pieces subordinate any tube message to the theme of your quality radio service. This service theme is carried through on counter displays, blotters, direct-mail cards, newspaper mats—many other items which actively *sell* for you day-in and day-out.

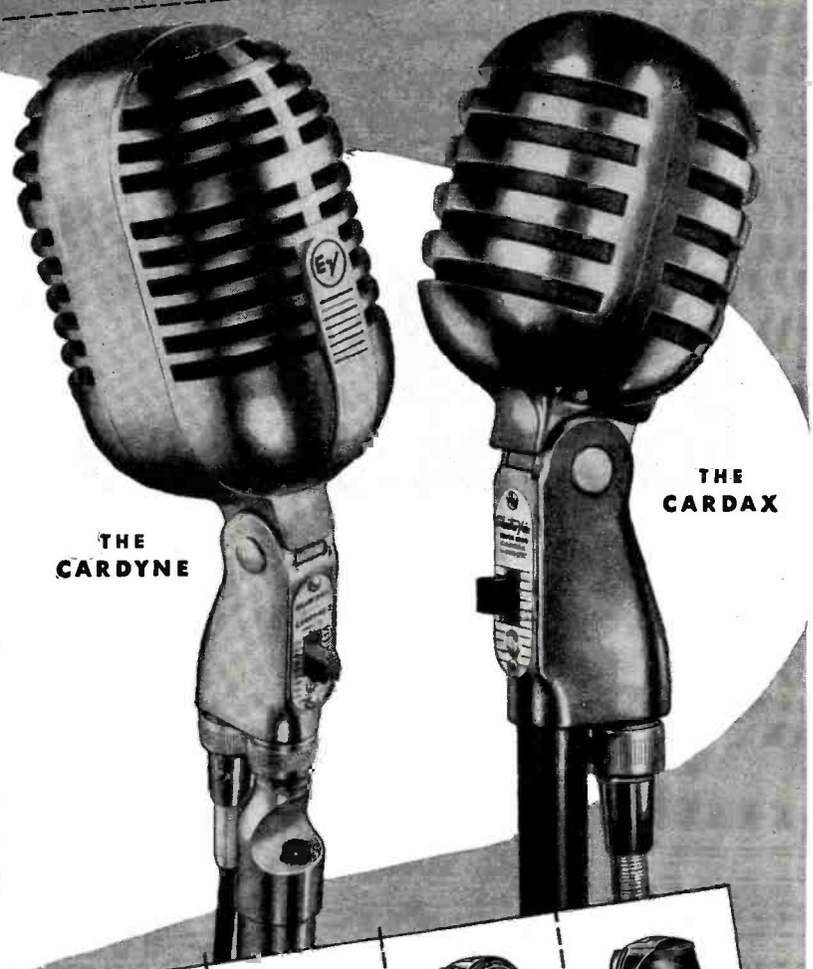
Make 1947 your biggest year by taking full advantage of G-E technical leadership—universal owner acceptance—brilliant new advertising material that's ready to help *you* secure the volume tube business waiting for you! *Electronics Department, General Electric Company, Schenectady 5, N.Y.*

GENERAL ELECTRIC

176-F3-8850

FIRST AND GREATEST NAME IN ELECTRONICS

The Complete E-V Line Assures *the Right Microphone for Every Need*



● Only ELECTRO-VOICE provides such a complete line of microphones. With outstanding developments in Unidirectional, Differential†, Bi-directional, and Non-directional types . . : in Dynamic, Crystal, Carbon and Velocity models . . . you can more easily obtain the microphones best suited to your needs.

● Proved in critical service, E-V Microphones are widely used today by leading manufacturers and sound engineers in all kinds of applications. They are produced from finest materials under E-V quality control. Consult our engineers.

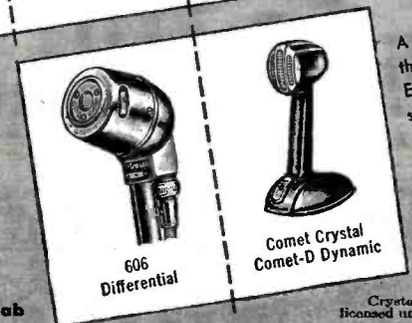
THE CARDYNE—True cardioid unidirectional dynamic microphone, with exclusive E-V *Mechanophase** principle, *Acoustalloy* diaphragm, smooth, wide range response, and high output.

THE CARDAX—The only high level cardioid crystal microphone with Dual Frequency response for high fidelity voice and music, or rising characteristic for extra crispness of speech.

†Patent No. 2,350,010 *Electro-Voice Patents Pending

Send for Catalog No. 101

This illustrated catalog gives complete data and information on E-V Microphones. Includes helpful selection guide. Write for it today.



A portion of the Complete E-V Line is shown here

NO FINER CHOICE THAN **Electro-Voice**

ELECTRO-VOICE, INC., BUCHANAN, MICHIGAN

Export Division: 13 East 40th Street, New York 16, N. Y., U. S. A. Cables: Arlab

Crystal Microphones licensed under Brush patents

GET YOUR *PROFIT-MAKING* FEDERAL SELENIUM RECTIFIERS FROM THESE JOBBERS!

There's an authorized jobber near you who can supply your Federal Miniature Rectifiers — and give you *free selling-aids* that will help you cash in on the big market for this new component that replaces the rectifier tube in AC-DC, Portable, Table, and Console radio receivers.

It's the modern way to give better service, improve set performance, get instant starting and longer life. . . . Get in touch with your nearest jobber today.

ALABAMA
Mobile—Radio Labs

ARIZONA
Phoenix—Southwest Wholesale Radio & Appliance Co.

ARKANSAS
Ft. Smith—Wise Radio Supply

CALIFORNIA
Long Beach—Fred S. Dean Co.
Los Angeles—U. S. Grant Supply Co.
Radio Equipment Distributors
Radio Products Sales Co.
Radio Specialties Company
United Radio Supply Co.
Sacramento—Sacramento Electric Supply
San Diego—Electronic Distributors
Radio Parts Co.
San Francisco—Leo J. Meyberg Co., Inc.
Schuyler-Wilson Co.
Zack-Radio Supply Co.
Santa Ana—Radio & Television Equipment Co.

COLORADO
Denver—Inter-State Radio & Supply Co.
Radio Products Sales Co.

CONNECTICUT
Bridgeport—R. G. Sceli & Co.
Hartford—R. G. Sceli & Co.
New Britain—United Radio Supply

DELAWARE
Wilmington—Radio Electric Service Co. of Pennsylvania

DISTRICT OF COLUMBIA
Washington—Capitol Radio Wholesalers
Emerson Radio of Washington

FLORIDA
Miami—Herman Radio Supply Co.
Thurow Distributors, Inc.
Jacksonville—Thurow Distributors, Inc.
Orlando—Thurow Distributors, Inc.
St. Petersburg—Welch Radio Supply
Tallahassee—Thurow Distributors, Inc.
Tampa—Thurow Distributors, Inc.
W. Palm Beach—Goddard Distributors
Thurow Distributors, Inc.

GEORGIA
Atlanta—Concord Radio Corp.
Augusta—Prestwood Electronics Co.

IDAHO
Boise—Craddock's Radio Supply

ILLINOIS
Chicago—Allied Radio Corporation
The Lukko Sales Corp.
Walker-Jimieson, Inc.

INDIANA
Anderson—Seybert's Radio Supply Co.
Evansville—Wesco Radio Parts
Indianapolis—Kiefer-Stewart Co.
Radio Distributing Company
Rodefield Co.
Van Sickle Radio Supply Co.
Muncie—Standard Radio Parts
South Bend—Colfax Co., Inc.
Terre Haute—Terre Haute Radio

KANSAS
Wichita—Radio Supply Company

KENTUCKY
Louisville—P. I. Burks & Co.
Universal Radio Supply Co.
Owensboro—General Electronic Supply

LOUISIANA
New Orleans—Radio Parts, Inc.
Shuler Supply Co.
Southern Radio Supply Co.
Walther Bros. Company

MAINE
Auburn—Radio Supply Co., Inc.
Bangor—Radio Service Laboratory of New Hampshire & Maine
Portland—Radio Service Laboratory of New Hampshire & Maine

MARYLAND
Baltimore—Kann-Ellert Electronics, Inc.
Wholesale Radio Parts Co., Inc.
Cumberland—Radio Wholesaler

MASSACHUSETTS
Boston—De Mambro Radio Supply Co.
Louis M. Herman Company
Hub Cycle and Radio Co., Inc.
Radio Shack Corporation
Cambridge—Electrical Supply Corp.
The Eastern Company
Fall River—Flint Radio Co.
Roxbury—Gerber Radio Supply Co.
Worcester—De Mambro Radio Supply Co.

MICHIGAN
Detroit—Ingram Distributing Co.
Grand Rapids—Milton Bursma

MINNESOTA
Minneapolis—Lew Bonn Co.

MISSOURI
Kansas City—Potter Radio Company
St. Louis—Radonics

NEBRASKA
Omaha—General Appliance Co.

NEW HAMPSHIRE
Manchester—De Mambro Radio Supply Co.
Radio Service Laboratory

NEW JERSEY
Camden—General Radio Supply Co.
Radio Electric Service Co. of Pennsylvania
Newark—T. A. O'Loughlin & Co.
Variety Electric Company
Perth Amboy—Bennett's Radio Supplies
Phillipsburg—Carl B. Williams

NEW MEXICO
Albuquerque—Radio Equipment Co.

NEW YORK
Albany—Hudson Valley Asbestos Corp.
E. E. Taylor Co.
Binghampton—Broome Distributing Co.
Federal Radio Supply
Morris Distibuting Co., Inc.
Buffalo—Genesee Radio & Parts Co.
Radio Equipment Corp.
Standard Electronics Co.
Elmira—Fred C. Harrison Co.
Le Valley-McLeod-Kincaid Co.
Glens Falls—Ray Distributing Co.
Hempstead—Standard Parts Corp.
New York—Bronx—Slate and Company
Brooklyn—Eenray Distributing Co.
Electronic Equipment Company, Inc
Green Radio Distributors
Hornbeam Distributing Co.
Manhattan—H. L. Dalis, Inc.
Federated Purchaser Inc.
Harvey Radio Company, Inc.
Milo Radio & Electronics Corp.
Newark Electric Co. Inc.
Radio Wire Television Inc.
Radionic Equipment Co.
Stan-Burn Radio & Electronics Co.
Terminal Radio Corporation
Queens—Peerless Radio Distributors
Rochester—Hunter Electronics
Masline Radio & Electronic Equipment Co.
Rochester Radio Supply Co.
Schenectady—M. Schwartz & Son
Syracuse—Broome Distributing Co.
W. E. Fernadt
Morris Distributing Co.
Syracuse Radio Supply Co.
Troy—Trojan Radio Co., Inc.
Utica—Beacon Electronics, Inc.
Electronic Lab's & Supply Co.
Vaeth Electric Co.
White Plains—Sound Products Co.
Westchester Electronics Supply Co.

NORTH CAROLINA
Charlotte—Radiotronic Distributors, Inc.
Raleigh—Supreme Radio Suppliers

OHIO
Akron—Brighton Sporting Goods Corp.
Cincinnati—Herrlinger Distributing Co.
Holub & Hogg
Cleveland—Goldhammer, Inc.
Columbus—Hughes-Peters, Inc.
Thompson Radio Supplies
Dayton—Hughes-Peters, Inc.
Standard Radio & Electronics Products Co.
Toledo—Lifetime Sound Equipment Co.
Warren Radio Company

OKLAHOMA
Lawton—Reynolds Radio Supply

OREGON
Portland—Lou Johnson Company
Tracy & Company, Inc.

PENNSYLVANIA
Allentown—Radio Electric Service Co. of Pennsylvania
Ardmore—O. K. Griffith Radio
Erie—Warren Radio Company
Harrisburg—Radio Distributing Co.
Lancaster—Geo. D. Barbey Co.
Mt. Carmel—Big Boys Auto Parts Co.
Philadelphia—Almo Radio Co.
Emerson Radio of Pennsylvania
Lectronic Research Laboratories
Radio Electric Service Co. of Pennsylvania
Pittsburgh—Cameradio Co.
Tydings Company
Reading—Geo. D. Barbey Co.
Scranton—Fred P. Pursell
Sunbury—Big Boys Auto Parts Co.
Wilkes-Barre—General Radio & Electronic Co.
York—J. R. S. Distributors

RHODE ISLAND
Providence—Wm. Dandreta & Co.
De Mambro Radio Supply Co. (Branch)
W. H. Edwards Co.

SOUTH DAKOTA
Rapid City—Giraud Supply Co., Inc.

TENNESSEE
Memphis—Bluff City Distributor Co
Nashville—Currey's, 109 16th Ave.

TEXAS
Dallas—Crabtree's Wholesale Radio
Huey & Philip Hardware Co.
Wilkinson Brothers
Ft. Worth—Fort Worth Radio Supply Co.
Houston—Sterling Radio Products Co.
San Antonio—Mission Radio, Inc.

UTAH
Salt Lake City—S. R. Ross

VERMONT
Burlington—Vermont Hardware Co.
Rutland—Rutland Radio Center

VIRGINIA
Norfolk—Radio Parts Distributing Co.
Radio Supply Company
Roanoke—Leonard Electronic Supply
Staunton—Southern Electric Co.

WASHINGTON
Seattle—Seattle Radio Supply, Inc.
Herb E. Zobrist Co.
Yakima—Lay & Nord

WISCONSIN
Milwaukee—Radio Parts Co., Inc.

OUTSIDE THE UNITED STATES

HAWAII
Hilo—Photo Radio Products, Ltd.
Honolulu—Radio Wholesale & Supply Co.

GET THESE FREE SALES HELPS

SELF-SERVICE COUNTER DISPLAY
Holds 12 individually boxed units.

SERVICE MANUALS
Show how to apply and install Federal's Miniature Rectifiers.

ALSO — a 17-by-22 inch 3-color window poster, that gives all sales points at a glance. Available from your nearest jobber!

Federal Telephone and Radio Corporation

In Canada: — Federal Electric Manufacturing Company, Ltd., Montreal.
Export Distributors: — International Standard Electric Corp. 67 Broad St., N. Y.

An IT&T Associate — Federal Telephone & Radio — FTR

100 Kingsland Road, Clifton, New Jersey

Where Do YOU Go From Here?

CREI Streamlined, spare time training is the DIRECT COURSE to that Secure, GOOD-PAYING JOB You Want

NEVER was there such widespread opportunity as exists today in every field of radio-electronics. Not only are there countless new jobs . . . but *more* jobs with good salaries. The demand, however, is far beyond the number of radiomen *qualified* to fill these positions.

You may have "gotten by" up to this point. But if you want to progress with the industry . . . if you want an important, good-paying position and the security that goes with it—you must acquire up-to-date technical training.

No matter if your interest lies in broadcasting, aviation, manufacturing, television or radio service, or in any of the many other radio-electronics applications that are open today . . . you can enroll with CREI confident that this high-calibre, professional, practical radio-electronics engineering training will give you proper and sound qualifications for the field of your choice.

Decide today "where YOU will go from here". You can assure your future security . . . end the threat of competition challenging you for your job. CREI is prepared to train you for a better place in this new world of electronics. Mail the coupon today for details of the CREI self-improvement program. Yes, a 3c stamp can result in more security . . . a better job . . . happiness. Write *now*.

If you have had professional or amateur radio experience and want to make more money, let us prove to you we have the training you need to qualify for a radio job. To help us intelligently answer your inquiry—PLEASE STATE BRIEFLY YOUR BACKGROUND OF EXPERIENCE, EDUCATION AND PRESENT POSITION.

VETERANS! CREI TRAINING AVAILABLE UNDER THE "G. I." BILL!

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CAPITOL RADIO ENGINEERING INSTITUTE
16th & Park Rd., N. W., Dept. RN-5, Washington 10, D.C.

Gentlemen: Please send me your free booklet, "CREI Training for Your Better Job in RADIO-ELECTRONICS", together with full details of your home study training. I am attaching a brief resume of my experience, education and present position.

CHECK COURSE ☐ PRACTICAL RADIO ENGINEERING ☐ PRACTICAL TELEVISION ENGINEERING

NAME.....

STREET.....

CITY.....ZONE.....STATE.....

☐ I am entitled to training under the G.I. Bill.

Metropolitan Introduces for the first time

The NEW PREMIER Model 570

SIGNAL GENERATOR

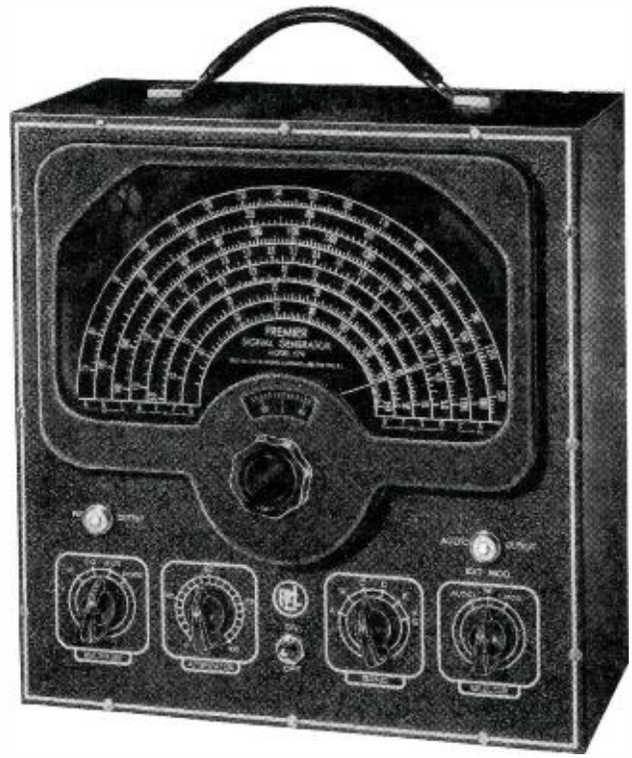
With the NEW EXCLUSIVE

MICROMASTER BAND SPREAD DIAL

an important feature for testing and aligning

BROADCAST — SHORT WAVE
FM and TELEVISION RECEIVERS

Range: 75 Kc to 150 Mc



The PREMIER MODEL 570 is the **only** low priced Signal Generator incorporating a MICROMASTER BAND SPREAD DIAL . . . This Dial is geared to the tuning condenser and main dial, giving a total scale length of approximately 60 inches. It is a very important and major feature for tuning and aligning FM and Television receivers where tuning is very sharp and critical. Any frequency setting can be tuned and repeated very accurately.

The main nine-inch **THREE COLOR DIAL** is directly calibrated in Kilocycles and Megacycles, and the BAND SPREAD DIAL can be used for your own accurate calibrating purposes . . . it reads 0 to 100.

VERNIER and BAND SPREAD DIAL are housed in a casting which contains spring-loaded split-gears to eliminate backlash and provide smooth split-cycle tuning.

Complete dial and fine pointer are enclosed in a dust-proof casting with a glass window, which prevents the pointer from accidentally being bent or otherwise disturbed and thus putting the instrument out of calibration.

Dial is indirectly illuminated by two hooded pilot lights.

Manufactured by PREMIER ELECTRONIC LABS., N. Y.

Specifications

AIR TRIMMERS: The use of Air Trimmers on all bands retains original calibration regardless of temperature or humidity changes.

BUFFER STAGE: The oscillator is electron coupled to a Buffer Stage, which is in turn modulated, resulting in frequency stability.

ACCURACY: Calibrations are stable and accurate better than 1%.

TRIPLE SHIELDING: Coils, Attenuator and Line Filter are individually shielded, then in addition the entire chassis is completely shielded. The metal cabinet offers final shielding. Chassis and shields are copper plated. This series of shielding reduces leakage and radiation to an absolute minimum.

BANDS: 75—220; 200—600; 550—1700 KC and 1.6—5.0; 5.0—16; 14—50 MC on fundamentals and 45—150 MC on third harmonic.

COILS: All coils are pretested and individually calibrated before they are installed, resulting in greatest possible accuracy in calibration. Unused coils are automatically shorted out, eliminating dead spots and absorption.

CONDENSER: A special geared wide spaced straight line frequency condenser provides linear calibrations over the entire dial range. (Does not crowd up towards the high frequency end of the dial as found in other signal generators.)

SINE WAVE: Internal 400 cycles Audio Generator provides a pure sine wave for modulation (Less than 5% distortion) as well as an audio signal for external testing purposes.

EXTERNAL MODULATION: High Fidelity modulation from 0 to 100% from below 50 cycles per second to over 15,000 cycles per second.

ATTENUATOR: Four step ladder type completely shielded attenuator provides a smooth control from zero to full output.

LINE FILTER: A very effective shielded Line Filter is incorporated consisting of two inductances and condensers (not merely bypassing the line) reduces line leakage to a negligible point.

SIZE: 12″ x 12½″ x 5½″.
WEIGHT: 16 lbs. net.

Spring action, snap-type leather carrying handle.

$54.75 NET

Complete with coaxial cable.

IMMEDIATE DELIVERY FROM STOCK — GUARANTEED!

TERMS: 25% DEPOSIT, BALANCE C.O.D. OR FULL PAYMENT WITH ORDER.

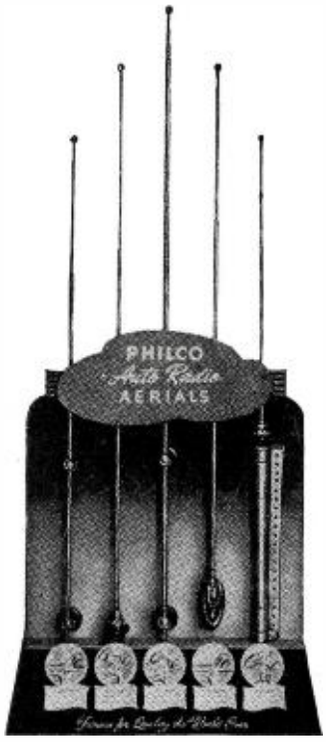
WRITE FOR FREE CATALOG

Metropolitan ELECTRONIC & INSTRUMENT CO.
Dept. R, 6 MURRAY STREET
NEW YORK 7, N. Y., U. S. A.
Cable Address: METRONICS
Phone: BArclay 7-5556

PHILCO

Aerial Merchandising

means Bigger Profits for YOU

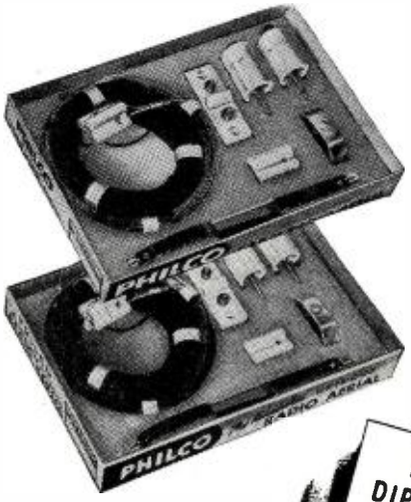


PHILCO 5-UNIT AUTO AERIAL DISPLAY

Shows a selection of 5 popular models. Smartly styled. Occupies minimum space. Permits customer to see them *all* and make his choice. Helps you sell-up. Get it FREE from your Philco Distributor.

PHILCO 2-UNIT AUTO AERIAL DISPLAY

Shows 2 models — the famous Philco Duoflex and the sensational "Special," greatest auto aerial value of all time. The perfect sell-up display! Fits anywhere. Get it FREE from your Philco Distributor.



PHILCO OUTDOOR AERIAL

Everything in one package at a sure-fire low price. For months it's been selling like hot cakes. Profitable!

PHILCO FARM AERIAL

Another big selling package deal. A "must" for dealers selling in the farm areas.

PHILCO FM DIPOLE AERIAL

Makes any FM radio perform better. Get set for the swing to FM by featuring your installation service with this new Philco product.

Here it is from Philco—the aerial line that gives you everything to get a bigger share of this profitable business this year. *All* the best-selling types of aerials—*plus* sensational new models with quality and price appeal. Auto Aerials—Home and Farm Aerials—FM Aerials. Values that stand out above competition! Features that sell on sight! Displays that catch customer's eyes—lead to many extra sales!

PHILCO COOPERATIVE ADVERTISING
Greatest in the Aerial Business

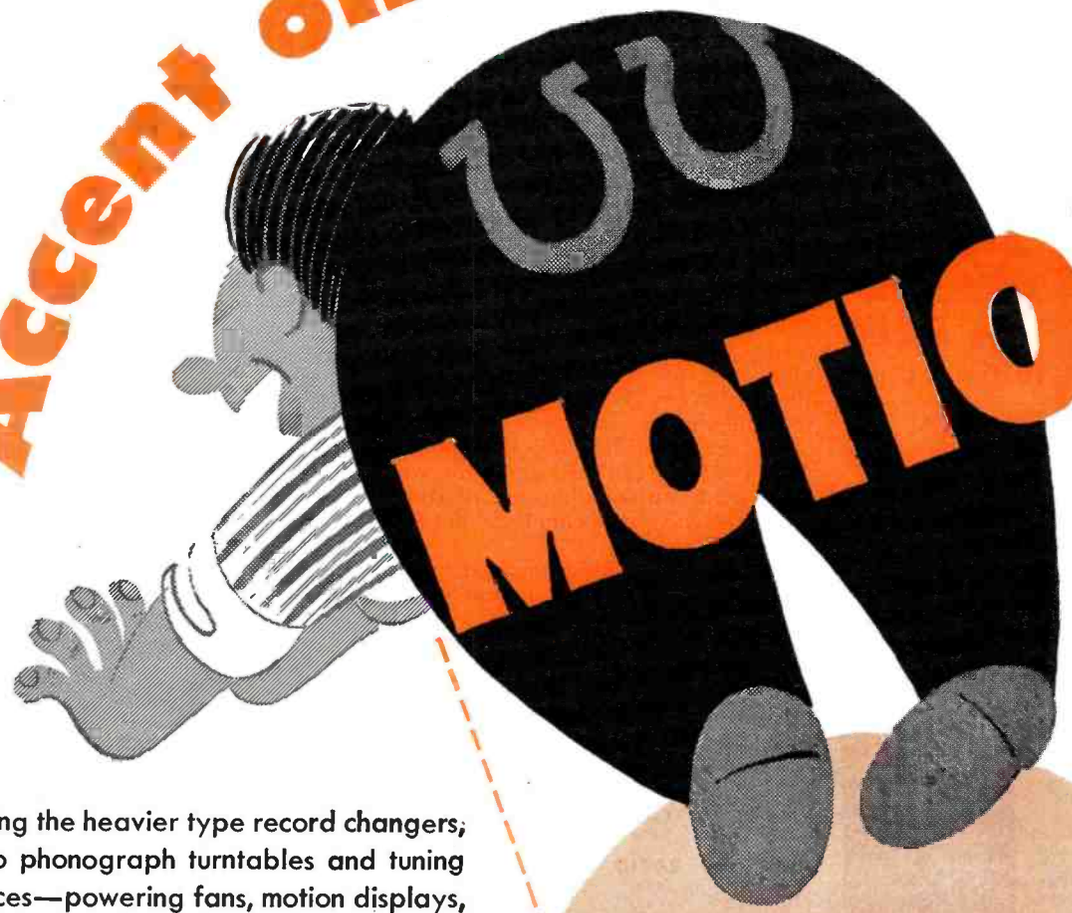
Yes, cooperative local advertising over *your* name—newspaper advertising, radio advertising, direct mail pieces, handbills—Philco goes *all out* to make *your* store the aerial headquarters of your community.

Every month, the year 'round, new PHILCO SALES-BUILDING PROMOTIONS help you get this profitable business

With Philco Aerials and other Accessory Products, you can take the seasonal dips out of your sales. Fresh new Philco promotions help you keep sales going up month after month—keep stocks moving. There's nothing like the Philco plan for profits! Get the facts at once from your Philco Distributor.

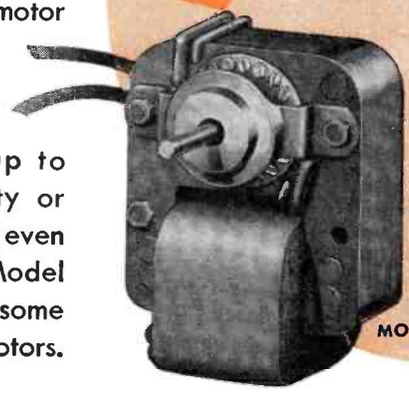
PHILCO ACCESSORY PRODUCTS ARE BIG BUSINESS!

Accent on MOTION



Driving the heavier type record changers, radio phonograph turntables and tuning devices—powering fans, motion displays, actuating switches, levers and timing devices—operating business and vending machines, toys—these are just a few of the tasks performed by *Alliance's Model K Powr-Pakt motor.*

This basic 2-pole induction type motor can be *mass produced* to meet variations in design. It will adapt to any standard AC voltage and frequency, and will develop up to 1/100th h. p. For intermittent duty or where forced ventilation is provided even greater output can be obtained. Model K is used in all 25-cycle and in some 50 and 60-cycle Alliance phonomotors.



MODEL K

The trend is to make things move!

Designs will call for more action—movement! Flexible product performance needs power sources which are compact, light weight! Alliance Powr-Pakt Motors rated from less than 1-400th on up to 1-20th h.p. will fit those "point-of-action" places! Alliance Motors are *mass produced at low cost*—engineered for small load jobs!

For vital component power links to actuate controls... to make things move... plan to use them!

WHEN YOU DESIGN—KEEP alliance MOTORS IN MIND

ALLIANCE MANUFACTURING COMPANY • ALLIANCE, OHIO

Within the INDUSTRY

D. E. NOBLE, vice-president in charge of the Communications and Electronics Division of *Motorola*, was awarded the grade of Fellow by the Institute of Radio Engineers at their banquet held in conjunction with the IRE New York meeting.

The grade of Fellow is honorary and awarded to IRE members who have made outstanding contributions to the science or technology of radio and allied fields.

Mr. Noble has been engaged in the development of FM equipment for mobile service and military applications since joining *Motorola* in 1940. He is chairman of Panel 13 of the Radio Technical Planning Board, chairman of the IRE technical committee on Railroad and Vehicular Communications and chairman of the RMA committee on Vehicular Radio Communications Equipment.

* * *

CONCORD RADIO CORPORATION recently opened the new *Concord Buying Center* at 229 West Madison Street, Chicago, to an enthusiastic preview audience.

The new store has been especially designed to feature several revolutionary merchandising ideas, including sound-proof demonstration salons to enable customers to sound test and inspect radios, radio-phonographs, amplifiers, microphones, sound equipment and movie equipment.

Special facilities have been provided for the comfort and convenience of servicemen, dealers, hams, and other buyers.

* * *

ALBERT C. GABLE has been named assistant engineer of the Tube Division of *General Electric Company's* Electronics Department.

Mr. Gable, who was formerly administrative assistant of the division's engineers, will continue to maintain his headquarters at Schenectady where he has worked on various engineering assignments since 1929.

A native of Macon, Ga., Mr. Gable holds a B. S. degree in electrical engineering from Georgia Tech. He joined *General Electric* in 1929, working in the Test Department and Vacuum Tube Engineering Department. In 1931 he became section leader on the development of rectifier tubes. Responsibility for ignitron and thyratron tube engineering was added to his duties shortly thereafter.

* * *

NATIONAL ASSOCIATION OF BROADCASTERS announced the appointment of three new members to their Sales Managers Television Subcommittee.

Newly appointed members are Samuel H. Cuff, *Allen B. DuMont Laboratories, Inc.*, New York; G. Emerson Markham, WRGB, Schenectady, New York; and George Moskovics, commercial manager, WCBS-TV, New York.

* * *

EDWARD E. WINEBLATT was recently named as the first direct factory representative to handle the *JFD Manufacturing Co.'s* line of radio parts.

After an extensive training in the various company plants, Mr. Wineblatt is now prepared to serve the company's customers for dial belts, cables, battery plugs, ballast tubes, step-down ballasts and line cords.

Mr. Wineblatt will maintain headquarters at the Hotel Monterey, 808 Junior Terrace, Chicago 13, Illinois. He will cover the state of Illinois.

* * *

DONALD MacGREGOR, formerly executive vice-president of *Webster-Chicago Corporation,* has been elected vice-president in charge of production for the *Zenith Radio Corporation* of Chicago.

He began his business career with the *Belden Manufacturing Company* in 1920. Since that time, he has held positions with *All-American Mohawk Corporation, Rauland Corporation, Thordarson Electrical Manufacturing Company, and Watsontown Cabinet Company.*

Mr. MacGregor is one of the founders of RMA and for several years held the post of director for the association.

* * *

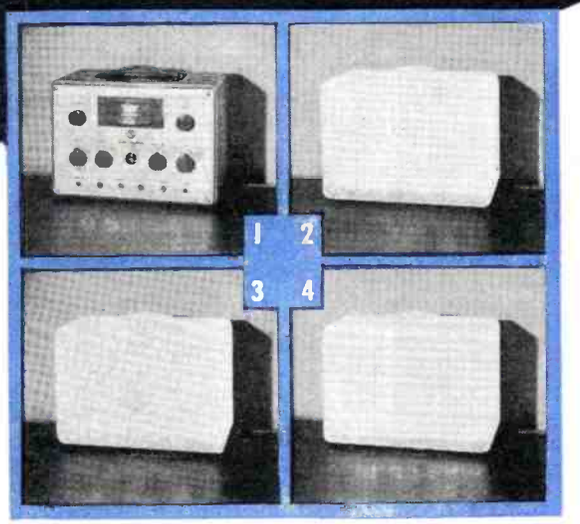
JOHN C. WEBB, former sales manager for *Micro-Ferrocart Products Division,* of *Maguire Industries,* Stamford, Conn. and former vice-president of the *Ferrocart Corporation of America,* announces the organization of a new company to be known as the *Stanwyck-Webb Magnetic Core Corporation,* with both plant and laboratories to be located in Ossining, New York.

Large scale production is now underway with several recently completed new developments for low frequency application.

Mr. Webb is well known in the radio

DESIGNED FOR THE BETTER SERVICE SHOP . . .

RCA's NEW AUDIO OSCILLATOR
. . . first unit of a revolutionary new line



ON THE WAY—a superior line of test equipment that puts time-consuming service jobs on a profitable, production-line basis . . . that anticipates all FM and television needs. Matched styling of all instruments permits attractive, convenient grouping. Watch for announcements of the other units in this new line. *Keep in touch with your RCA Test Equipment Distributor.*

A real time-saver for loudspeaker testing and radio servicing

Profitable applications include such diverse jobs as finding the cause of loudspeaker rattle, measuring receiver fidelity and audio amplifier response.

The WA-54A is a temperature-compensated, beat-frequency oscillator with an electronic output-level indicator. The electronic eye serves as a reference to provide an even signal level at all frequencies, and also acts as a zero-beat calibration indicator.

Other outstanding features of this audio-frequency signal source include: wide range . . . continuous tuning . . . low distortion . . . low hum level . . . balanced line outputs . . . application as an a-f amplifier . . . all explained in the WA-54A bulletin, which is yours for the asking.

TEST AND MEASURING EQUIPMENT

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

industry, having covered the entire United States and Canada as Field Sales Manager for the *Ferrocart Corporation.*

* * *

L. C. McCARTHY of Chicago, well known radio sales representative, was recently elected to the board of directors of *Electronic Laboratories, Inc.,* of Indianapolis.

Mr. McCarthy's sales experience covers over 20 years in the radio business with the last fourteen years spent in Chicago representing *Electronic Laboratories, Inc.*

During the war he was general manager of the Canadian subsidiary of *Electronic Laboratories of Canada, Limited,* which was engaged in the production of specialized communications equipment.

* * *

RADIO MANUFACTURERS ASSOCIATION has recently initiated a new service for its member companies. Weekly reports are now issued from RMA headquarters for the benefit of set manufacturers and covering available surplus radio materials.

These new RMA surplus inventory reports were recommended by the Set Division, under Chairman Paul V. Galvin of Chicago, and authorized by the RMA Board of Directors.

To assist in inventory and production matters, RMA set manufacturers may report available surplus of parts, tubes, accessories, and other radio materials. These reports from the set manufacturers are then compiled and distributed weekly for the exchange or sale of surplus inventory between the RMA set companies.

* * *

LEO L. HELTERLINE, JR., was recently appointed Chief Engineer for *Sorensen & Company, Inc.*

Mr. Helterline has been with *Sorensen* since January, 1946 as senior project engineer. In his new capacity he will be responsible for the design and development of all company products which include voltage regulators, transformers, Nobatrons, and special electronic equipment.

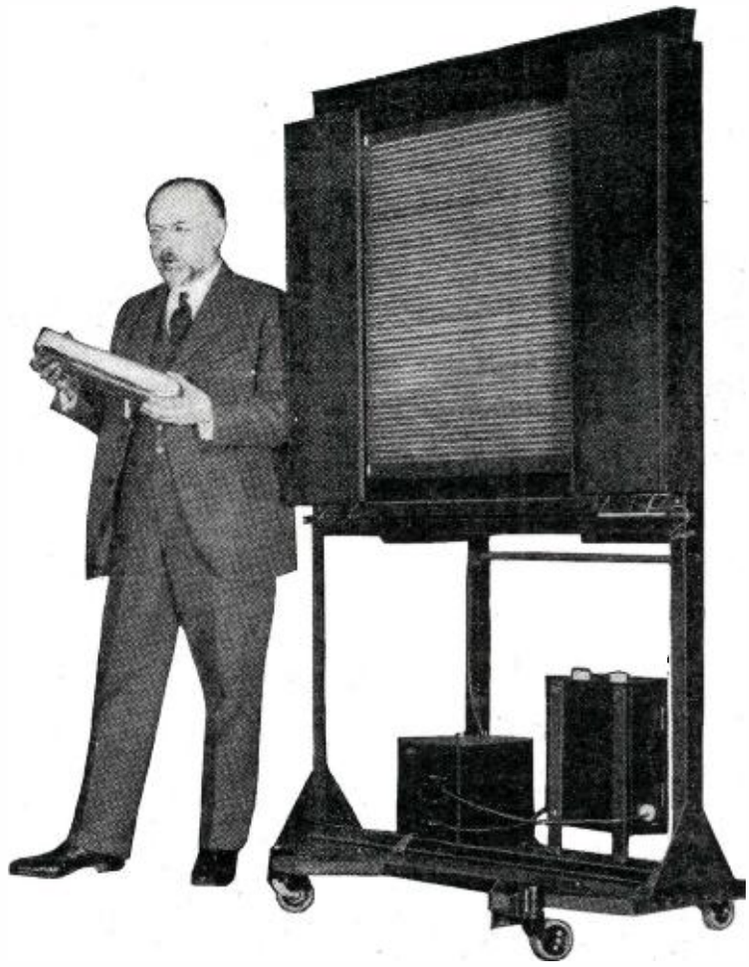
Mr. Helterline is a graduate of Rensselaer Polytechnic Institute and prior to joining the *Sorensen* organization he was affiliated with *Sylvania Electric Products Inc.* as a quality control engineer doing test and liaison work on radar vacuum tube components.

* * *

RAYTHEON MANUFACTURING COMPANY'S new permanent sales headquarters for the Radio Receiving Tube Division are now located at 445 Lake Shore Drive, Chicago. All activities in connection with sales engineering, ad-

(*Continued on page* 176)

Long-distance Television is twenty years old



At the 1927 demonstration, Dr. Herbert E. Ives explained the television system developed in Bell Telephone Laboratories.

APRIL 7 is a notable day in communication history, for on that day in 1927 was the first demonstration of television over long distances. Large-scale images were flashed from Washington, D.C., by wire and from Whippany, N.J., by radio to a public demonstration in New York City. "It was," said a newspaper, "as if a photograph had suddenly come to life and begun to smile, talk, nod its head and look this way and that."

That was the first of many public demonstrations, each to mark an advance in the television art. In 1929 came color television, and in 1930 a two-way system between the headquarters buildings of A. T. & T. and Bell Laboratories. When the first coaxial cable was installed in 1937, television signals for 240-line pictures were transmitted between Philadelphia and New York and three years later 441-line signals were transmitted. By May, 1941, successful experiments had been made on an 800-mile circuit.

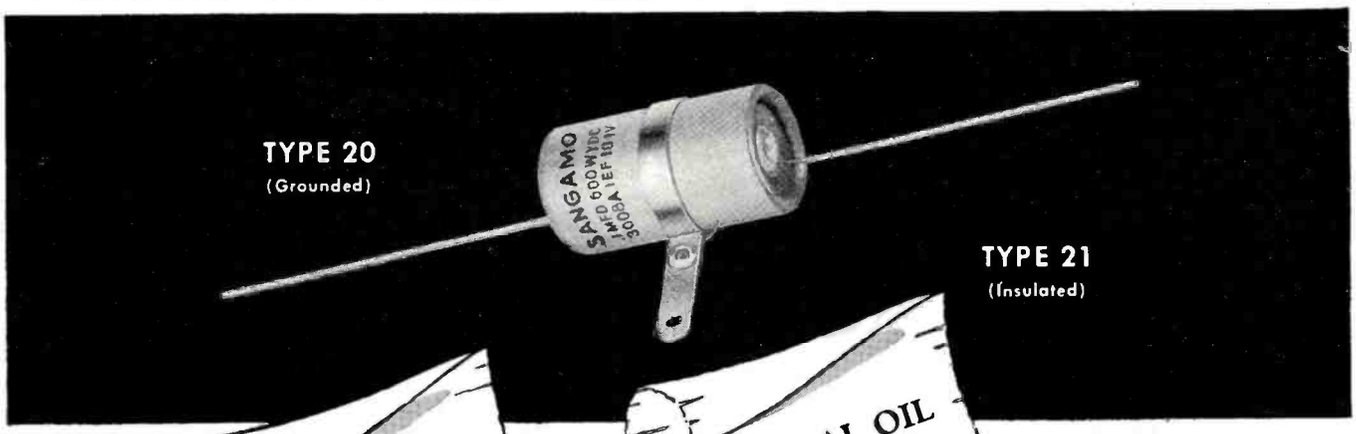
End of the war brought a heightened tempo of development. Early in 1946 began the regular experimental use of coaxial cable for television between New York and Washington, and a few months later a microwave system for television transmission was demonstrated in California.

Transmission facilities will keep pace as a great art advances to wide public usefulness.

BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

SANGAMO METAL-CASED MINERAL-OIL PAPER CAPACITORS



STABLE CAPACITY FROM −55°C TO +85°C

MINERAL OIL FILLED TO ASSURE LONGER LIFE

CREDENTIALS *that* QUALIFY !

EXCELLENT BY-PASS AND COUPLING QUALITIES

AVAILABLE WITHIN A RANGE OF 200 to 2000 VOLTS WORKING

TYPES 20 AND 21 AVAILABLE NOW FOR *IMMEDIATE DELIVERY*

SANGAMO CAPACITORS

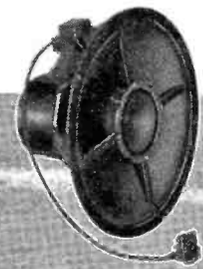
SANGAMO CAPACITORS ARE NOW MANUFACTURED IN CANADA BY SANGAMO COMPANY LIMITED, LEASIDE, ONTARIO

SANGAMO ELECTRIC COMPANY · SPRINGFIELD, ILLINOIS

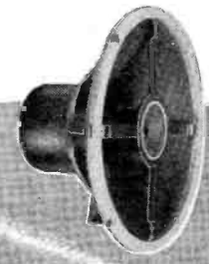
Listen...IT'S A Jensen SPEAKER!

Model HNP-51
(15-inch)

Model JAP-60
(15-inch)



Model JHP-52
(15-inch)



Model JCP-40
(12-inch)

JENSEN BASS REFLEX* REPRODUCERS with COAXIAL SPEAKERS

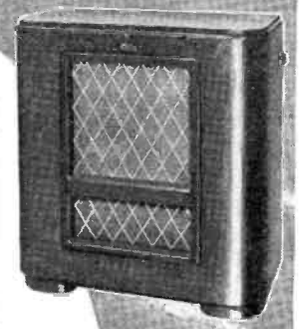
TYPE "RD"

REPRODUCER NO.	STOCK NO.	CABINET NO	SPEAKER NO.	IMPEDANCE, OHMS	LIST PRICE
RD-122	ST-159	D-121	JCP-40	6-8	$120.00
RD-151	ST-160	D-151	HNP-51	500-600	212.00
RD-152	ST-161	D-151	JAP-60	500-600	164.00
RD-153	ST-162	D-151	JHP-52	500-600	151.00

TYPE "RA"

RA-124	ST-134	A-121	JCP-40	6-8	$ 76.45
RA-151	ST-136	A-151	HNP-51	500-600	177.40
RA-153	ST-138	A-151	JAP-60	500-600	128.90
RA-154	ST-139	A-151	JHP-52	500-600	115.90

JENSEN BASS REFLEX* CABINETS



TYPE "D"

MODEL NO.	STOCK NO.	SPEAKER SIZE	DIMENSIONS			LIST PRICE
			HEIGHT	WIDTH	DEPTH	
D-121	ST-156	12"	27⅞"	31⅜"	13⅜"	$75.00
D-151	ST-157	15"	27⅞"	31⅜"	13⅜"	75.00

TYPE "A" (Finished)

A- 81	ST-123	8"	24"	18"	9¼"	$24.55
A-121	ST-124	12"	27"	24¾"	13½"	34.05
A-151	ST-125	15"	32⅜"	27⅜"	13½"	42.15

TYPE "A" (Unfinished)

A- 82	ST-145	8"	24"	18"	9¼"	$24.55
A-122	ST-146	12"	27"	24¾"	13½"	34.05
A-152	ST-147	15"	32⅜"	27⅜"	13½"	42.15

Designers and Manufacturers of Fine Acoustic Equipment

JENSEN MANUFACTURING COMPANY
6617 SOUTH LARAMIE AVE., CHICAGO 38, U. S. A.
IN CANADA: Copper Wire Products Ltd., 11 King St. W., Toronto, Ont.
*Trade Mark Registered

Jensen
SPEAKERS
WITH ALNICO 5

War Surplus Equipment!..

AT A FRACTION OF THEIR ORIGINAL GOVERNMENT COST

SUN'S GREATEST OFFER!

WHILE THEY LAST!

CHECK THESE VALUES

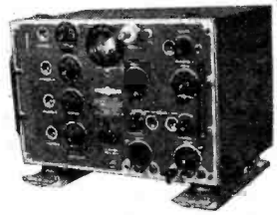
SUPERHETERODYNE RECEIVER

This crystal fixed frequency receiver comes with full conversion instructions for variable tuning of all ham bands and broadcast. A highly selective superheterodyne receiver, 110 V. A.C. power supply built in. Using the following tubes: 6K7-RF Amplifier; 6K8-Mixer and Oscillator; 6K7-I.F. Amplifier; 6F7-Detector and A.V.C.; 6C8-Output and Noise Suppressor; 80-Rectifier. Dimensions 3½x19x11½ inches. Comes complete, Brand New, with one set of coils and two sets of tubes..... **$16.95**

Extra set of coils..... **$2.95**

BENDIX TRANSMITTER

$49.95



Three 807 tubes; Four 12SK7; One 2-inch 5 amp. RF meter; Four Separate Master oscillators. (These can be easily changed to cover 20-40-80 meters and by using crystal for the 10 meter band you will have a complete coverage transmitter.) Four Separate output tanks; One 4 Position selector channel switch having seven sections which changes the ECO, IPA and output tanks simultaneously. All the controls are mounted on the front panel. The housing is cast aluminum; shields and case are sheet aluminum. Dimensions 11x12x15 inches, weighing 35¼ lbs. Complete, simple instructions for conversion furnished.

BRAND-NEW — Complete with tubes..... **$49.95**

R.F. TUNING UNITS

Beautiful black crackled aluminum cabinet with two variable transmitting condensers and two vernier dials, one heavy duty ceramic four position wafer switch, mica condensers, 2,500 working volts and coils wound on porcelain ribbed forms. Available TU5B (1500-3000kc), TU7S (4500-6200), TU8B (6200-7700kc), TU9B (7700-10,000kc) and TU10B (10,000-12,500kc). Please specify model..... **$3.89**

AUTOMATIC RECORD PLAYER

Including Webster No. 50 changer, three tube amplifier, 5" Alinco V speaker in a deluxe leatherette case.

List..... **$57.50**

YOUR cost..... **$36.75**

Lots of six..... **$34.50**

INTER-COM AMPLIFIER

Comes completely wired in aluminum cabinet with following: 2—12A6, 2—12J5 tubes, 1 bathtub condenser, 3 can filters, 12 precision resistors, 4 low loss octal sockets, shielded input and output transformers, 2 shielded R.F. chokes, 1 S.P.S.T. toggle, 28v D.C. dynamotor. Sun Radio furnishes the instructians for easy conversion to Hi-Fidelity phono or speech amplifier..... **$8.95**

BRAND NEW RADIO TUBES

SAVE UP TO 80% AT SUN RADIO ON

ALL STANDARD BRAND TUBES

No.	Price	No.	Price	No.	Price
0Z4	$1.32	6B7	$1.00	12C8	$1.59
1A5GT	.90	6B8	1.50	12F5GT	.81
1A7GT	1.08	6BA6	1.08	12H6	.90
1B4P	1.08	6BE6	1.08	12J5GT	.81
1B5/25S	1.08	6BF6	.90	12J7GT	.90
1C5GT	1.08	6C5	.90	12K7GT	.81
1C6	1.08	6C6	.80	12K8	1.32
1E5GP	1.32	6C7	.57	12SA7GT	1.00
1E7G	1.92	6D6	.80	12SC7	1.00
1F5G	1.08	6D7	1.08	12SF5	.90
1F6	1.32	6D8G	1.32	12SF7	1.08
1G4GT	1.08	6E5	.90	12SG7	1.00
1G5G	1.08	6F5	.90	12SH7	1.08
1G6GT	1.32	6F6	.90	12SJ7GT	.90
1H4G	.81	6F7	1.32	12SK7GT	.90
1H5GT	.90	6F8G	1.00	12SL7GT	1.32
1H6G	1.08	6G6G	1.00	12SN7GT	1.08
1J5G	1.59	6H6	.75	12SQ7GT	.90
1J6G	1.08	6J5	.75	12SR7	.90
1LA4	1.92	6J6	1.59	12Z3	.81
1LC6	1.92	6J7	1.08	14A7/12B7	1.30
1LB4	1.92	6K6	.80	14G6	1.32
1LH4	1.92	6K7	.90	14H7	1.32
1LN5	1.92	6L5G	.90	14Q7	1.08
1N5GT	1.08	6L6G	1.50	25L6GT	.90
1Q5GT	1.32	6L7	1.32	25Z6GT	.81
1R5	1.25	6N7	1.32	26	.63
1S4	1.25	6Q7	1.08	27	.57
1S5	1.25	6R7	1.32	30	.81
1T4	1.25	6SA7	.80	31	.81
1T5GT	1.32	6SA7GT	.90	32L7GT	1.59
1V	.81	6SB7-Y	1.59	35	.81
2A6	.81	6SC7	1.00	35L6GT	.81
2B7	.75	6SF5	.70	35W4	.69
2E5	1.08	6SF7	1.08	35Z3	1.08
3A8GT	1.59	6SG7	1.08	35Z4GT	.66
3Q5GT	1.32	6SH7	.90	35Z5GT	.69
3S4	1.25	6SJ7GT	.75	36	.81
5T4	1.50	6SK7	.80	37	.69
5U4G	.81	6SL7GT	1.10	38	.90
5V4G	1.32	6SN7GT	.90	39/44	.75
5W4	.90	6SQ7	.80	41	.69
5X4G	.90	6SR7	.80	45	.66
5Y3GT	.57	6SS7	.80	45Z3	.90
5Y4G	.63	6U5/6G5	1.08	46	.90
5Z3	.90	6U7G	.81	50A5	1.50
5Z4	1.80	6V6	1.35	50B5	1.08
6A4	1.32	6W7G	1.10	50L6GT	.90
6A6	1.25	6X5GT	.81	55	.50
6A8	1.08	6Y6G	1.10	56	.66
6AB5/6N51	1.32	6Y7	1.08	59	1.32
6Ab7/1853	1.50	6V7G	1.08	75	.69
6AC5GT	.90	6ZY5G	1.00	76	.75
6AC7/1852	1.50	7A4	1.00	77	.75
6AD6G	1.32	7A5	1.00	78	.75
6AD7G	1.32	7A7	1.00	79	.44
6AE8GT	1.08	7C7	1.08	80	.57
6AE6G	1.08	7E6	1.08	85	.75
6AF6G	1.32	7E7	1.32	89	.50
6AG5	1.92	7F7	1.32	117L7GT/	
6AG7	1.92	7H7	1.30	117M7GT	1.92
6AK6	1.32	7J7	1.59	117Z3	1.08
6AL5	1.08	7K7	1.32	117Z6GT	1.32
6AQ5	1.08	7Q7	1.08	XXb	1.32
6AQ6	1.08	7Y4	1.08	XXFM	1.32
6AT6	.90	12A5	.90	VR-90/30	1.92
6AU6	1.08	12A6	1.32	VR-105/30	1.92
6B4G	1.30	128GT	.81	VR-150/30	1.92
6B6G	.90	12AH7GT	1.32	1B2B	1.92
		12AT6	.90	485	1.92
		12BA6	1.08	1619	1.50
		12BE6	1.08	2051	1.00

BC-684 F.M. 35 WATT TRANSMITTER

Brand new, complete with eight tubes, crystal control, 10 channel pushbutton, nonlenier modulation coil . . . less coverplate, crystal and power supply.... **$17.95**

NAVY V.H.F. RADIO TRANSMITTER

Brand New

Battery operated (67½ V.B. and 1½ V.A.). Frequency 80 to 105 M.C. Complete with 2—1G4 tubes and full instruction manual..... **$6.95**

NAVY SPEAKER

Stromberg Carlson and RCA waterproof speakers. Brand New in original cartons. 25 Watt PM driver unit with line matching transformer and projector mounted in heavy duty round metal baffle. Ideal for communication receivers and sound systems at lowest price ever offered.

$14.95

● **All items F.O.B. Washington, D. C. Orders $30.00 or less, cash with order. Above $30.00, 25 percent with order, balance C.O.D.**

SUN RADIO

OF WASHINGTON, D. C.

938 F STREET, N.W. WASH. 4, D. C.

Prepare NOW for a Better Job in RADIO ENGINEERING

Don't Delay—
Write Today!

In This New World of Electronics Better Training Means Better Opportunities!

TODAY, the new war-developed techniques offer greater opportunities than ever existed in the early days of broadcasting! Micro-Wave Relay Systems, Television, FM Broadcasting, Mobile Communication Systems for Trains, Automobiles, Busses, Trucks, many Industrial Applications—these are just a few of the new techniques which offer marvelous, exciting opportunities to you who are alert—and are qualified!

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CLEVELAND INSTITUTE COURSES OFFER COMPLETE *TECHNICAL TRAINING* RANGING FROM LOW-LEVEL TO COLLEGE-LEVEL.

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Covers complete preparation for broadcast station employment including preparation for FCC License Examinations.

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Including post-war Television Techniques.

All Courses Include

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If you need only highly specialized training, you can study one or more of the following sections instead of a complete course.

1. Mathematics of Radio.
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3. Essentials of Radio Communication.
4. Communication Networks.
5. Advanced Radio Telephony for the Broadcast Operator.
6. Audio and Radio Components and Systems (Design of Receiver and Transmitter Equipment)

CLEVELAND INSTITUTE OF RADIO ELECTRONICS

Contractors to the Canadian Broadcasting Corporation

RN-5 Terminal Tower
CLEVELAND 13, OHIO

Approved for Training under "G-I Bill of Rights"

(MAIL THIS COUPON)

Cleveland Institute of Radio Electronics, RN-5, Terminal Tower, Cleveland 13, Ohio.
Gentlemen: Please send information about your home courses in Radio Electronics.

NAME .....
ADDRESS .....
CITY .....
ZONE ..... STATE .....

I desire training in ☐ A ☐ B ☐ C
I have had experience in broadcasting ☐ servicing ☐ operating ☐ mfg. ☐ CAA ☐ Army-Navy ☐ amateur ☐ other .....
I am a High School Grad. ☐ College ☐ Degree ☐
☐ Check here for Veteran Enrollment Information.

Get your FCC Commercial Radio Operators' LICENSE NOW!

Don't Delay—
Write Today!

Approved for Veteran Training under "G-I Bill of Rights"

IT'S EASY IF YOU FOLLOW OUR PLAN!

Thousands of new jobs are opening up—FM, TELEVISION, MOBILE COMMUNICATIONS SYSTEMS, are only a few of the radio fields which require licensed operators.

TIME IS IMPORTANT TO YOU!

You can get your License quickly with NILSON'S MASTER COURSE in RADIO COMMUNICATION and exclusive CIRE Workbooks of Instructional Aids. Saves you many hours or random, undirected study.

Assures a MINIMUM of time in getting your ticket.

FREE BOOKLET tells you the Government Requirements for all classes of commercial licenses — Sent immediately upon receipt of coupon.

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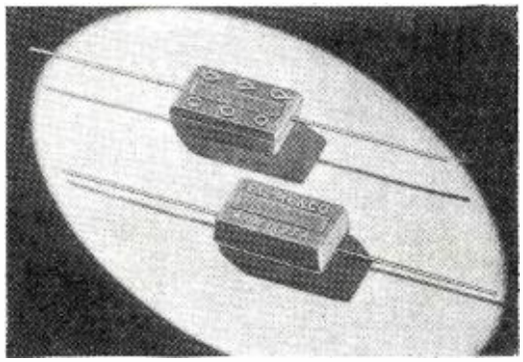
Gentlemen: Please send information about your Home Study Course for preparation for FCC Commercial License Examinations (this course does not cover amateur license examinations).

Name _____
Address _____
City _____ Zone _____ State _____
☐ If a Veteran check here

For Dependable Performance . . .

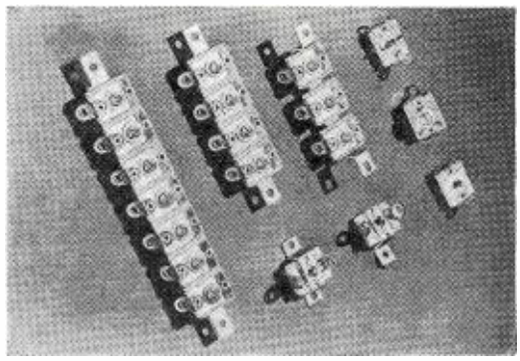
Choose Time-Tested

El-Menco CAPACITORS AND FUSED PLUGS



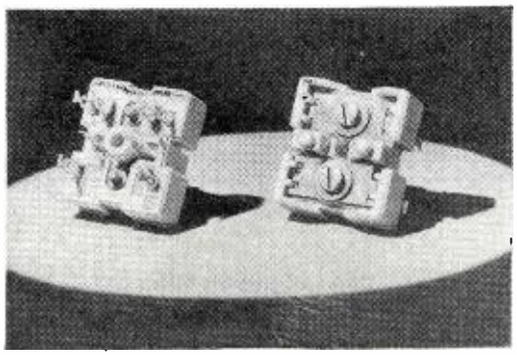
MOLDED MICA CAPACITORS

Compact, precision made, fixed mica dielectric capacitors. Made in accordance with American military standards to meet Army and Navy JAN-C-5 specifications. All impregnated and JAN-C-5 color coded.



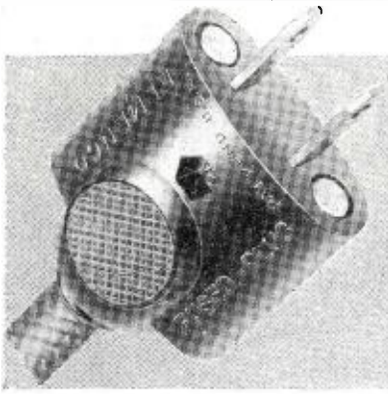
MICA TRIMMER CAPACITORS

Clear India ruby mica. Base made of low-loss ceramic materials. Treated for humidity resistance and permanence of capacity setting. Adjusting screw advances 1/64" for one complete rotation, thus insuring accurate adjustment of capacity setting.



PADDERS

Completely enclosed construction protects delicate edges of the clear India ruby mica films. Phosphor bronze adjusting plates assure permanent resilience and freedom from mechanical fatigue. All parts heavily plated to resist corrosion.



THE REVOLUTIONARY El-Menco Fused Plug

THE ONLY PLUG
THAT CARRIES ITS OWN FUSES

Provides complete protection against damage to product and main line. Contains two small fuses that are easily removed and replaced. Molded finger grips. Attaches to cord like any standard plug. Replacement fuses available in all amperages. Specify on equipment of all voltages up to 250 and currents up to 8 amperes. Approved by Underwriters Laboratories.

ALL EL-MENCO PRODUCTS *AVAILABLE*
FOR *IMMEDIATE DELIVERY FROM STOCK*

ATTENTION JOBBERS!

A few valuable territories are still open. Contact Arco Electronics for information.

ARCO ELECTRONICS Inc.

135 LIBERTY STREET NEW YORK, N. Y.

SOLE DISTRIBUTOR FOR U.S. AND CANADA

Littlefuses for Immediate Delivery 3 AG up to 8 amps. 3 AB up to 15 amps.

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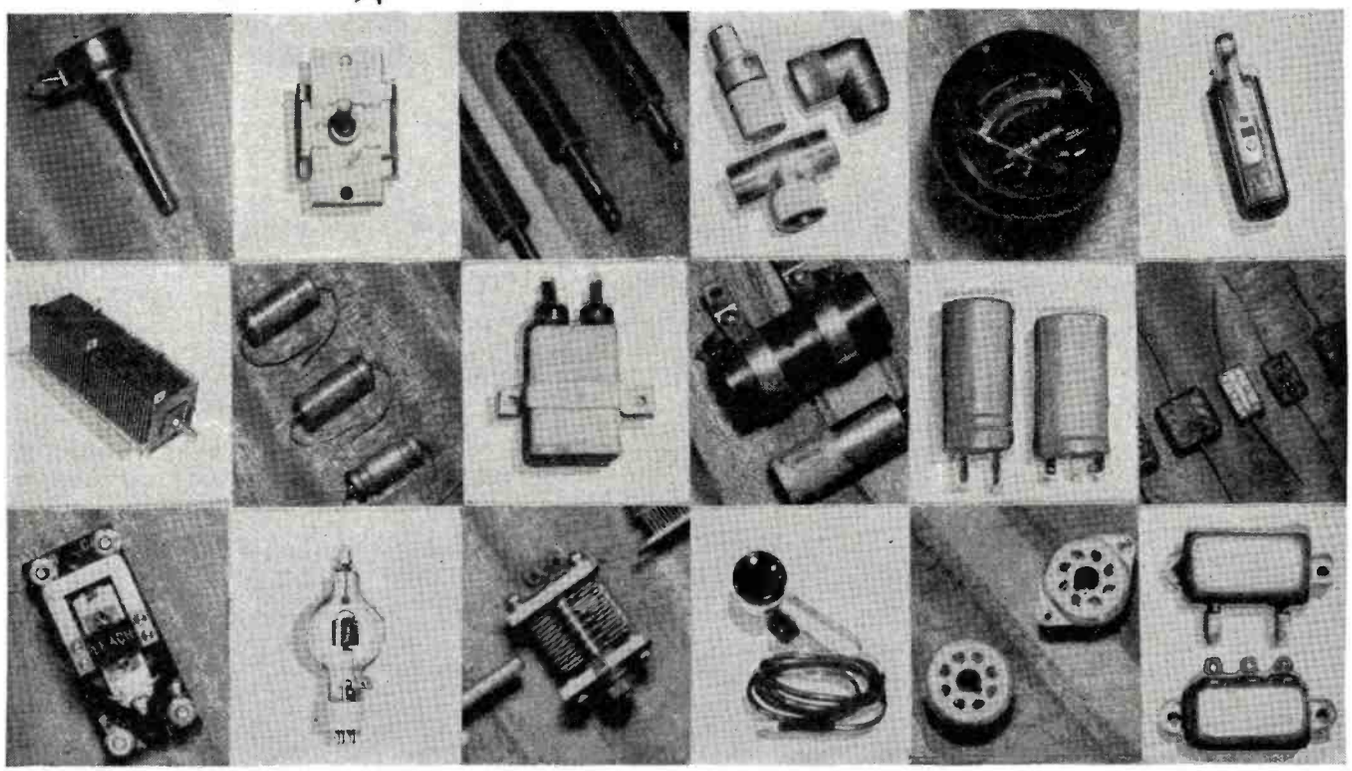

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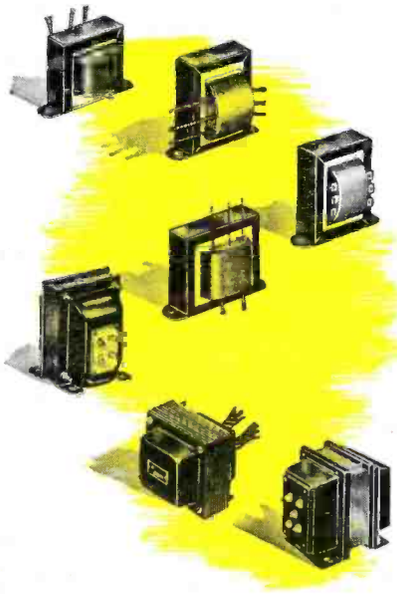

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This truck driver is receiving instructions for his next assignment. Thus the new mobile telephone service will enable commercial vehicles to operate with increased efficiency and economy. The control unit mounted conveniently under the dashboard holds the telephone handset and contains the bell and signaling light. This service makes possible calls between any regular telephone and the telephone in the vehicle.

Mobile Radio-Telephone Service Links Nation

By FRANK E. BUTLER

Mobile radiotelephone service is now being provided to subscribers. This relatively new "Bell" system provides 2030 selective signaling combinations.

THE act of "calling" or "receiving" a mobile radiotelephone call is no more complex or difficult than performing the same operation with a regular wire line telephone. Transmission standards are equal to wire line service and no tricky operating procedure or "tuning" is necessary.

This new service, which combines regular wire telephone operation with shortwave radio is remarkably clear and free from "dead spots," fading or static. This perfection is obtained by using frequency modulation to bridge the gap between the regular wire telephone channels and the specially equipped vehicles. Two bands are allocated for this service. One operates in the 152-162 megacycle band and its counterpart operates in the 30-44 megacycle band.

Complete equipment on the vehicle consists of a radio receiver and transmitter, an 18 inch stand antenna, a selective signaling device and a telephone instrument. All controls and the cradle telephone are conveniently mounted under the instrument board of the car in a single unobstructive unit. On the left of the control panel is a small lamp which lights to indicate an incoming call. A regulation bell signal is also used.

However, the bell stops ringing after a short interval but the lamp remains lighted until the driver acknowledges the call. Thus by having the lamp signal "lock in" the driver is notified that he had been called during his absence from the car.

Centered on the front panel is the main *"On-Off"* switch. With the switch in the *"On"* position, the receiver is in operating condition, ready to receive a call while the transmitter is in a standby condition. The transmitter is ready to operate when the handset is removed from the cradle, and operates when the "push-to-talk" button in the center of the handset is depressed. To the right of the switch is a lamp which indicates the power is on. The control weighs less than 8 pounds, including the handset. A retractile cord is used to prevent any fouling or tangling that might occur with a regular handset cord. The ringing bell is mounted inside the control unit.

Unique with the *Western Electric* equipment is a selective signaling device, incorporated as an integral part of the receiver. It is the "heart" of the mobile radiotelephone unit. This selector and its associated filters and relays provide full selective signaling with 2030 combinations available. Each radio channel will serve a number of mobile stations. Each mobile installation is assigned a five digit number prefixed by a channel designation of two letters. Because the number "1" is used as a selector "return to normal" pulse, the station number never includes the digit "one." The selector is designed so that the total of the five digits add up to "23." As an example: "WJ6-2834" . . . WJ, is the channel designation and 62834 the mobile radiotelephone station number.

When a call comes in to the mobile telephone traffic operator she dials the digits for this particular station. In so doing, she causes the control terminal equipment to modulate the land transmitter with a series of pulses of 600 and 1500 cycles. These pulses, received and amplified at the mobile stations, cause all selector sets assigned to the same channel to be actuated. Stop pins in the cog wheel of the selector in the receiver called will cause only that selector to be positioned to ring a bell and light a call lamp in the vehicle. All other selectors will fail to reach the final or signaling operation.

Operation of mobile telephone service is very simple. All calls are handled by special mobile service operators at a central office. It is only necessary to give central the telephone number wanted, such as . . . "WJ6-2834." This numbering, by the way,

	HIGHWAY	URBAN
1. Frequency range		
(Transmitting)	42-44 mc.	152-162 mc.
(Receiving)	30-40 mc.	152-162 mc.
2. Max. frequency tolerance (−20 to + 55 deg. C.)	.01%	.005%
3. Type of modulation	Phase	Phase
4. Predistortion (FM characteristic)	6 db./octave	6 db./octave
5. 100% modulation swing	± 12kc., (± 7.4 radians)	± 15kc., (± 10 radians)
6. Audio band transmitted	300-3000 c.p.s.	300-3000 c.p.s.
7. Max. radio bandwidth	40 kc.	60 kc.
8. Output power	20-40 watts	15-35 watts
9. Max. transmitter spurious radiation	70 db. below carrier	70 db. below carrier
10. Max. residual transmitter noise modulation	The measured residual transmitter noise should be 47 db. below the level of a 1000 c.p.s. sine wave tone which modulates the transmitter the full radian swing. The noise should be measured in a manner which takes into account its interfering effect on a telephone circuit.	
11. Receiver sensitivity limiter effectiveness	30 db.	30 db.
Signal input for complete limiting	5 μv.	5 μv.
12. Receiver acceptance band	± 10 to ± 15 kc.	± 20 to ± 25 kc.
13. Receiver suppression	85 db. adjacent to midchannel	85 db. adjacent to midchannel
14. Receiver spurious response	−70 db.	−70 db.
15. Max. squelch sensitivity (adj. inside equipment over 25 db. range)	1 μv.	1 μv.
16. Receiver noise figure	12 db.	8 db.
17. Max. residual receiver noise	The measured residual receiver noise (car engine operating) should be at least 50 db. below the level of a 1000 c.p.s. sine wave tone which modulates the test radio frequency signal the full radian swing.	
18. Radio receiver de-emphasis (FM characteristic)	6 db./octave	6 db./octave
19. Receiver output power (250 mw. required for operation of selector set—10 mw. for handset)	250 mw.	250 mw.
20. Audio characteristics with 100% modulation of transmitters or receivers	1000 c.p.s. reference; 250 c.p.s. 0 to −4 db.; 500 to 2000 c.p.s. 0 to −3 db.; 2000 to 3200 c.p.s. 0 to −4 db. Characteristics specified in terms of departure from the ideal 6 db./octave transmitter pre-emphasis or receiver de-emphasis.	
21. Selective signaling	The selector set must respond to the two-tone audio frequency signaling code transmitted by the land station. The transmitted code consists of a series of pulses of two tones, 600 and 1500 c.p.s. which are transmitted alternately at a uniform rate of 8 to 11 per second. The tones are transmitted successively without interruption, and all pulses are of equal length (.09 to .125 sec.). The local signal circuits associated with the selector set should provide a bell of suitable audibility and a lock-in lamp signal. The bell circuit should be arranged to remain operated (bell ringing) as long as the selector contact is closed. The lamp circuit should operate when the selector contact closes and remain operated (lamp lighted) until the local circuit is restored by the operation of a release button or contact.	
22. Transmitter warmup	Full operation within 300 milliseconds after push-to-talk button is depressed.	
23. Nominal battery voltages	6-12 volts	6-12 volts
24. Ambient temperature	Satisfactory operation with ambient temperatures ranging between −40 and +65 degrees C.	
25. Voice frequency control unit	Bell System installations should include push-to-talk handset, equipped with a carbon-button type transmitter unit and a telephone type receiver unit having a 5 foot conductor cord. The frequency characteristics of the handset should be such as to utilize efficiently the voice frequency band specified above.	

Table 1. Technical characteristics of mobile equipment recommended for Bell System general mobile radiotelephone service.

does not conflict with any existing central code of the entire wire telephone system.

The mobile operator then checks channel "WJ" to determine whether it is in use. If the channel is idle the mobile service operator inserts a dial cord and dials "62834." The mobile station bell rings and the driver answers and talks. The mobile service cord circuit supervisory lamp is extinguished. The operator starts timing the ticket covering that particular call.

At the termination of the call, the supervisory lamp at the switchboard lights. The mobile service operator releases the channel and enters the time of the call on the ticket. The channel is now ready for the next call.

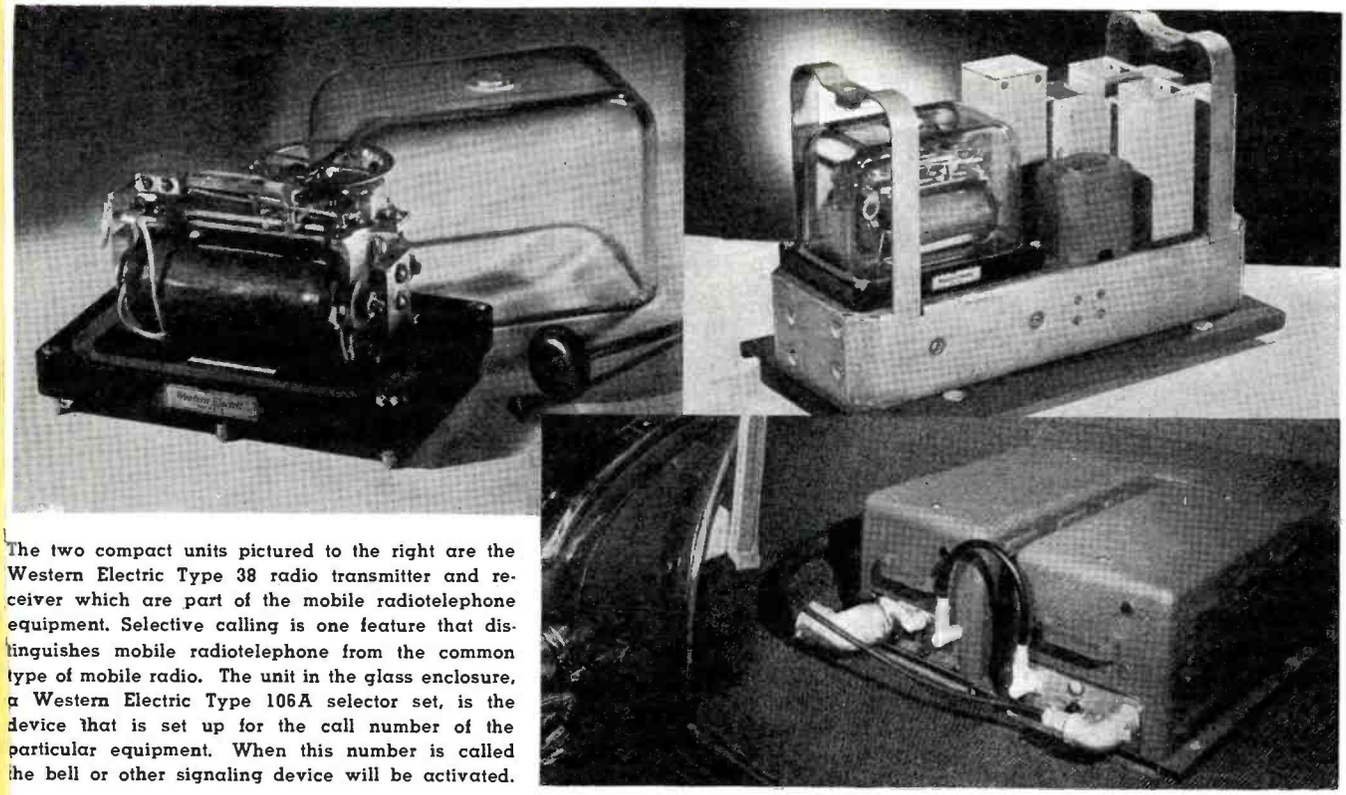
A call from the automobile to a wire-line subscriber is just as easily completed. The driver removes the handset from the control unit and "monitors," i.e., listens to check that the channel is not in use. This consumes about three seconds of time. If the channel is idle, the driver presses the "push-to-talk" button on the handset. The line lamp at the mobile service switchboard position lights. The mobile service operator answers, and asks for called number. The mobile service operator completes the call in the same manner as for wire line subscribers. As before, the cord supervisory lamp gives a continuous indication of the progress of the call.

The receiver and transmitter are housed in separate cases which can be easily carried in the luggage compartment of a passenger automobile. The transmitter with its 20 watt output is capable of providing reliable service in the area served, which is approximately 25 to 30 miles. A special dynamotor powered by 6 or 12 volts, depending on the vehicle in which the radiotelephone is installed, is used to operate the equipment.

Quartz plate crystal control of the transmitter frequency is provided, with a thermostatically controlled, constant temperature oven enclosing the quartz plate. Temperature control insures operation of the transmitter on its proper frequency.

The radio frequency carrier is modulated by a phase modulation circuit, resulting in excellent voice quality transmission with an extremely low noise level. Maximum deviation plus frequency tolerance of the carrier under speech modulation is normally a swing of plus or minus 15 kilocycles. The modulation circuit requires no adjustment, and only one vacuum tube is used.

Spurious radiation, that is, radiation of signals on other than the assigned frequency, is well below what is normally expected with mobile transmitters. An unusual double tuned circuit in the first doubler stage accounts for the absence of undesirable radiation.



The two compact units pictured to the right are the Western Electric Type 38 radio transmitter and receiver which are part of the mobile radiotelephone equipment. Selective calling is one feature that distinguishes mobile radiotelephone from the common type of mobile radio. The unit in the glass enclosure, a Western Electric Type 106A selector set, is the device that is set up for the call number of the particular equipment. When this number is called the bell or other signaling device will be activated.

The receiver is a sensitive, triple detection superheterodyne type. It is fixed tuned, with quartz plate control for both conversion oscillators. Triple detection is a modification of the usual superheterodyne, and incorporates two converters and two intermediate frequencies. The great advantage of triple detection lies in its effective image suppression with no loss in selectivity. Images in superheterodyne receivers are spurious responses to signals separated from the frequency to which the receiver is tuned by twice the intermediate frequency. Further image rejection, along with added sensitivity, is gained by having a tuned radio frequency amplifier ahead of the first converter stage.

A non-synchronous vibrator is used in the power supply circuit. The advantage gained by using this type of vibrator is that no concern need be given as to whether the positive or negative side of the vehicle battery is grounded.

The intermediate frequency stages are designed to have bandpass characteristics that provide an unusual degree of selectivity. The audio frequency response of the receiver is flat in the voice frequency range with the resultant faithful reproduction of the speaker's voice. With less than 1 microvolt input to the receiver the signal-to-noise ratio is about plus 25 db. During the period when the voice circuit is in use, negative feedback is introduced, further providing for a high degree of distortionless reception. The selective signaling device incorporated in the receiver requires slightly more output power than is available when the feedback circuit is operative. Consequently when the handset is not in use, i.e., when it is in the cradle, the feedback circuit is disconnected, thus providing additional power to operate the selector.

A frequency modulation type of squelch is used to make the audio circuit operative whenever a usable signal is received. An outstanding feature of the squelch circuit is that selected noise is amplified to bias the audio circuit to cut-off, reducing the possibility of anything but the desired radio frequency carrier opening the squelch and making the audio circuit operative. Such an arrangement greatly reduces the possibility of false operation of the selective signaling equipment by noise.

Two types of radiotelephone service are currently in service and supply both urban and highway service. Urban mobile radiotelephone service extends telephone service, not only to motor vehicles but to other mobile units, such as harbor craft, operating in a city or metropolitan area, the extent of coverage being determined by the needs of the subscribers.

A system of this kind requires a fixed plant comprising one or more land radio transmitters at locations which are favorable from the standpoint of radio transmission coverage, and a number of strategically located land radio receivers, all connected by wire lines to a centrally located control terminal and the telephone switchboard. Completing the system are the mobile radio transmitters, receivers, and signaling units of the motor vehicles and water craft equipped for radiotelephone communication with the land equipment.

In most cities, a single land radio transmitter for each frequency channel will suffice. Some of the larger cities may require two. Experience has indicated that little if any trouble will be experienced as a result of interference where more than one land transmitter is operated on the same frequency.

Radio frequencies allocated to urban radiotelephone service by the Federal Communications Commission are in the 152 to 162 megacycle band (See Table 1). At these frequencies radio waves are propagated over substantially line-of-sight paths between the transmitter and receiver. Therefore, the location of the land transmitter and receiver antennas greatly affects the coverage obtained. The antennas ordinarily will be the simple vertical half-wave coaxial type, the supporting structure being determined in each case by the height required and local mounting conditions. The vehicle or water craft antenna will be a simple quarter-wave vertical whip in most cases.

Vehicle transmitters are limited to relatively low power because of space and primary power available. Antenna heights are also restricted, so the range of transmission from the vehicle transmitter may be considerably less than that from the land transmitter. This makes it necessary to provide additional land station receivers at strategic locations.

High power is required in the land transmitter because of the antenna and power supply restrictions of the vehicle receiver and because of the presence of local radio-frequency noise. More than one land transmitter per channel may be necessary for a large area or for an area in which

(*Continued on page* 108)

Simple Two-Tube HAM SUPER

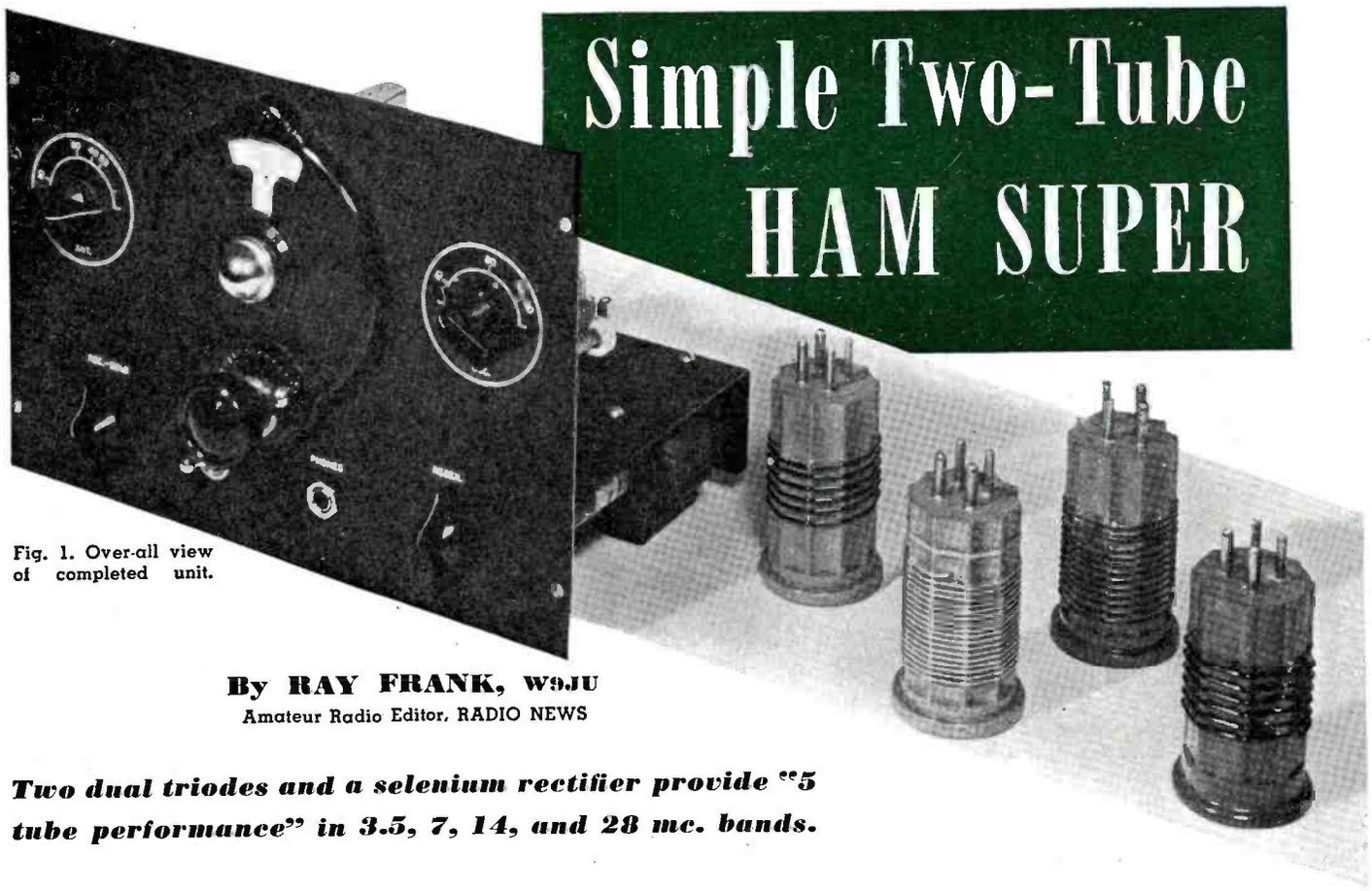


Fig. 1. Over-all view of completed unit.

By RAY FRANK, W9JU
Amateur Radio Editor, RADIO NEWS

Two dual triodes and a selenium rectifier provide "5 tube performance" in 3.5, 7, 14, and 28 mc. bands.

FREQUENTLY the embryo ham is confronted by the high cost of a complete station with all its accessories. Too often, when the transmitter has been built or purchased, the funds then available for a satisfactory receiver are found to be insufficient. The usual result is that the remaining funds are invested in a receiver that will not meet future requirements.

It was with this thought in mind that the receiver described in this article was designed. The complete cost is low, and when more funds are available, it may be discarded or kept as a standby unit. In addition, its compact size lends itself well to portable work.

While the performance of this receiver cannot equal that of the regular communications jobs, ease in handling, plus sufficient selectivity to work under difficult conditions is attained. To keep the parts to a minimum, it was decided to dispense with the usual output stage, and confine the output to a level adequate for headphone use.

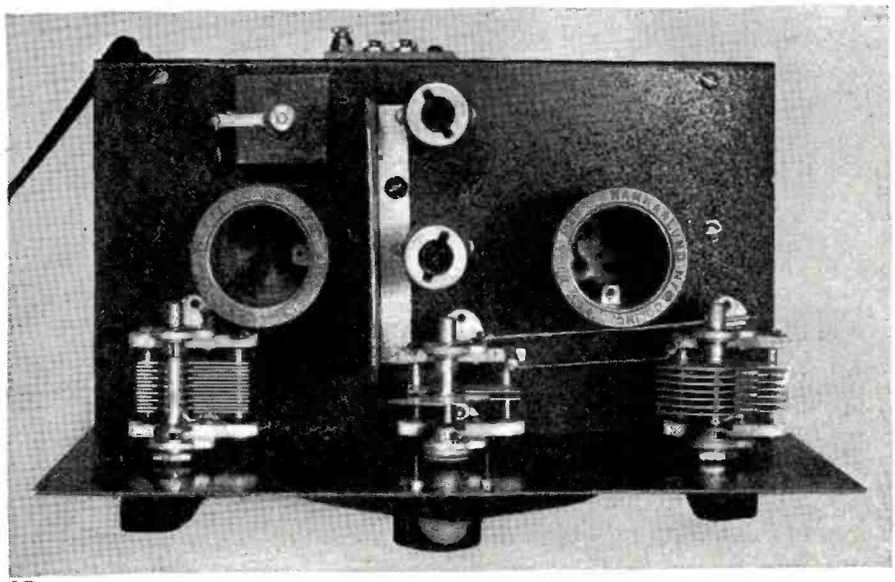
In order to have usable selectivity, it is almost essential that any ham receiver be of the superheterodyne type. In these days of parts shortages this often entails considerable searching to locate the desired components. By the use of a regenerative second detector, however, it is possible to realize considerable gain. The use of a high frequency i.f. system insures adequate freedom from images.

As finally adopted, the lineup is as follows: 6J6 oscillator and first detector, with another 6J6 serving the dual purpose of a regenerative detector and audio amplifier. These tubes were chosen because of their small size, excellent performance, and availability on the surplus market. Pulling between the oscillator and first detector, so common in a receiver of this type, is practically absent, due to the low interelectrode capacities of the tube, and the low amount of oscillator injection needed to give satisfactory conversion.

The i.f. circuit consists of L_4 and a feedback winding L_5. One section of the second 6J6 is used as a regenerative detector. The resistor, R_6, controls the amount of feedback by adjusting the plate voltage on the detector section of this 6J6.

For maximum convenience a built-in power supply was included. This power supply consists of a selenium rectifier and a simple *RC* filter. Heater power for the tubes is supplied by a 1 ampere, 6.3 volt filament transformer rather than a dropping resistor. The heater current of 6J6's is .45 amperes each and the heat dissipated in a dropping resistor to carry this current would be considerable.

Fig. 2. Top view of receiver. Rectifier is shown mounted to rear of L_1, L_2.



One of the bugaboos of transformerless power supplies is the danger to the operator when a metal chassis is used. To eliminate the possibility of shock, the variable condensers and the phone jack are insulated from the panel by means of fiber washers. All ground returns are made to a piece of tinned copper bus, insulated from the chassis. This bus is bypassed to the chassis by means of an .05 μfd. condenser. This permits connection of the chassis to a direct ground with no danger to the user.

The entire receiver is built on a 5″x9½″x1½″ black crackle finished chassis. A 7″x10″ front panel is used. The lower edge of the chassis is mounted ½″ above the lower edge of the panel to give greater clearance for the various knobs.

Coils L_4 and L_5 are wound on a ¾″ diameter bakelite form. L_4 consists of 55 turns of No. 30 enameled wire closewound, while L_5 is 10 turns of No. 36 single-silk covered, wound at the "cold" end of L_5. It is essential that proper polarity of L_5 be observed or the i.f. will not oscillate. If this winding is reversed, it will be necessary to reverse the leads.

Tube shields should be used on both tubes, mainly to eliminate microphonics. A small shield formed of scrap aluminum measuring 3½″ wide x3½″ high is used to separate the oscillator and mixer portions of the receiver.

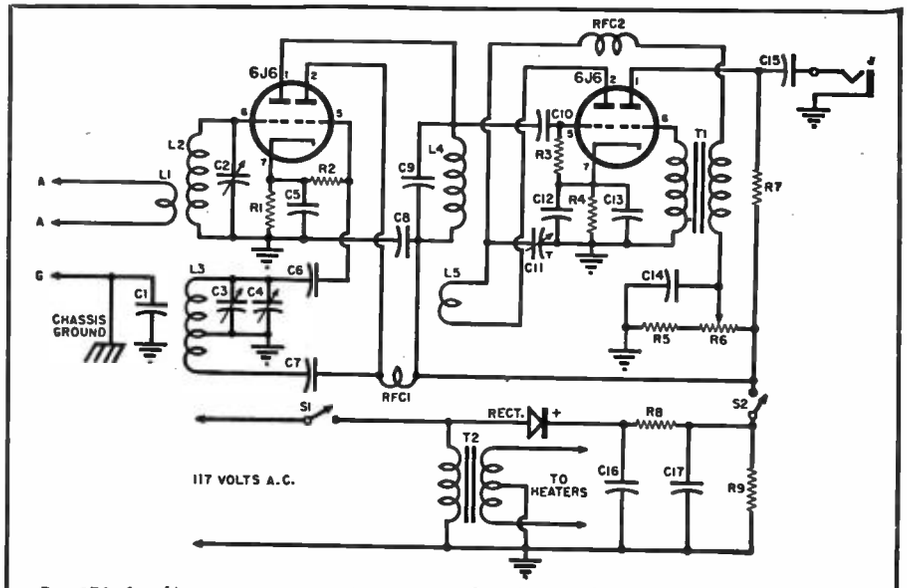
The controls as seen from the front are, upper left hand knob C_2, center dial, bandspread tuning C_4 upper right hand knob, band set condenser C_3. Along the lower edge are mounted the send-receive switch S_2, the on-off switch S_1, the phone jack, and the regeneration control R_6.

The selenium rectifier is mounted on the antenna section of the chassis just to the rear of the antenna coil. This insures adequate ventilation for the rectifier. Parts below the chassis are mounted wherever convenient.

When construction has been completed, the receiver should be turned on and allowed to thoroughly warm up. The antenna coil should be removed and a 1 megohm resistor connected across the terminals of C_2. A signal generator or other source of modulated signal should be applied across this resistor and the frequency of the signal source varied until the signal is heard in the headphones. This frequency should lie somewhere in the range of 1500 to 1700 kc. The exact frequency is not important as long as it is in an interference free spot. It is easy to change the frequency by changing the value of C_9. In the particular unit constructed here, C_9 consisted of a 200 μμfd., 5 per-cent mica condenser shunted by a 25 μμfd. mica. This gave an i.f. frequency of 1630 kc.

With the regeneration control R_6 full on, the trimmer condenser C_{11} should be adjusted so that the i.f. just goes into oscillation at the maximum

(*Continued on page 98*)



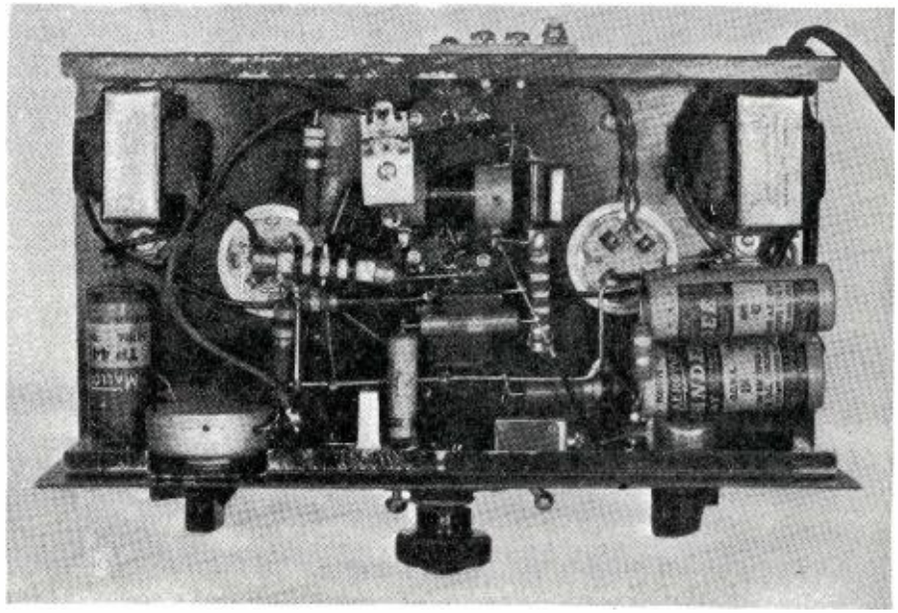
R_1—270 ohm, ½ w. res.
R_2—33,000 ohm, ½ w. res.
R_3—1 megohm, ½ w. res.
R_4—47 ohm, ½ w. res.
R_5, R_9—50,000 ohm, 1 w. res.
R_6—50,000 ohm, w.w. pot.
R_7—25,000 ohm, ½ w. res.
R_8—2700 ohm, 1 w. res.
C_1—.05 μfd., 200 v. paper cond.
C_2, C_3—100 μμfd. midget var. cond.
C_4—20 μμfd. midget var. cond.
C_5, C_7, C_8, C_{12}—.002 μfd. mica cond.
C_6—50 μμfd. mica cond.
C_9—.0002 μfd. mica cond. (See text)
C_{10}—100 μμfd. mica cond.
C_{11}—3-30 μμfd. compression type padder cond.
C_{13}—10μfd., 25 v. elec. cond.
C_{14}—.5 μfd., 200 v. paper cond.
C_{15}—.02 μfd., 200 v. paper cond.
C_{16}, C_{17}—40 μfd., 150 v. elec. cond.
L_1, L_2, L_3—See Table 1
L_4, L_5—See text
RFC_1, RFC_2—2.5 mh. r.f. choke
T_1—3:1 audio interstage trans.
T_2—Fil. trans., 6.3 v. @ 1 amp.
S_1—S.p.s.t. toggle sw.
S_2—S.p.s.t. rotary sw.
J—Open circuit jack
Rect.—100 ma. selenium rectifier
2—6J6 tubes

Fig. 3. Complete circuit diagram and parts list for simple two tube "ham-super."

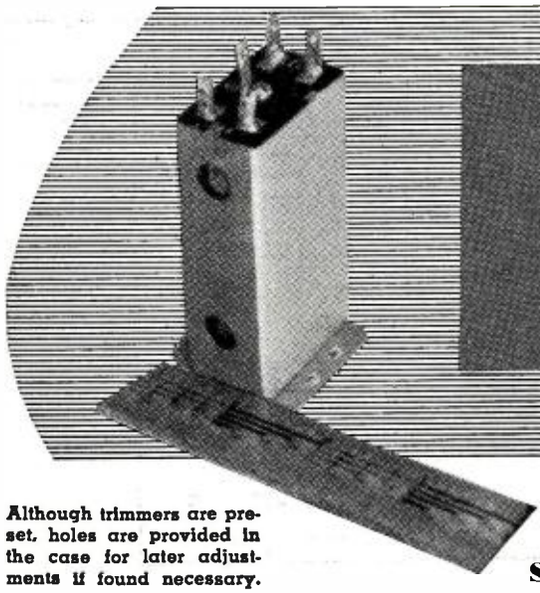
Antenna Coil		Oscillator Coil
	3.5 mc.	
L_2—37 t., #22 e., 1½″ long. L_1—11 t., #30 s.c., ¼″ from cold end.		L_3—26 t., #20 e., 1⅜″ long. Tap at 6th turn from bottom.
	7 mc.	
L_2—17 t., #20 e., 1½″ long. L_1—6 t., #30 s.c., ¼″ from cold end.		L_3—13 t., #20 e., 1½″ long. Tap at 3½ turns from bottom.
	14 & 28 mc.	
L_2—6 t., #16 e., 1″ long. L_1—2 t., #30 s.c., ⅛″ from cold end.		L_3—6 t., #16 e., 1″ long. Tap at 2 turns from bottom.
	All coils wound on 1½″ diameter forms.	

Table 1. Detailed specifications for constructing antenna and oscillator coils.

Fig. 4. Bottom view showing location of component parts. The i.f. coil, L_4, L_5 may be seen in center of the chassis. C_{11} is mounted directly above i.f. coil.



A Simple FM CONVERTER



Although trimmers are preset, holes are provided in the case for later adjustments if found necessary.

By
STANLEY N. FINLEY

There are many FM stations now operating on the new 88-108 mc. band. This unit permits old band 40-50 mc. receivers to tune in the new FM band.

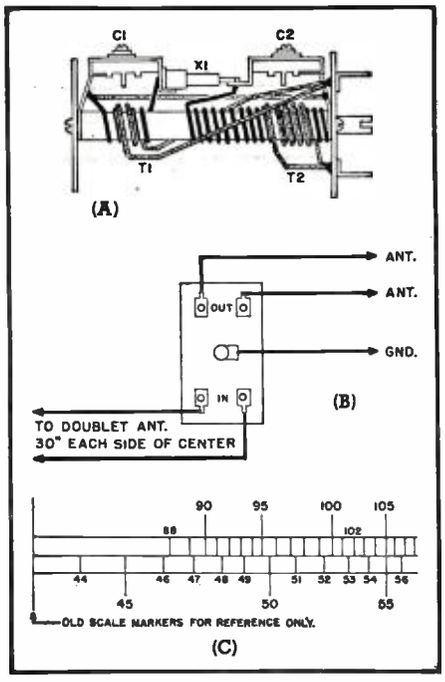


Fig. 1.

Receiver I.F.	Old band Tuning Range In which New Band Falls
5.0 mc.	46.5 mc. to 56.5 mc.
4.3 mc.	46.15 mc. to 56.15 mc.
3.0 mc.	45.5 mc. to 55.5 mc.

Table I.

THERE are many ways of converting FM receivers for operation in the new 88-108 mc. band. The simplest method yet devised is the conversion of the set into a double superheterodyne by the addition of a unit which requires only the connection of a suitable antenna to its input connections and then it is connected to your present old-band (40-50 mc.) FM receiver. It is then effectively in series with the doublet antenna lead-in.

The unit may be used without making any changes or adjustments in the present receiver but this limits the range to just the first half of the new band for some receivers. The intermediate frequency of the present set and its present range are factors in determining how much of the band can be tuned with the converter pictured in the photographs. Table 1 shows the range in which the new band falls on typical old band receivers, when using the crystal diode FM converter. For any other i.f. in an FM receiver the range can be determined from the formula:

$$88 - \frac{(88\text{-i.f.})}{2} = \text{low end}$$

$$108 - \frac{(108\text{-i.f.})}{2} = \text{high end}$$

The stations in the old band will be received through the converter as usual.

To make the present tuner operate with the crystal diode FM converter over the *entire* new band is a very simple operation. Merely shift the tuning range upward by adjusting all capacitors used as trimmers on the tuning condensers in the direction of less capacity. This raises the minimum frequency and maximum frequency to which the dial will tune. The ranges listed in the table will cover all or nearly all the receiver types that were sold for the 40-50 mc. band. For the intermediate frequencies not listed the formula may be used to determine the range to which the set should tune to cover the entire new band.

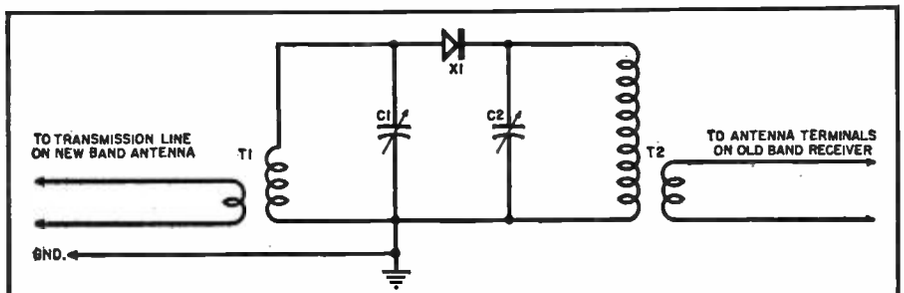
In making the shift to a higher range the oscillator trimmer is first set to minimum capacity. Then with the signal generator set to some frequency in the middle of the former range tune in the generator signal. In the absence of a generator a mid-band (old band) station may be used. This mid-band signal should now fall near the low frequency end of the dial. Final adjustment is made with the other trimmers. These are tuned for maximum output.

Recalibration of the set is simply a matter of receiving known stations and marking their frequencies on the dial or a new dial plate. A typical scale change on one of the receivers (Meissner Tuner 9-1047) is shown in Fig. 1C.

There are two trimmers on the FM converter which can be preset for best

(*Continued on page* 181)

Wiring diagram of FM converter. In using this unit with old band receivers simply connect it between the antenna and the antenna terminal posts on the receiver.



C_1, C_2—3-30 μμfd. mica compression trimmer
X_1—1N34 or 1N21B crystal diode
T_1—Input trans., Pri. 2 t. #22 e.; Sec. 5 t. #20 e.
T_2—Output trans., Pri. 5 t. #22 e.; Sec. 17 t. #20 e.

FM TUNER CONVERSION with LC Circuits

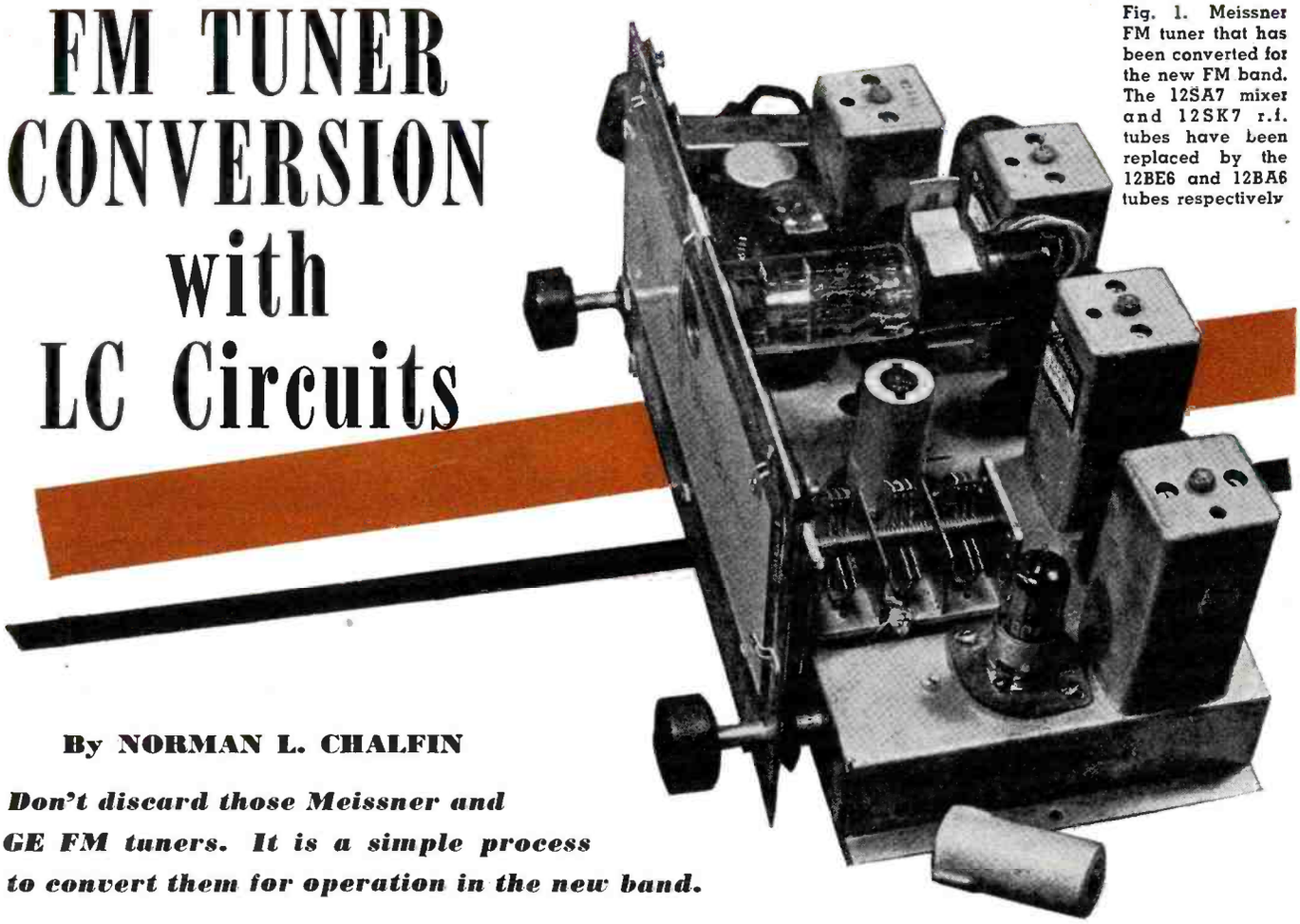


Fig. 1. Meissner FM tuner that has been converted for the new FM band. The 12SA7 mixer and 12SK7 r.f. tubes have been replaced by the 12BE6 and 12BA6 tubes respectively

By NORMAN L. CHALFIN

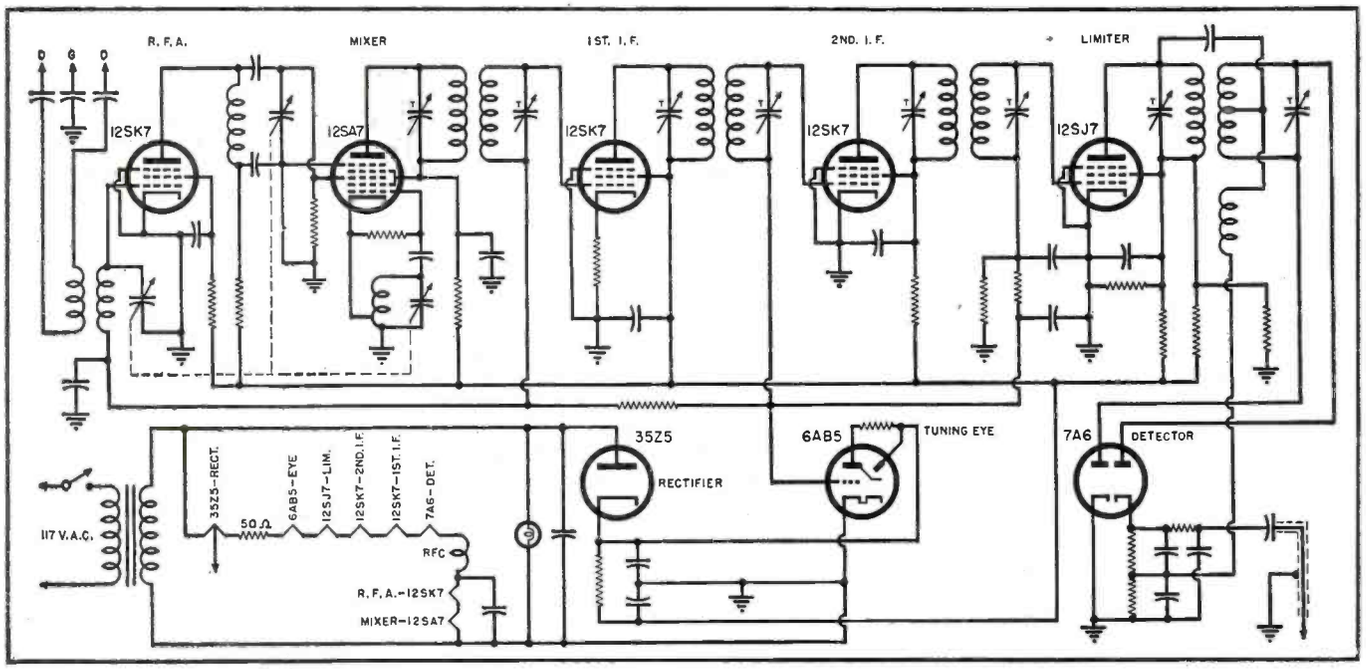
Don't discard those Meissner and GE FM tuners. It is a simple process to convert them for operation in the new band.

IT SEEMS a shame that there are so many FM tuners lying idle or are now tuning only the one or two stations still available in the 40-50 mc. band for any area. Since new converters are unavailable and new sets are slow to appear on the market in any quantity these tuners can be made serviceable by coil and other changes that will convert them for operation in the 88-108 mc. FM band. The *Meissner* 9-1047 and the *GE* JFM 90 were probably the most popular units and there are many of them around. These have been converted by the author with the changes described herein and are giving excellent service where they had previously been unused. The cost of the conversion is entirely negligible in terms of the original cost of the set.

Since the conversion of the *Meissner* unit was accomplished most easily we will describe this first:

The first operation is to strip the unit of the three coil assemblies for the r.f., oscillator, and antenna tuning.

Fig. 2. Schematic diagram of the Meissner FM tuner before it was converted for operation in the new FM band.



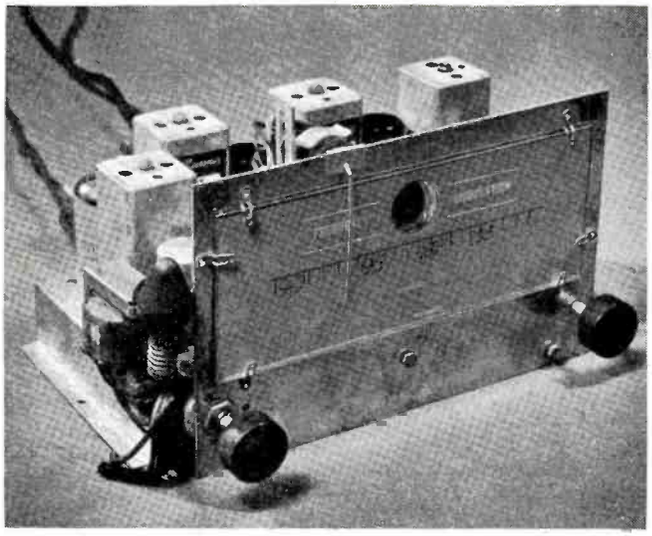


Fig. 3. Meissner tuner with the newly calibrated dial scale.

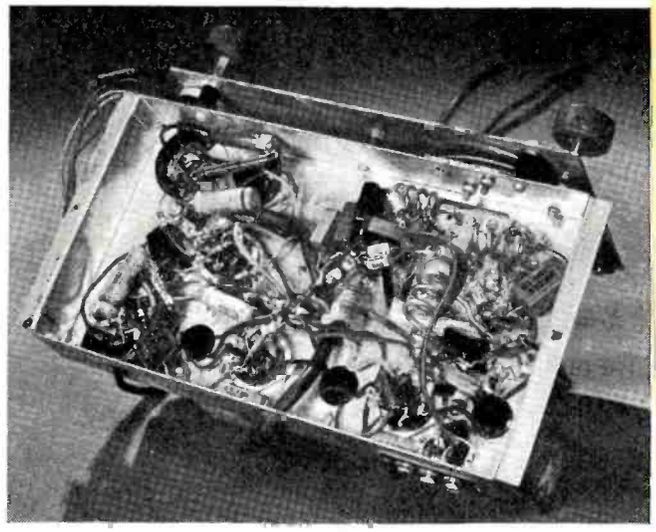


Fig. 4. Converted Meissner tuner showing coil placement.

If it is desired to retain the original tubes as in choice 1, below, make certain in this operation that all parts are left connected to their original points on the chassis and the tube sockets, removing only the coil assembly wires. Next remove the a.v.c. dropping resistance and its assembly tie points from the front wall of the chassis near the r.f. stage (12SK7). Connect the grid return end of the first i.f. transformer to ground (black wire). Remove the connections to the a.v.c. source resistances. (There is really no need for a.v.c. in this type of FM receiver since the limiter serves this function to a large extent). From this point on there are three choices from which to select a method of conversion. These are:

1. Use the existing tubes; 12SA7 mixer, 12SK7 r.f. or 6SK7, and 6SA7.

2. Change to the newer types with more transconductance (12SG7 r.f. and 12SA7 mixer) or the types for the 6 volt equivalent set: 6SG7 r.f. and 6SB7Y mixer.

3. Change the r.f. section over for miniature tube types: 6BA7 r.f. and 6BE6 mixer or, as was the case in the unit pictured in the illustrations (Fig. 1), 12BA6 and 12BE6.

Our experience with the first was that the operation was satisfactory for the area within the immediate vicinity of the transmitters. When tried in suburban areas more gain was desirable. The second choice helped considerably for the twelve volt series. Use of the 6SB7Y and 6SG7 for a 6 volt filament unit left nothing to be desired. In order to equal the performance of the 6 volt unit it was necessary to use the miniature tubes.

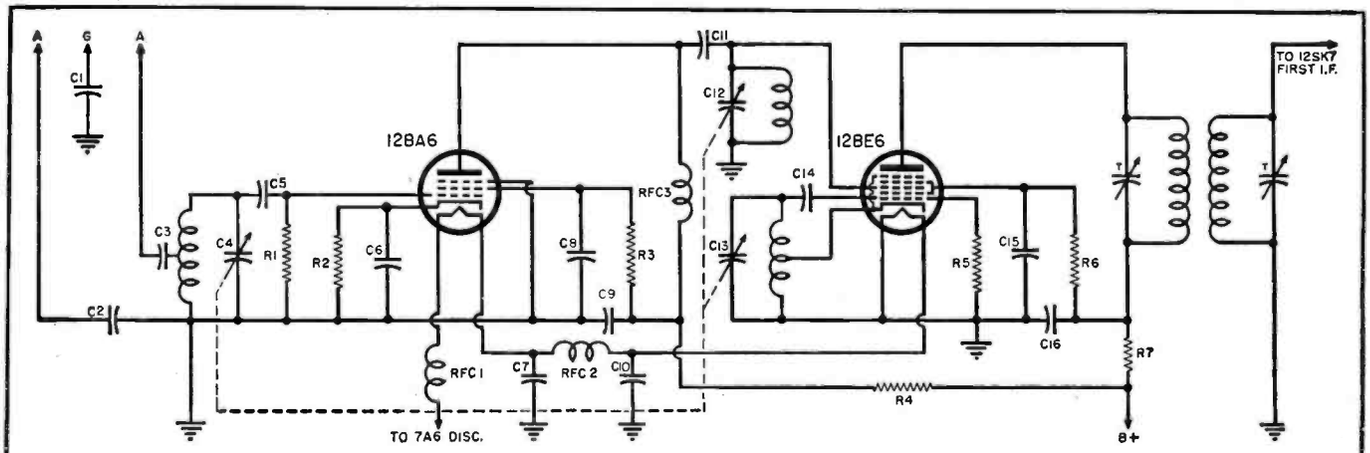
The miniature tube sockets are mounted on deck switch separator shield plates drilled for the purpose. The r.f. tube socket (12BA6) was assembled and mounted so that pin 1 (grid) faces the front of the chassis. This makes pin 5 (plate) face the rear of the chassis, thus, short leads to the tuning capacitor and coils are assured. The 12BE6 socket is mounted so that pin 1 (oscillator grid) is directly facing the tuning capacitor. This places the signal grid connection (7) in line for close connection to the mixer grid tuning tank.

An r.f. choke (*Ohmite* Z-1 or equivalent) is now connected in the series filament connection between the 12BA6 and 12BE6: This is bypassed to ground with .01 μfd. at the .12BE6 socket. The filament series connections are completed as in the diagram Fig. 5.

The tuning coils are each four turns of #10 tinned copper wire wound on a ¼ inch form spaced approximately 3/16" per turn. The final spacings will vary for each coil when the set is aligned for tuning capacitor tracking as described later. The coils are assembled in the set as shown in the picture, Fig. 4.

The grid ends of the coils are mounted directly on the tuning capacitors; the antenna-r.f. stage is at right angles to the direction of the tuning capacitor mounting on the condenser nearest the front; the oscillator tank in the same direction on the middle tuning capacitor with the ground end of the coil away from the antenna tank; the mixer grid tuning coil is mounted at right angles to the other two with the ground end towards the rear of the chassis. Thus, the fields of the three coils are made to oppose one another—the antenna and oscillator

Fig. 5. Schematic diagram of the converted r.f. end of the Meissner tuner. The r.f. and mixer stages have been changed.



R_1—100,000 ohm, ½ w. res.
R_2—68 ohm, ½ w. res.
R_3, R_4, R_6, R_7—1500 ohm, ½ w. res.
R_5—20,000 ohm, ½ w. res.

C_1, C_2, C_3, C_{14}—50 μμfd. mica cond.
C_4, C_{12}, C_{13}—Variable cond. (original)
C_5, C_{11}—100 μμfd. mica cond.
C_6, C_7, C_8, C_9, C_{15}—.005 μfd. mica cond.

C_{10}, C_{16}—.01μfd., 400 v. cond.
RFC_1—R.f. choke (original)
RFC_2, RFC_3—R.f. choke
See text for coil data.

by virtue of winding direction and the mixer with respect to the other two by virtue of positioning at right angles to them.

Reference to the diagram and bottom view photograph (Figs. 4 and 5) will show that r.f. stage is capacitively coupled to the tuning coil ½ turn down from the grid end. The grid is returned to ground through a 100,000 ohm grid leak.

The oscillator tank is arranged for Hartley operation and the tap is one and a half turns from the ground end.

The balance of the wiring can be done with only one major precaution in mind. The bypass capacitors should be connected with as short a lead connection as is possible and the ground ends should come to a common point for any one tube. For the r.f. stage all bypass capacitors are connected to the point where the ground end of the tank coil is connected. This is a little more difficult to do at the mixer stage but, if the screen and plate decoupling bypass capacitors are brought to the ground end of the signal tank and the filament bypass to the ground end of the oscillator tank, this will do the trick.

When the wiring is completed the condenser is made to track in tuning by squeezing together and separating the turns of the coils as required. The oscillator tuning range should be 83.7 mc. to 103.7 mc. If an absorption type wavemeter is handy this can be readily checked by observing the grid current dip on an 0-1 ma. meter inserted in the ground end of the local oscillator grid leak resistance. When doing this, bypass the meter to sustain oscillation.

In the absence of a signal generator the tracking can be checked with known stations.

The tracking that has been attained by the author is indicated in the photograph of Fig. 1.*

It has been assumed that the alignment of the i.f. has not been touched throughout this conversion. Some readjustment of the first and second i.f. transformers can be anticipated. A further improvement in limiter action can be had by making the limiter tube a 12SH7 replacing the 12SJ7. The i.f. transformers will require slight retuning if this is done. For the 6 volt counterparts the tube type for this change is the 6SH7.

The use of negative temperature coefficient capacitors (*Erie* Ceramicons) would undoubtedly reduce any frequency drift of the oscillator due to heat generated within the tuner.

The JFM 90 Tuner

The conversion of the JFM 90 *GE* FM translator can be made readily. It is important first to understand its operation. The tuner is a double superheterodyne of very unusual type. The first i.f. is tuned along with the oscillator and r.f. (1st mixer) stage. The operation is as follows:

The local oscillator beats with the carrier in the first mixer to produce the first i.f. This first i.f. is tunable with the oscillator and antenna stage. This difference frequency in turn beats with the same local oscillator frequency which passes through the first mixer and the resultant is the final i.f. If the final (second) i.f. is known the first i.f. range and the oscillator range can be determined from the formulas: $(F_c\text{-}F_2)/2 = F_o$ and $F_c\text{-}F_o = F_1$ where: F_c = carrier frequency; F_o = oscillator frequency; F_1 = first i.f. (variable); F_2 = second i.f. (fixed).

Thus for the 4.3 mc. i.f. of the set (F_2) the local oscillator (F_o) range for the FM band is 41.85 mc. to 51.85 mc. and the first i.f. (F_1) range is 46.15 mc. to 56.15 mc. The carrier (F_c) range, of course, is 88-108 mc.

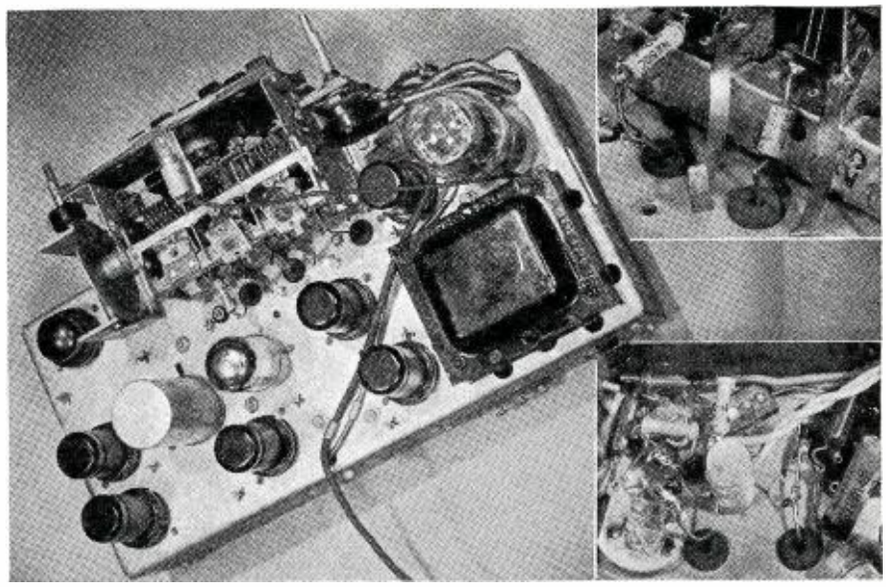


Fig. 6. Top view of the converted General Electric JFM-90 FM tuner. Insets show position of series condensers that are placed in the variable condenser leads and the under chassis position of the new oscillator coil.

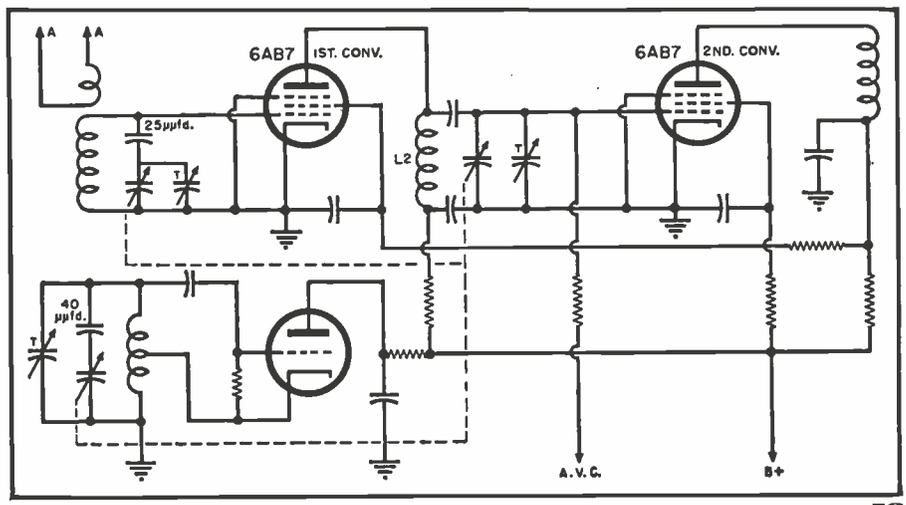
It is quite apparent that this represents a nice tracking problem. In the original set the tracking was taken care of in a tuning capacitor with three (3) special units ganged together.

The antenna primary, the r.f. grid and the local oscillator coils are wound on a single form. The original coil assembly was removed and a new coil form of a one-half inch polystyrene rod was made. Nearest the bottom end of the form is wound seven (7) turns, center tapped, of #18 solid copper tinned wire. The turns are spaced 12 turns to the inch.

On the same form 3/16" above the oscillator coil wind one and three-quarter turns of # 18 tinned copper wire spread 3/16" apart. Then 3/16" above this wind 1¼ turns (12 turns per inch) #18 tinned copper wire leaving very long ends, about 8 inches, covering these ends with spaghetti, then twist together. A sketch of this coil is shown in Fig. 9.

(*Continued on page* 120)

Fig. 7. Schematic diagram of the front end of the JFM-90 tuner after conversion. The oscillator tube is a 7A4. See Fig. 9 for complete coil specifications.



* In the picture Fig. 1 there can be seen at the left of the chassis a small a.c.-d.c. filter choke that was added in place of the resistive power supply filter in the original set. This removed a tunable hum which appeared in the set both before and after the conversion. This choke is soldered to the chassis and made a considerable difference in the over-all performance.

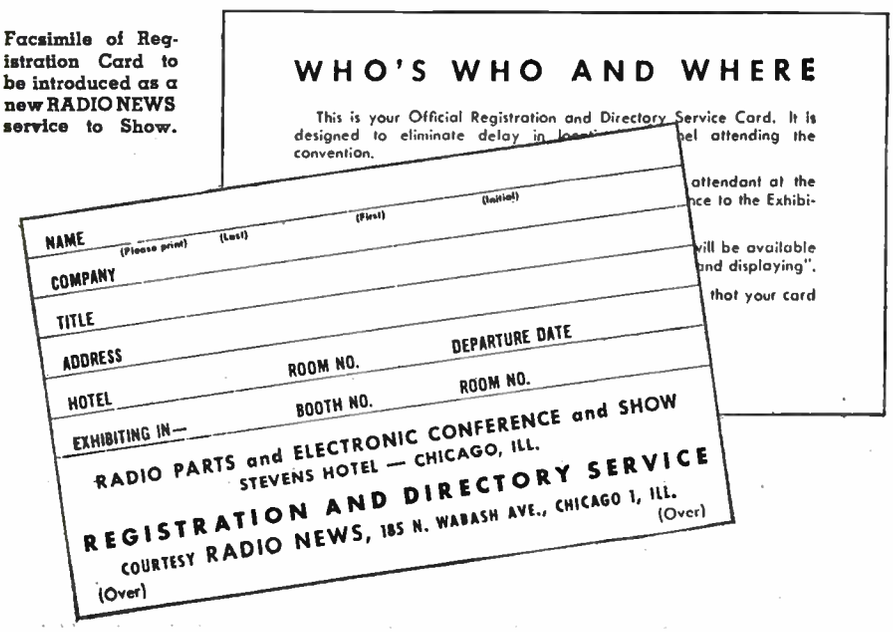
1947 RADIO PARTS and Electronic Equipment CONFERENCE and SHOW

The Trade Show will feature "Open House Day" this year on May 16th.

THE 1947 Radio Parts and Electronic Equipment Conference and Show, to be held at the Stevens Hotel, Chicago, is destined to break every record for attendance when it opens its doors on May 13th. From nearly every corner of the globe representatives will gather with their exhibits of brand new products, most of which will be shown for the first time.

The Show is sponsored by the Association of Electronic Parts and Equipment Manufacturers, The Radio Manufacturers Association (RMA), The Sales Managers Club, and the National Electronic Distributors Associations (NEDA).

The editorial staff of RADIO NEWS will again publish the RADIO NEWS DAILY which was introduced at the 1946 Show. Widely heralded for its on-the-spot coverage of the conference, the paper will again be distributed early each morning from Monday to Friday, inclusive. Familiar faces in our industry will appear in the DAILY in the form of photos and specially drawn caricatures by a leading artist. Other features too will appear for the first time in a show daily.



Facsimile of Registration Card to be introduced as a new RADIO NEWS service to Show.

As a further service to the industry, RADIO NEWS will conduct a Registration and Directory Service Booth. This innovation will make it possible to locate any registrant by simply inquiring at the Booth near the entrance to the Exhibition Hall where a complete up-to-the-minute card file system will be maintained. Manned by, or should we say womaned by, our RADIO NEWS cover girl, Carmen Garcia (see front cover) and other Chicago lovelies, this "Who's Who and Where" service will eliminate previous delays encountered in the typing and printing of registration lists in the DAILY. This becomes the Show's Official Registration and Directory Service. The cards, illustrated, will be distributed at every meeting during the convention and will be available at other strategic locations. Inasmuch as changes of room assignments sometimes occur, registration cards will be corrected upon notification.

RADIO NEWS will also have its Display Booth, No. 44½, in the Exhibition Hall.

"Radio's Old Timers," suspended back in 1941 on account of Hitler and Tojo, will again meet at a cocktail party at the Stevens, May 11. As qualifications for membership require members to have been connected commercially with the radio or electronic industry for twenty years or more, nearly all of the "Old Timers" have attended all the Trade Shows and have seen the Shows grow from a me-

(*Continued on page* 118)

Charles Golenpaul
Aerovox Corp.
Vice-pres., RPEE Show

Bill Cunningham
Keynote Dinner Speaker

J. A. Berman
Shure Brothers
President, RPEE Show

Kenneth C. Prince
General Mgr., RPEE Show

J. J. Kahn
Standard Trans.
Secretary, RPEE Show

R. J. Sherwood
The Hallicrafters Co.
Director, RPEE Show

R. C. Sprague
Sprague Electric Co.
Director, RPEE Show

Sam Poncher
Newark Electric Co.
Treasurer, RPEE Show

W. O. Schoning
Lukko Sales Co.
Director, RPEE Show

W. W. Jablon
Hammarlund Mfg.
Director, RPEE Show

MEMBER-EXHIBITORS IN THE 1947 RADIO PARTS & ELECTRONIC EQUIPMENT CONFERENCE & SHOW

COMPANY NAME	BOOTH NUMBER
Advance Electric and Relay Co.	47
Aerovox Corporation	85
Alliance Manufacturing Co.	123
Alpha Metals, Inc.	144
Alpha Wire Corp.	125
American Coil & Eng. Co.	116
American Condenser Co.	129
American Microphone Co.	4
American Phenolic Corp.	65
American Radio Hardware Co., Inc.	75
Amperex Electronic Corp.	67
Amperite Co.	60
The Astatic Corp.	95
Atlas Sound Corp.	134
Audio Devices, Inc.	148
Barker & Williamson	77
Belden Manufacturing Co.	128
Bell Sound Systems, Inc.	43
Bliley Electric Co.	78
David Bogen Co.	40
William Brand & Co.	13
British Industries Sales Corp.	112
Bruno Tools	76
Brush Development Co.	118
*Bryant-Davis Pub. Co.	27½
Bud Radio, Inc.	39
Burgess Battery Co.	147
Burlington Instrument Co.	22
*Boland & Boyce, Inc.	154½
*Caldwell-Clements, Inc.	20½
Camburn, Inc.	143
Carron Mfg. Co.	57
Centralab	68
Chicago Transformer Div.	11
Cinaudagraph Speakers, Inc.	3
Clarostat Mfg. Co., Inc.	124
Condenser Products Co.	153
Continental Carbon, Inc.	150
Cornish Wire Co.	48
*Cowan Publishing Corp.	130½
Croname, Inc.	84
Dial Light Co. of America, Inc.	109
Drake Electric Works, Inc.	61
Dumont Electric Corp.	12
Duotone Co., Inc.	20
Eastern Amplifier Corp.	34
Eastern Electronics Corp.	111
Eckstein Radio and Television Co.	29
Eitel-McCullough, Inc.	14
Electric Soldering Iron Co.	58
Electronic Engineering Co.	62
Electronic Laboratories, Inc.	56
Electro Products Laboratories	81
Electro-Voice, Inc.	15
Electrovox., Inc.	122
The Erwood Co.	105
Federal Telephone & Radio Corp.	135
Freed Transformer Corp.	113

COMPANY NAME	BOOTH NUMBER
General Cement Mfg. Co.	98
General Electric Co.	8
General Industries Co.	110
General Transformer Corp.	63
Guardian Electric Mfg. Co.	51
The Halldorson Co.	37
The Hallicrafters Co.	86
Hammarlund Mfg. Co.	90
Hardwick, Hindle, Inc.	36
Hickok Electrical Instrument Co.	142
Hytron Radio & Electronics	91
Indiana Steel Products Co.	38
Industrial Condenser Corp.	141
Insuline Corp. of America	114
International Resistance Co.	88A
Jackson Electrical Instrument Co.	98
Jackson Industries Inc.	156
J-B-T Instruments, Inc.	5
Jensen Manufacturing Co.	44
J. F. D. Manufacturing Co.	117
E. F. Johnson	73
Kenyon Transformer Corp., Inc.	6
Kings Electronics Co.	94
Lectrohm, Inc.	132
Lenz Electric Mfg. Co.	104
P. R. Mallory & Co.	106
Marion Electrical Instrument	32
John Meck Industries, Inc.	133
Meissner Manufacturing Co.	93
Merit Coil and Transformer Corp.	52
James Millen Mfg. Co., Inc.	33
Milwaukee Stamping Co.	136A
National Co., Inc.	70
National Union Radio Corp.	10
Newcomb Audio Products Co.	7
Ohmite Manufacturing Co.	74
Operadio Manufacturing Co.	139
Oxford Radio Corp.	59
Panoramic Radio Corp.	115
Park Metalware Co., Inc.	136
Par-Metal Products Corp.	24
*The Parts Jobber, Inc.	28½
Permo, Inc.	41
Philmore Manufacturing Co.	119
Pioneer Electric & Res.	9
Potter & Brumfield Mfg. Co.	53
Precision Apparatus Co., Inc.	152
Premax Products Division	18
Presto Recording Corp.	23
Price Recording Corp.	145
Pyramid Electric Co.	157
Quam-Nichols Co.	140
Racon Electric Co., Inc.	158
*Radcraft Publications, Inc.	21½
Rad-El-Co Manufacturing Co.	87A
Radiart Corp.	79
Radio City Products Co., Inc.	35
Radio Corporation of America	135A

COMPANY NAME	BOOTH NUMBER
The Radio Craftsmen, Inc.	25
*Radio & Electronic Jobber News	45½
*Radio News	44½
*Radio News Directory Service	Stair Lobby
*Radio & Television Weekly	129½
The Rauland Corp.	83
Raytheon Manufacturing Co.	99
The Recordisc Corp.	27
Recoton Corp.	26
Reiner Electronics Co., Inc.	35
Rek-O-Kut Company	55
John F. Rider, Publisher, Inc.	120
Howard W. Sams & Co., Inc.	31
Sangamo Electric Co.	2
Walter L. Schott Co.	71
Shur-Antenna-Mount, Inc.	42
Shure Brothers	87
McMurdo Silver Co.	138
Simpson Electric Co.	149
Mark Simpson Mfg. Co., Inc.	46
SNC Manufacturing Co., Inc.	72
Snyder Manufacturing Co.	66
Sola Electric Co.	30
Solar Manufacturing Corp.	92
Special Products Co.	103
Speed X Manufacturing Co.	64
Spirling Products Co.	159
Sprague Products Co.	89
Standard Transformer Corp.	88
Stromberg-Carlson Co.	108
Supreme Instruments Corp.	102
Sylvania Electric Products	50
Talk-A-Phone Co.	151
Technical Appliance Corp.	19
Telex, Inc.	131
Thordarson Electric Co.	126
Trimm, Inc.	100
Triplett Electrical Instrument	121
Tung-Sol Lamp Works, Inc.	107
The Turner Co.	49
*United Catalog Publishers	153½
United Transformer Corp.	1
University Loudspeakers	16
Utah Radio Products Div.	97
Vaco Products Co.	82
Vertrod Corp.	69
Ward Leonard Electric Co.	127
Ward Products Corp.	80
Waterman Products Co.	101
Webster-Chicago Corp.	155
Webster Electric Co.	137
Weller Manufacturing Co.	43
Westinghouse Electric Corp.	17
Weston Electrical Instrument	54
Wirt Co.	146
Workshop Associates, Inc.	41A
*Ziff Davis Publishing Co.	44½

* Guest-Exhibitor.

Ham Ticket in 30 Days

By JOHN T. FRYE, W9EGV

If you have postponed getting your ham ticket try this tested method of preparing for exams.

ARE you a SWL? In your case, do these letters stand for "Sure Would Like" a ham ticket? Do you hang around ham shacks, read all the short-wave magazines, build receivers and even dummy-loading transmitters, but still cannot go on the air because you do not have an amateur license? If so, this is your article.

If you will do what I tell you, whole-heartedly and with enthusiasm, you can earn a ham ticket in thirty days, devoting only an hour and a half each day to the project.

Learning the code is the highest barrier between the would-be ham and a license, but did you ever stop to think what a simple matter learning the code really is? There are twenty-six letters, ten numerals, and four marks of punctuation that you should learn to identify instantly when you hear them. That makes a total of forty. But the multiplication table, which you know frontwards and backwards, has a hundred and forty-four combinations!

Again, suppose I spell "c-a-t" out loud. Instantly you think of the word "cat." Consider the thousands of letter combinations that you can recognize in a split second when you hear or see the words spelled. Beside these two feats of learning *that you have already accomplished,* learning the code dwindles to the small matter that it really is.

No, *learning the code is not hard.* It only seems so because you have fallen into the rut of thinking that it is. Make your mind up right now to quit stalling around and to get yourself a ham ticket. For once, just for the heck of it, show that naturally lazy mind of yours who is really the boss. Are you ready? Let's go!

Secure some 3" x 5" file cards. With a small paint brush and some India ink, paint on the blank face of each card a single different letter of the alphabet, numeral from 1 through 0, or a question mark, error sign, period, or comma. Make the letters as large and as bold as the space permits. Then, on the back of each card, write the code combination for the character appearing on the opposite side, using the word "dit" for each dot and "dah" for each dash.

Shuffle the cards and place them in front of you with the "dit-dah" sides up. Say the combination of the top card aloud, as rapidly as you can do so distinctly, while you turn the card over and stare fixedly at the big letter painted on the opposite face. "Dit" is pronounced as shortly and as sharply as you can make it. "Dah," by its very nature, is dragged out a trifle longer. No appreciable space is left between the elements of a "dit-dah" combination in pronouncing it. For example, the combination for *K,* "dah-dit-dah," is pronounced with exactly the same rhythm as "shoot the chutes."

Speak the combination five times; then go on to the next card and do the same thing. Make no attempt to memorize the combination of letter and "dit-dahs." Simply keep the eyes glued to the letter while you repeat the correct "dit-dah" combination. Learning to read code is not a matter of memory. It is one of association.

Did you ever catch a whiff of perfume that instantly threw the face of a blonde you used to know on the screen of your mind, and then you searched around in your memory until you came up with her name? The first part of this process was instantaneous and purely automatic, like a reflex; the second part took time and effort. "Association" was working for you when the perfume recalled the blonde, and association is what we want to work for you in learning the code. If the ear is forced to listen to "dit-dah, dit-dah, dit-dah, dit-dah, dit-dah," an association is formed in the subconscious between the sound and the letter so that the instant the one is seen or heard the other is instantly called to mind.

As soon as you have gone through the pack, shuffle the cards and start right back through. Be sure and shuffle the cards. The mind must not be allowed to form any misleading sequence-patterns. Keep going through the cards again and again, saying each "dit-dah" combination *aloud* while you keep your attention—not just your eyes—sternly fixed on the big letter in front of you.

I suggest that you do this in private for two reasons: first, you need complete privacy and insulation from all distraction to get the full benefit from this method; secondly, the family will probably think that you are ready for one of those jackets with the wrap-around sleeves if they hear you muttering this baby-talk to yourself.

Keep at the practice for a solid hour and a quarter, not trying to hurry, but never stopping to get a drink of water, light a cigarette, or to do any of the hundred and one things that your squirming mind will suggest in an effort to escape from the unaccustomed work you are forcing it to perform. Stick right at it, and do not be surprised if, toward the end of the period, you catch yourself "seeing" the letter that is written on the opposite side just as soon as you say the "dit-dah" combination written on the ruled face of the card, even before you turn it over. When you do, this is a good sign that you are making progress, but do not try to force it. Always go on and turn the card over for a check and continue to repeat each combination the regular five

(*Continued on page* 178)

By
SAMUEL MILLER
Premier Electronic Labs., N.Y.C.

MICROMETER Tuning Signal Generator

Fig. 1. One of the commercially built generators which may be used for servicing all types of home radio receivers.

With the increased acceptance of FM and television service a signal generator assumes an ever greater role in the servicing of these high frequency units.

PROGRESSIVE radio repairmen are coming more and more to the realization that there is no substitute for proper test equipment in servicing modern receivers, and that accurate and reliable test instruments are an absolute necessity for intelligent troubleshooting and repair. The time when it was possible for the serviceman to get by with a minimum number of test instruments (and sometimes with almost as little understanding or knowledge of the basic principles and operation of the receivers on which he was working) is rapidly disappearing.

It is true that in the past many types of receivers could be put back into some sort of operating condition without the use of any test equipment, especially under emergency conditions, but with the increasing complexity of modern receivers, such methods are now completely inadequate. Furthermore, as the newer AM, FM and television receivers appear in greater quantity, much of the equipment which is at the present time being used by servicemen in their work will be found to be inadequate and obsolete. If the radio serviceman expects to be a major factor in the postwar receiver servicing field in the face of increased competition from large service organizations and the manufacturers themselves, he will have to keep his equipment, as well as his knowledge of fundamentals and basic principles, abreast of the latest developments in his field.

One of the most important requirements in servicing any type of communications equipment is to have available a signal generator supplying an accurate and readily controllable signal which is similar to the actual signal present in the circuit under operating conditions. This signal can then be traced, analyzed and measured through every stage of the equipment until the source of any trouble is located. The signal generator is also used for final alignment of the r.f. and i.f. stages of the receiver, and the accuracy with which this can be done depends directly upon the accuracy of the signal generator. The requirements of modern radio servicing make a good signal generator one of the most important and crucial instruments the serviceman can have.

Commercial receivers are designed to track well and follow accurately the dial calibration for only one particular intermediate frequency, and therefore the i.f. amplifier must be aligned to this exact frequency for good tracking. If the i.f. is aligned to a different frequency, the dial calibration will be off over most of the range (even though the 600 kc. and 1400 kc. check points may have been set correctly by means of their respective trimmers), tracking will be poor and receiver sensitivity will vary over different portions of the dial. This is an important point in favor of using the most accurate signal generator in aligning i.f. channels, even though a rough and approximate alignment can be performed by ear. The accuracy of the signal generator is of considerable importance not only in guaranteeing the accuracy of the frequency to which the i.f. channel is aligned, but also in assuring the accuracy of the 600 and 1400 kc. points at which the dial calibration is checked, and of any additional radio frequency points at which the tracking may be spot checked.

The need for an accurate, stable and reliable signal generator assumes even more importance in the servicing and aligning of FM and television receivers than in the case of standard broadcast receivers. While broadcast receivers can sometimes be roughly aligned without the use of good equipment, so that they will be acceptable to the uncritical customer, such a procedure becomes completely inadequate and unsuccessful for FM and television receivers. For example, a video amplifier certainly can not be aligned without a signal generator supplying a variable frequency signal up to about 10 mc.

A signal generator for universal use in all types of receivers, including FM and television as well as standard broadcast, has to possess many precision features. It must be capable of supplying a continuously variable tone-modulated signal whose frequency range extends to at least above 108 mc., in order to permit testing the performance of the r.f. sections of FM and television receivers under the new frequency allocations. The dial calibration must be accurate and have an easily read scale at even the highest frequencies, in order to permit accu-

rate testing of receiver bandwidth and dial calibration. External radiation from the circuit should be kept to a minimum, especially at the high frequencies. In testing FM receivers and high-fidelity phonographs, where audio fidelity is a much more important consideration than in broadcast receivers, a good source of pure sine wave audio frequency signal is required in order to test for fidelity and distortion characteristics. The r.f. carrier must also be capable of being externally modulated in order to be able to check video amplifiers in television receivers. At the same time, the signal generator possessing these features should be compact and portable for possible use in field servicing and for occasions when emergency repairs must be performed outside the repair shop.

The purpose of this article is to describe the design and constructional details of a new signal generator which provides the various features required in a modern servicing instrument. This signal generator is being made commercially available by the *Premier Electronic Laboratories* of New York City. A photograph of the instrument and the schematic circuit diagram are given in Figs. 1 and 2. The frequency range which is covered is from 75 kc. to 50 mc. on fundamental frequency of the r.f. oscillator, and to 150 mc. on third harmonic. This equipment possesses the following essential features:

A. It is extremely accurate and stable throughout its entire range. Accuracy is better than .5% throughout the broadcast band and 1% on higher frequencies.

B. The micrometer tuning mechanism provides that any frequency to which the generator has once been set can be repeated at any time to an accuracy of .02% of the frequency on the main dial.

C. The frequency scale is almost linear on all bands.

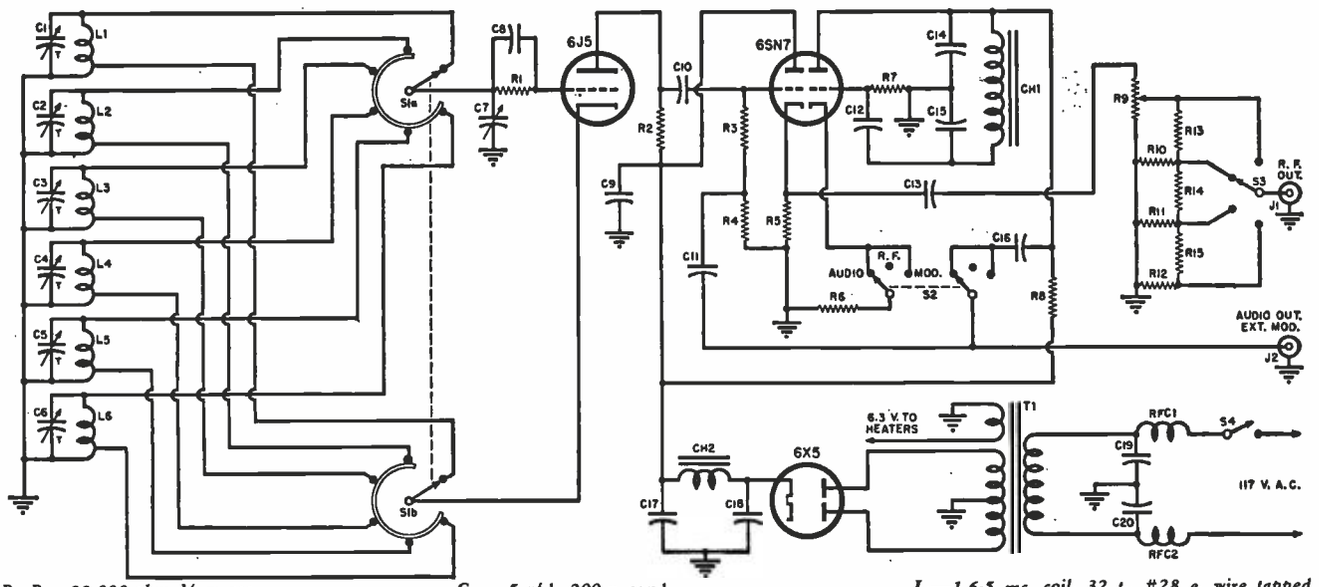
D. The 400-cycle audio modulation is essentially pure sine wave with well under 5% distortion.

Details of the circuit can be seen in the schematic diagram in Fig. 2. The radio-frequency signal is generated in a Hartley oscillator circuit using a 6J5 triode. Six coils are used to cover the entire band. The indicated values of the inductance of the oscillator coils were chosen so that, for convenience in operation, the entire broadcast band is covered in one range from 550 to 1700 kc. and no switching is necessary. On most of the frequency bands there is some overlap from one dial scale to the next. For best stability with variations in temperature and humidity, and under mechanical vibration, all the oscillator coils for the different bands are precision wound on bakelite forms and coated with Q-Max. The coils are tapped as indicated in the parts list at the point which gives best frequency stability. By means of a shorting type coil selector switch, all oscillator tuning coils except the one in use are shorted out, to eliminate any absorption effects which might otherwise be present due to self-resonance of the coils.

Each coil has across it an air trimmer with a minimum capacity of 30 $\mu\mu$fd. Air trimmers are used because they are less affected by changes in temperature and humidity than mica trimmers. The use of a relatively high minimum fixed capacity in the oscillator tuned circuit results in greater frequency stability and less effect upon the tuned circuit from heating of tube and circuit elements, and serves the additional function of spreading the tuning at minimum frequency setting of the main tuning condenser.

The 440 $\mu\mu$fd. variable tuning condenser is of special straight-line-frequency design with specially shaped plates to give almost linear frequency variation as the condenser is rotated through its 180° range. A major feature of the construction of this equipment is the *"Micromaster" Precision Tuning Dial.* Spring-loaded split gears are used to completely eliminate play and backlash, and provide extremely smooth and accurate settings. The tuning condenser is driven by the tuning knob through a special vernier geared to the main drive. The vernier dial has calibrated reference points from 0 to 100 to provide a micrometer tuning accuracy, and thus makes the

Fig. 2. Wiring diagram of "Micrometer" tuning signal generator covering the range from 75 kc. to 50 mc. in six bands.



R_1, R_8—22,000 ohm, ½ w. res.
R_2—500 ohm, ½ w. res.
R_3—1 megohm, ½ w. res.
R_4—250,000 ohm, ½ w. res.
R_5—10,000 ohm, ½ w. res.
R_6—200 ohm, ½ w. res.
R_7—65,000 ohm, ½ w. res.
R_9—1000 ohm, 3 w. attenuator pot.
R_{10}, R_{11}, R_{12}—100 ohm, ½ w. res.
R_{13}, R_{14}, R_{15}—1000 ohm, ½ w. res.
C_1, C_2, C_3, C_4, C_5, C_6—30 $\mu\mu$fd. air trimmer
C_7—440 $\mu\mu$fd. var. cond.
C_8—.0001 μfd. mica cond.
C_9, C_{11}, C_{12}, C_{16}—.05 μfd., 400 v. cond.
C_{10}—7 $\mu\mu$fd. ceramic cond.
C_{13}—.001 μfd. mica cond.
C_{14}—.25 μfd., 400 v. cond.
C_{15}—.5 μfd., 200 v. cond.
C_{17}—16 μfd., 400 v. elec. cond.
C_{18}—8 μfd., 400 v. elec. cond.
C_{19}, C_{20}—.01 μfd., 400 v. cond.
S_{1a}, S_{1b}—6-pos., 2-circuit bandswitch
S_2—2-pole, 3-pos. selector sw.
S_3—Single-pole, 4-pos. sw.
S_4—S.p.s.t. toggle sw.
L_1—75-220 kc. coil. 540 t., #38 d.c. wire tapped at 45 t., universal winding, bakelite form, ⅞" diam.
L_2—200-600 kc. coil. 205 t., #38 d.c. wire tapped at 26 t., universal winding, bakelite form, ⅞" diam.
L_3—550-1700 kc. coil. 76 t., #31 d.c. wire tapped at 15 t., universal winding, bakelite form, ⅞" diam.
L_4—1.6-5 mc. coil. 32 t., #28 e. wire tapped at 5 t., close spaced, bakelite form, ⅞" diam.
L_5—5-16 mc. coil. 9½ t., #22 e. wire tapped at 2½ t., double space, bakelite form, ⅞" diam.
L_6—13-50 mc. coil. 3½ t., #18 t. wire tapped at 1¼ t., triple spaced, bakelite form, ¾" diam.
RFC_1, RFC_2—R.f. choke, 57 t., #30 d.c. wire, universal winding, bakelite form, ⅜" diam.
CH_1—.75 hy. audio osc. iron core coil
CH_2—30 hy., 40 ma. filter choke
T_1—Power trans. 175-0-175 v. @ 40 ma.; 6.3 v. @ 2 amps.
1—6J5 tube
1—6SN7 tube
1—6X5 tube

instrument suitable for fine tuning adjustments even at the highest frequencies. This vernier dial lends itself to *delta* tuning and calibrating purposes, and makes possible delta tuning adjustments to an accuracy of better than 1/5000 (i.e., .02%) of the frequency to which the main dial has been set.

The r.f. signal is amplified by a triode buffer amplifier consisting of one section of a 6SN7 dual triode tube, and modulation of the carrier is performed in the grid circuit of this stage by applying the audio modulating voltage to a tap in the grid resistor. The r.f. oscillator is not modulated directly, in order to obtain better stability and prevent the modulation from causing any carrier shift or frequency modulation. The buffer stage is modulated approximately 45% by the internal modulation.

The r.f. output is taken from the cathode of the buffer amplifier operating as a cathode-follower. This provides a low-impedance output to the attenuator. The output voltage from the unit may be varied from zero to maximum by means of the potentiometer gain control, and the maximum output may be varied in four decade steps by means of the multiplier. The output attenuator is completely shielded to reduce leakage to a minimum.

The internal 400-cycle audio modulating signal is generated in the second half of the 6SN7 serving as a triode audio oscillator. A tuned-circuit type of oscillator, with an iron-cored inductance of approximately .75 henry, is used in order to obtain good wave shape in the audio-frequency signal. The oscillogram in Fig. 5 shows the actual 400-cycle modulated waveform of this signal generator. It was taken after the signal passed through the r.f. and audio sections of a commercial receiver. The presence of a pure sine wave audio signal, available for external audio testing purposes as well as for modulation of the r.f. carrier, is an important factor in making it possible to check both the quality of the audio circuit and the overall distortion of any receiver. Without pure sine wave modulation such checks cannot be made.

The audio signal is applied to the grid circuit of the buffer amplifier-modulator stage as shown, and is also available as an audio signal at the *"Audio-Out"* plug when the *"A.F.-R.F.-Mod."* switch is in the *"Audio-Modulate"* position. The carrier is unmodulated when this switch is in the *"R.F."* position, and may be modulated by any signal fed into the *"Audio-Out"* plug, which also serves as the *"External Modulation"* input. In order to eliminate the possibility of any audio leakage into the carrier when it is desired unmodulated, an additional gang is used on the *"A.F.-R.F.-Mod."* switch to open the audio oscillator cathode circuit so that the audio oscillation stops at the same time the modulator output is disconnected from the grid of the r.f. buffer amplifier.

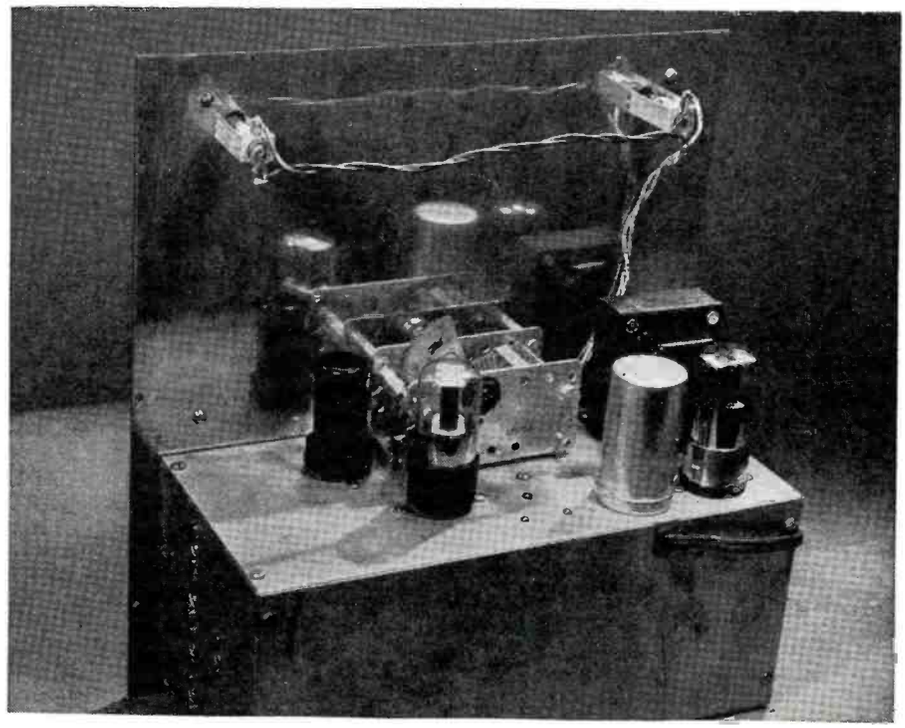


Fig. 3. Rear view of signal generator. Under chassis components of this r.f. section are completely shielded to prevent radiation to external circuits.

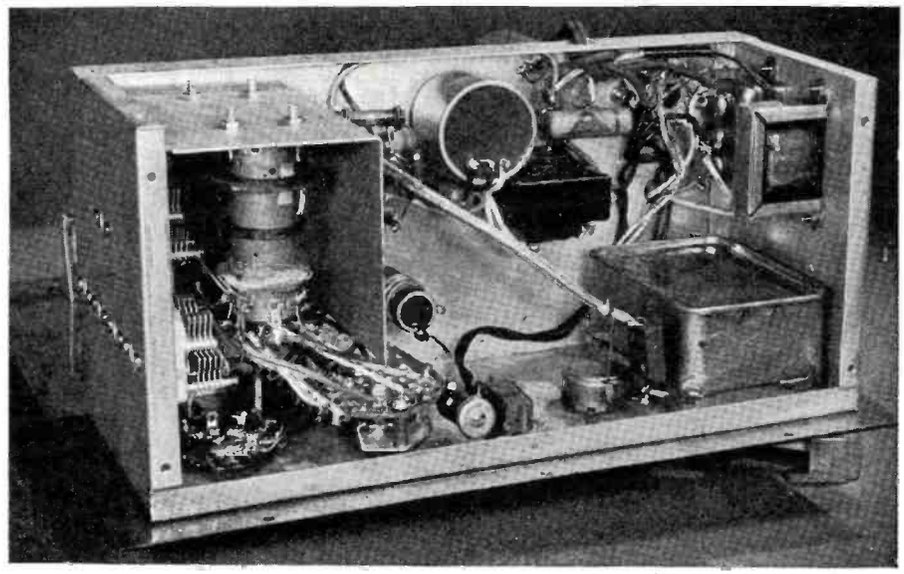
Physical details of the unit and its construction may be seen in the photographs in Figs. 1, 3, and 4. Fig. 1 shows the external details and all operating controls and input and output plugs, which are all located on the front panel. The entire unit is contained in a black crackle-finished metal case 12" wide, 12½" high and 5¼" deep.

The internal construction can be seen from Figs. 3 and 4. External radiation from the r.f. oscillator is kept to a minimum by placing an additional internal shield around the r.f. section inside the cabinet. This shielding may be seen in Fig. 4, which shows the inside of the unit with the cover removed, and with the internal shield in place. Any r.f. leakage into the a.c. line is minimized by the low-pass line filter shown in the schematic. The wiring details of the completed unit may be seen in illustration Fig. 4, which shows the internal view. It may be noted that frequency stability of the r.f. oscillator is affected by the wiring between the bandswitch and the various coils, therefore stiff solid wire is used for these connections to provide maximum frequency stability over long periods of time.

The precision tuning dial is seen in the center of the front panel in Fig. 1. The entire *"Micromaster"* tuning dial and vernier drive mechanism is located in a dustproof, glass-front casing. Settings are easily read by means

(*Continued on page* 183)

Fig. 4. Under chassis view of r.f. section shows relative placement of components.



Where Will You Find Them?

NOW that the sellers' market has done a rapid about face and become a buyers' market, the radio and appliance dealer is again faced with the problem of finding good prospects.

Before the great rush of competition begins, it would be well for each and every dealer to start compiling a list of persons to whom he wishes to sell his line. This compilation cannot and should not be a hit or miss affair. Since your list will be the one from which your salesmen will work, your mailings will be made, and to whom your advertising messages will be addressed, it must be as complete and accurate as possible. Your file will be of little use to you if it contains the names of persons who have moved from your primary service area, people who are no longer financially able to purchase your products, or persons whose status as householders has undergone a drastic revision.

Shown on this page are eight tested methods of getting sales prospects. Perhaps all of these methods are not applicable to your particular community, but some of them are worth your consideration.

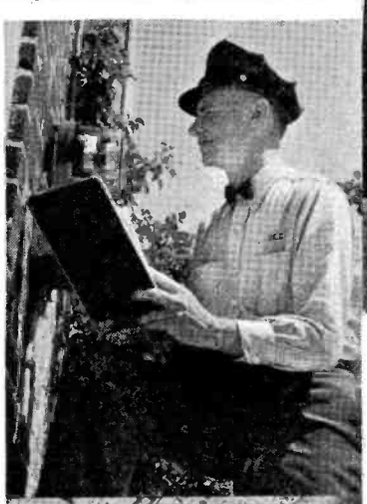
After compiling your prospect list, keep it up-to-date by constant revisions, additions and deletions. One excellent way to test your sales list is to make a mailing to all persons whose names appear on your records. If these letters or circulars are sent first class mail and in return address envelopes you can revise your list in the light of the mail which is returned to your office. This system is of no use unless all returns are carefully checked against your master copy—so don't adopt this plan unless you are willing to carry through with the scheme.

Business may be a bit slow now while your customers are shopping around or waiting to buy—so now is a good time to get your lists made out and the clerical work in connection with such a listing completed. It is not too early to get a head start on your competitor—in a few months you will be glad you had the jump on him! —30—

← A good source of sales prospects is your prewar listing of customers. If you have lost touch with these people—bring your list up-to-date right now.

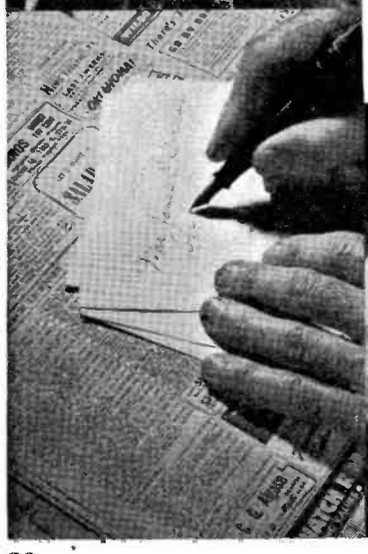
→ Your distributor or jobber is a good man to tie onto. He will give you names of prospects he has received for your territory. When your distributor gives you a name —make the call at once while the sale is active.

→ The mailman can give you much information on the whereabouts of your former customers and names of newcomers in your neighborhood. Keep him in mind.



← Meter readers get around. They know when new people move into your neighborhood. Good relations with them will pay off in increased business.

← Marriage license listing tell more than that another couple has said "I do." They are prospects par excellence for all types of appliances and radios.



← You can't go wrong in maintaining friendly relations with the milkman. He knows a lot about newcomers in your particular sales territory.

← A society page will provide a lot more information of importance to you than you might think possible. Try reading it carefully for the names of new and usually excellent prospects.

↑ The telephone book can help you bring your mailing list up-to-date in addition to furnishing you with names of newcomers.

The RECORDING and REPRODUCTION of SOUND

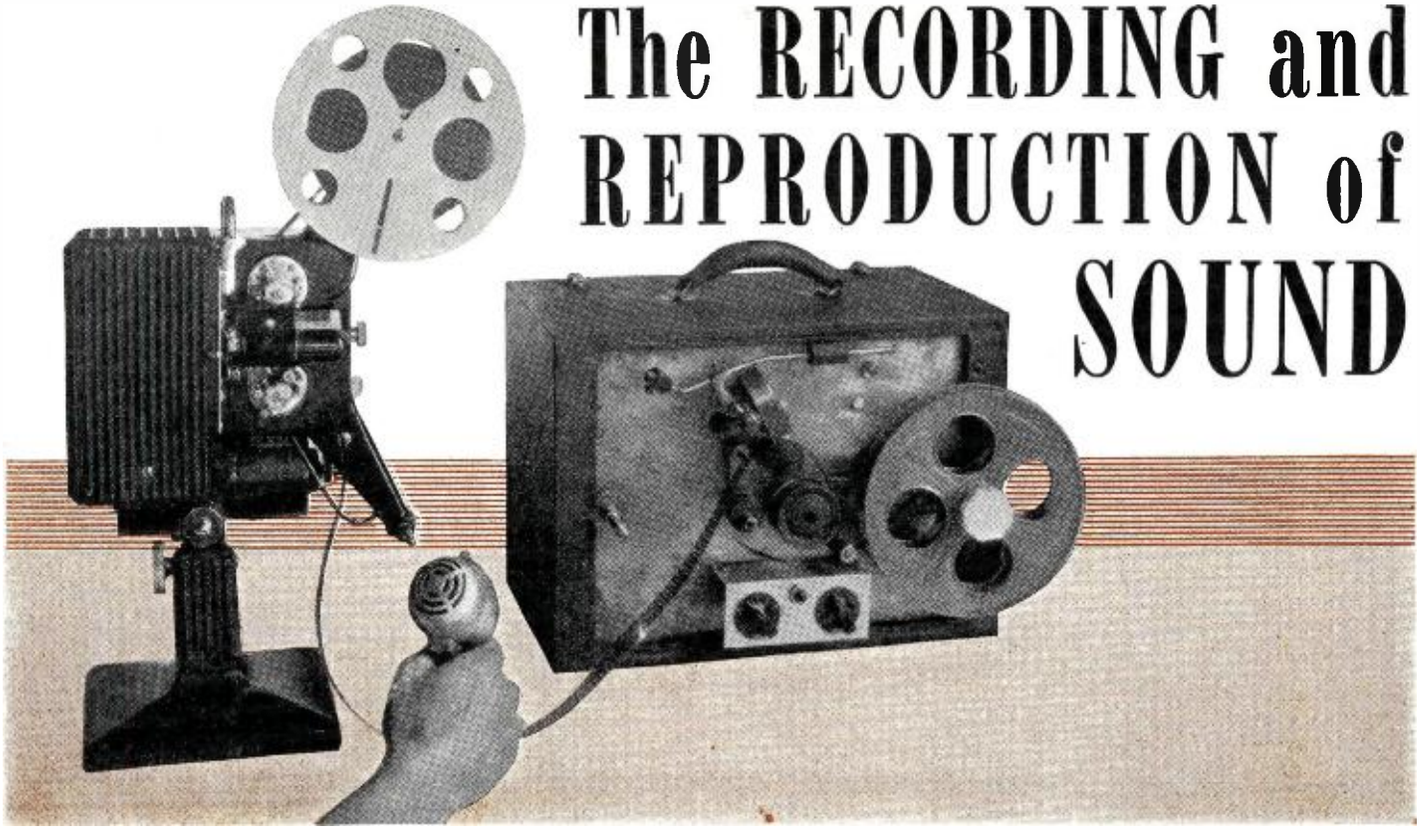


Fig. 1. A 16 mm. Filmgraph recorder in operation with home movie projector.

By OLIVER READ
Editor, RADIO NEWS

Part 3. Introduction to basic methods for embossing sound on film and disc, magnetic recording on tape, disc, and wire, and optical film recording systems.

SO FAR we have dealt briefly with the lateral type of disc recording whereby a moving stylus actually cuts from and modulates a groove in a plastic or lacquer coated disc. Several improvements have been made in order to gain more time on a record of given size. Among these are the methods for embossing sound on disc at *constant groove speed.*

Constant groove speed, as the words imply, means that the linear speed of the recording track or groove, in inches per second, is fixed (see Fig. 2A). This remains constant regardless of record diameter. In the conventional phonograph, a fixed turntable speed is employed resulting in a very high speed in the outer circumference. Linear speed becomes progressively slower as the smaller inner circumferences are approached (Fig. 2B). The result is that varying amounts of distortion of the original sound are present. This is especially true at 33⅓ r.p.m. In order to compensate for the variable speed, several forms of equalization are required in order to boost the high notes as the speed becomes slower at the smaller diameters.

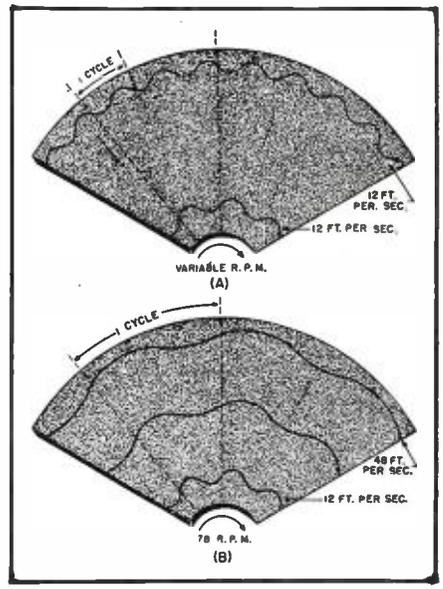
Constant groove speed techniques have been employed successfully in the design of highly efficient dictating machines such as the *Gray Audograph.* Vinylite records 10/1000 in. thick in sizes from 5⅝ to 8½ in. in diameter provide up to 31 minutes of dictation.

A roller drive at the stylus head provides constant recording speed. This speed is selected so that the maximum amount of dictation consistent with high intelligibility in sound reproduction can be embossed on the record (260 lines to the inch). This driving method does not require an extra mechanism to change rotational speed as the record center moves away from the stylus. The combination recording and reproducing head is illustrated in Fig. 3.

Three problems are encountered in playback stylus design; adjustment to vertical irregularities, adjustment to minute deviations from the Archimedes spiral that is theoretically traced during recording, and sensitive reproduction of the modulation pattern. The *Audograph* playback system comprises a stylus fixed on a flexible arm that is mounted on a heavy bar, a magnetic sleeve vertically set on the arm, a pivot shaft rubber-mounted in the sleeve, and a stationary coil surrounding the sleeve. Permanent magnets in the stylus head form a field about the coil. Lateral compliance is furnished by the heavy bar turning on the pivot; vertical compliance by the spring-loaded flexible arm.

Modulation reproduction can be followed from the schematic sketch. The groove force acts on the flexible arm through the stylus and weak torsion resistance, caused by the notches in the rear of the flexible arm, will permit the arm to tilt. This action tilts the sleeve mounted on the arm. As the ends of the sleeve rock forward, (one pole, then the other) lines of flux

Fig. 2. (A) Modulation by constant groove speed. (B) Constant hub speed produces variable groove speeds.



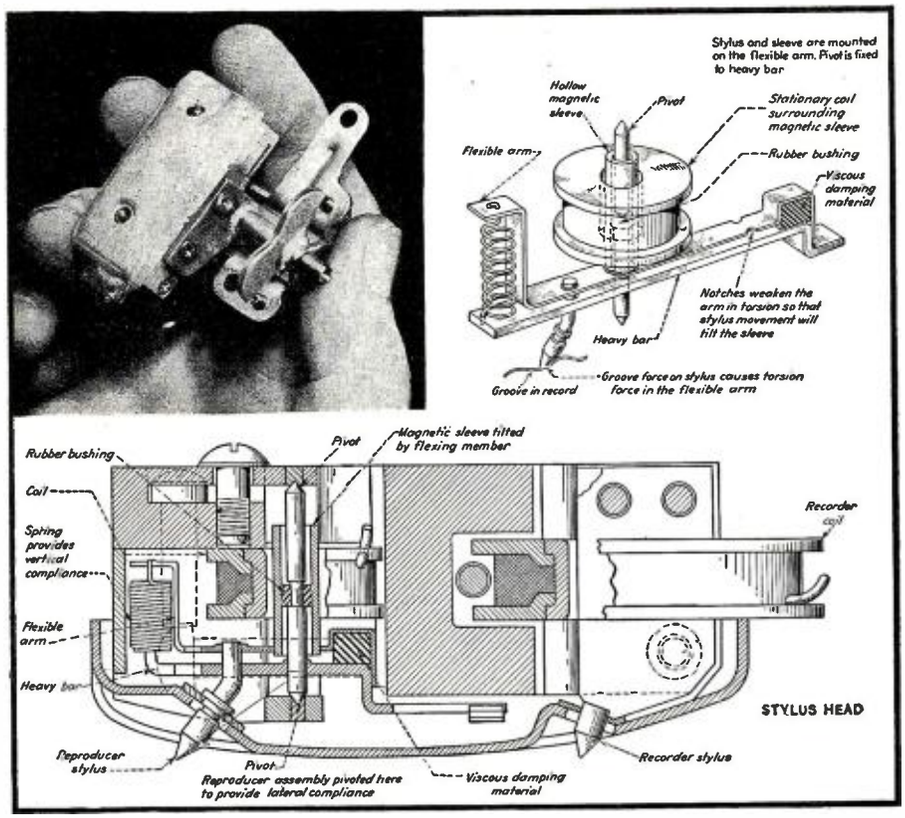


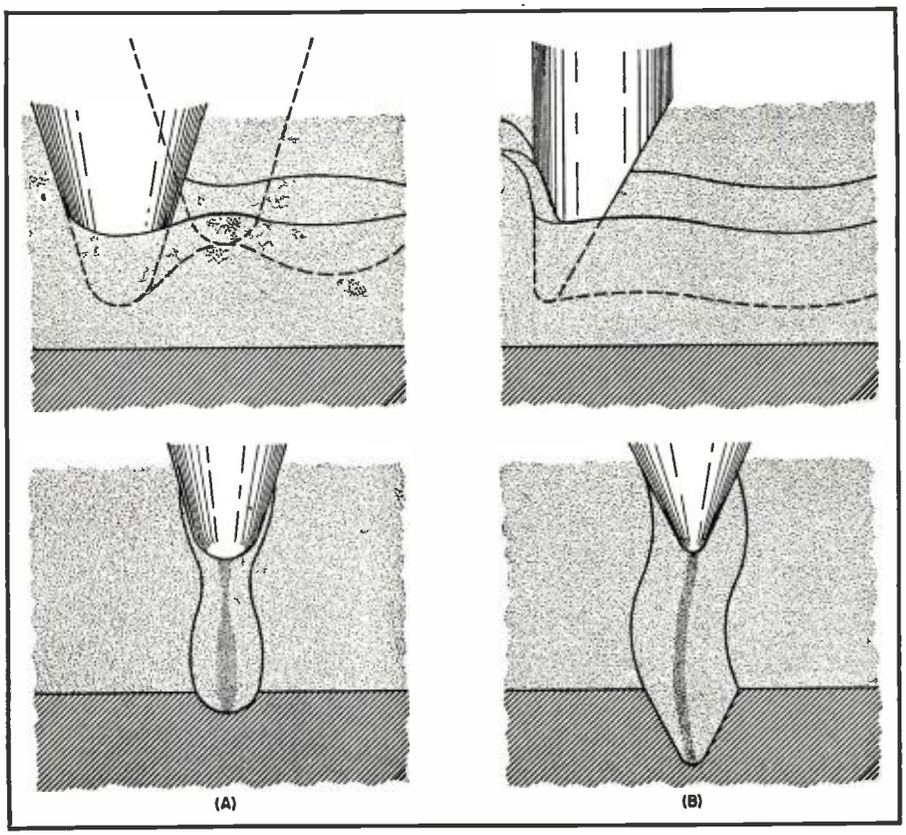
Fig. 3. Audograph record-playback head for embossing sound on Vinylite records.

flow through the magnetic sleeve, first in one direction and then in the other. This induces a voltage in the coil that electrically repeats the modulation pattern.

A belt reduction drive from the motor turns the driving roller. The idler roller, pressing the record against the driving roller, turns the record at a constant groove speed which is maintained throughout the recording. The angular velocity varies with the linear distance of the driving roller from the record axis. As the record turns the spindle, the carriage mechanism inside the case moves the record to the left.

A worm gear on the end of the spindle shaft engages a pinion on the end of the feed screw. Thus when the record turns, the feed screw is rotated. The feed screw, turning in engagement with the fixed worm pinion, is moved to the left, taking with it the carriage assembly that holds the spindle and record. In this manner, the record is slowly moved to the left while the driving roller rotates it beneath the recording stylus.[1]

(A) Embossing action of a dull stylus moving vertically. (B) Engraving action of a cutting stylus that is moving laterally.



Sound on Film

Original talking motion pictures were made possible by means of sound recorded on regular transcription discs and synchronized with the action as it appeared on the screen. This method became obsolete and was supplanted by the improved optical sound-on-film systems.

There are two general methods for recording sound on film. One is the *Movietone* method wherein the variations in sound are produced by *variable density* (variations in light through a sound track). This sound track has constant width along one edge of the film. See Fig. 4A. The other most commonly used method is the so-called *variable area* type. (*R.C.A. Photophone.*) Here the density remains fixed while the width of the sound track varies in accordance with the sound, as illustrated in Fig. 4B.

Variable density recording depends primarily upon the action of a "light valve." Basically, this valve consists of a loop of duraluminum ribbon, .003 in. thick and .006 in. wide, which is suspended in a very narrow slit between the two pole pieces of an electromagnet. Light from the exciter lamp is condensed and focused by means of a condenser lens system into a tiny path which shines through the slit in the light valve formed by the position of the duraluminum ribbons (Fig. 5). An objective lens system focuses and concentrates the tiny light beam onto the sensitized negative film which is traveling at a speed which is synchronized with the picture camera. The audio currents produce varying magnetic fields through the duraluminum ribbon loop. The varying magnetic fields cause the sides of the ribbon to repel each other. The amount of audio current flowing through the coils on the magnet governs the width of the slit, which in turn limits the amount of light that can pass through.

Reproduction from sound on film, employing the variable density technique, is shown in Fig. 6. The light from the exciter lamp, being focused into a very narrow beam, actually shines through the film to the photoelectric cell. The photocell, which is sensitive to variations of light, will pass minute variable electrical currents. These are then amplified by the audio system and fed through the

[1] Product Engineering, November 1946.

loudspeakers. The changes in the frequency of the sound are determined by the number of changes in film density per-inch-length of the sound track. The changes in the intensity of the sound are determined by the changes in the density or darkness of the lines on the sound track as the film passes the narrow beam of light. The light and dark lines on the sound track are continually interrupting the light going through the film. These interruptions vary the output currents of the photo-electric cell. Upon amplification, these variations or interruptions appear as sound waves and are heard through the speaker.

The fundamental setup for recording sound on film by means of the *variable area* method is shown in Fig. 7. Recording is accomplished by means of an oscillograph whose mirror is actuated by the variations in the intensity and frequency of the output voltage of the photocell. This, accordingly, throws a strong beam of variable light onto a moving film. These variations of light correspond to sound variations. They are recorded as a single heavy jagged line that looks very much like a series of high mountain peaks, as might be observed from a distance. Reproduction is similar to that of Fig. 6. Complete sound-on-film systems will be thoroughly discussed in later articles.

Embossing Sound on Film

One of the newer developments in sound-on-film is the technique employed to *emboss* sounds by means of a vertically driven stylus directly onto specially prepared film. See Fig. 8. One such machine, the *Filmgraph,* employs an endless loop of film which is placed in a magazine. The recording time depends upon the length of the loop used. Loops can be used for fifteen minutes', one hour's, two hours', five hours', and even up to eleven hours' recording. The loop moves forward continuously through the machine and no rewinding of the film is necessary. For example, if the recording is started on track No. 1, it automatically moves over to track No. 2 at the end of recording on track No. 1. This automatic movement continues until all tracks across the width of the film are indented or embossed. The track on which material is being recorded is indicated on a dial and this number changes as the stylus moves from one track to the other. Any track may be played back at any time by moving the stylus manually, by means of a control knob, to the desired number. Means are provided to start and stop the recording or playback instantly on a single word or syllable. A speed control is used on this type of machine for recording or playback.

The sound track is formed by indenting a groove into the film. The 16 mm. film is five-eighths of an inch wide and five-thousandths of an inch thick. A permanent type sapphire stylus of special design is used in the dual-purpose head for recording and playback.

The number of sound tracks that can be recorded on film depends on the physical width of the film. Sixteen or thirty-five millimeter film provides between forty and one hundred sound tracks. Sound may also be recorded on home movie film as shown in Fig. 1.

On the *Recordgraph* machine, sound is permanently embossed on thirty-five millimeter cellulose acetate film having a base material which is fire resistant and free of abrasives. No processing of the film is required before reproduction. Continuous recording with automatic trackover from groove to groove in the film is available. One hundred and fifteen tracks can be accommodated on one side of thirty-five millimeter film. Means are provided for the recording and also the locating of a particular track for playback as desired.

One of the earlier known methods of embossing is known as the *Western Electric* hill-and-dale recording technique. This is still used for many electrical transcriptions. Instead of a stylus moving laterally within a groove of a record, the stylus moves in a vertical plane and sound is actually cut and embossed by this motion.

Magnetic Recording on Film

The first talkies used the phonograph disc synchronized with the picture as mentioned previously. An optical sound track, however, proved itself better for most sound-on-film work. It is now used almost exclusively. *Magnetic* recording on film apparently has been neglected although it has some worthwhile advantages over the conventional optical systems.

Any system, no matter how successful in its application, has certain advantages and disadvantages compared to other methods. In optical recording systems we find that there is better resolution and better high frequency response at a given speed. There is no direct contact of the recording head with the film and neither is there any wear or clogging problem. The duplication of films recorded by the optical system may be accomplished easily by direct contact printing.

The disadvantages of the optical recording systems are briefly as follows: The films must be developed before the sound can be played back. They are relatively expensive and cannot be monitored immediately and as far as film technique is concerned, film must be handled in the dark and the processing requires highly skilled labor.

In the case of magnetic recording

(*Continued on page* 102)

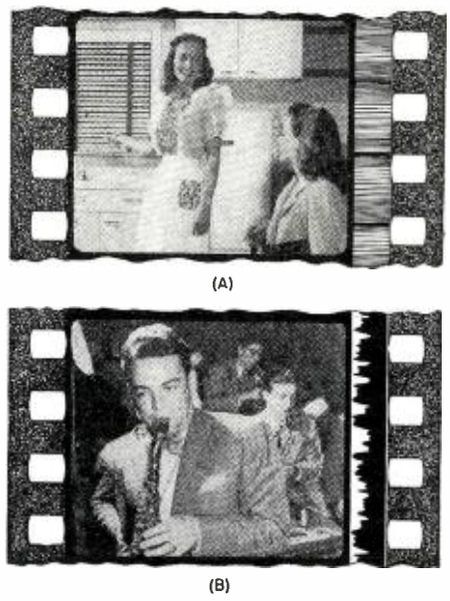


Fig. 4. (A) Variable density sound track on 35 mm. movie film. (B) Variable area sound track as it appears on a single frame.

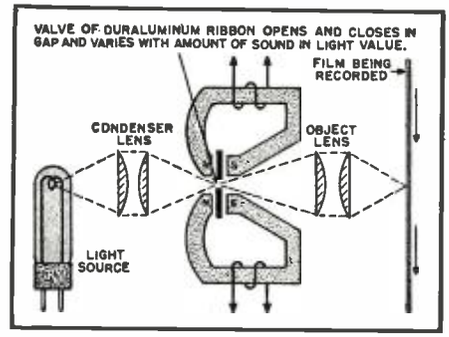
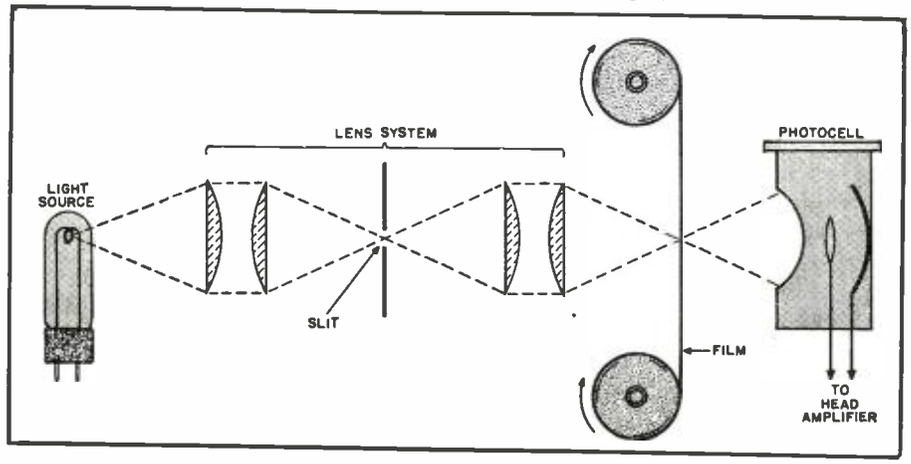


Fig. 5. The essential elements employed in variable density recording.

Fig. 6. Basic system for reproducing sound on film by optical methods.



A SALES CONTROL SYSTEM

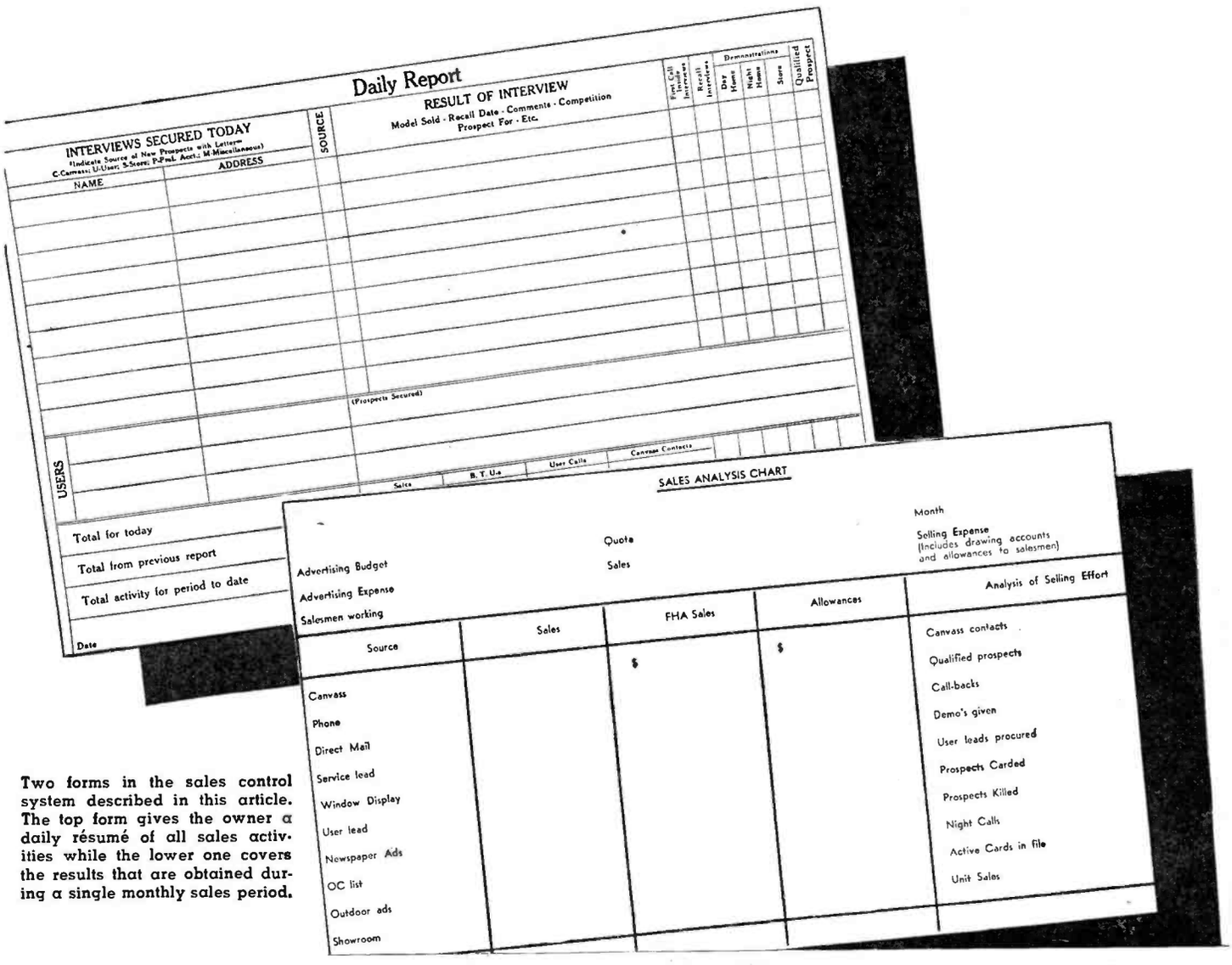
By FRED MERISH

The day of casual and slap-dash methods of sales control has drawn to a close and dealers must now revamp or go under.

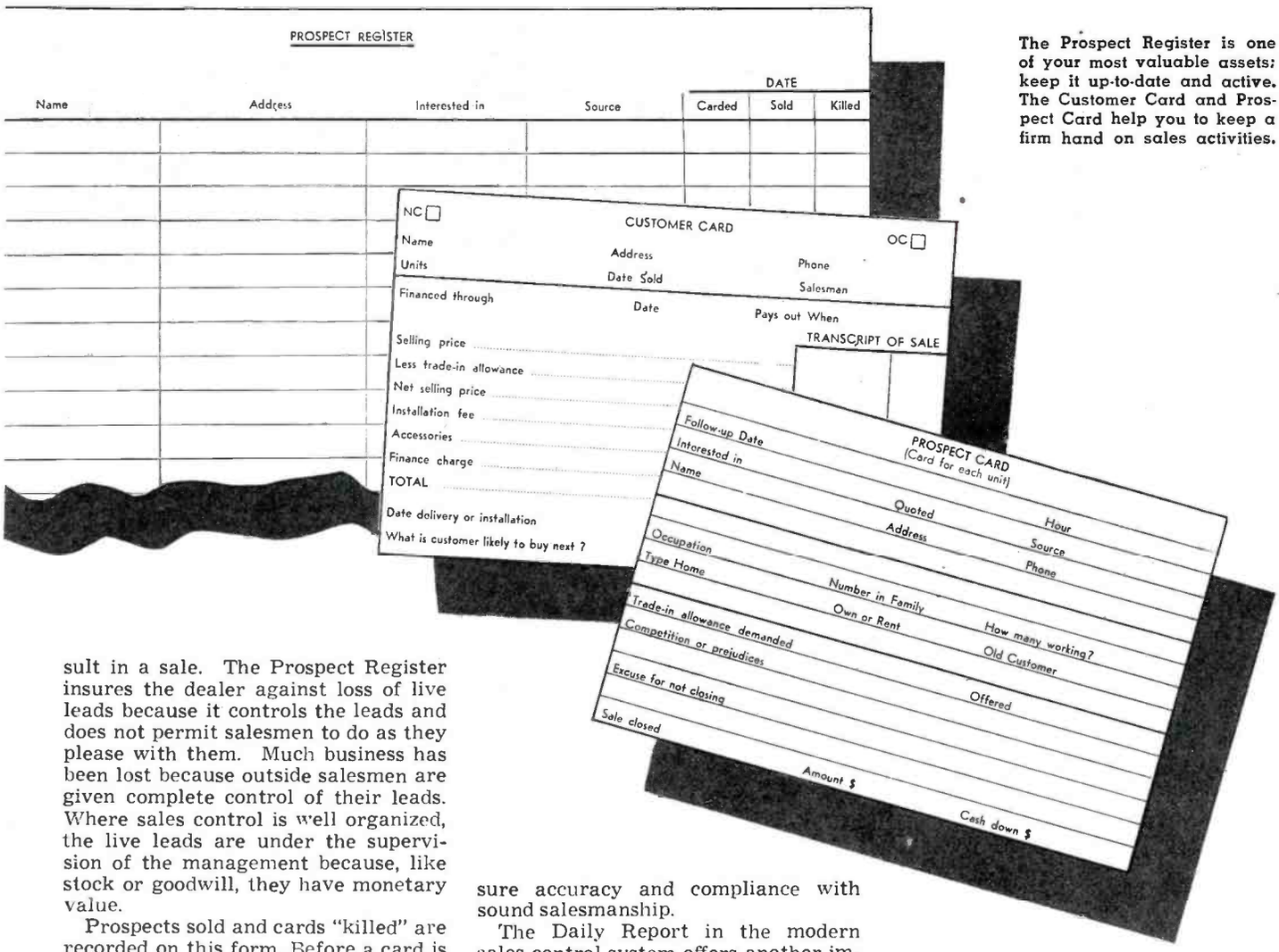
DIRECT selling will resume its place in the merchandising picture as soon as goods start to flow freely to retail stores—in fact, some dealers are already using "bird dogs" to track down live leads on home appliances and radios, these prospects to be followed up later on by "closers." Outside sales work requires adequate sales control for best results and the dealer can utilize effective sales control if he adheres to certain fundamentals. An efficient system should tell a complete story and function with mechanical precision. The "garden variety" type of prospect card, an ordinary 4 x 6 inch blank is a long way from being a well-balanced sales control system.

After analyzing many sales control systems, we find that the most adaptable routine for radio and appliance dealers embraces five forms. The Prospect Register is for listing all genuine prospects. This prevents loss of good leads and provides a central point from which the dealer can make a periodic check on the success his salesmen are having. The Prospect Register also supplies valuable statistical information for the Sales Analysis Chart, another form in this system.

In addition to the date, name and address of the prospect, the Prospect Register records the item in which the customer is interested, whether an electric refrigerator, radio, washing machine, etc. Under the column headed, "Source," should be recorded where the salesman got the lead; cold canvass, user, phone canvass, direct-mail, etc. The date when the lead is carded is placed in the appropriate column and this provides a check on lost cards or on cards that a salesman may "ditch" deliberately for one reason or another. At times, a salesman may hesitate to report that he cannot close a sale and dispose of a card, whereas, the lead, if given to another salesman, or contacted at a later date, may re-



Two forms in the sales control system described in this article. The top form gives the owner a daily résumé of all sales activities while the lower one covers the results that are obtained during a single monthly sales period.



The Prospect Register is one of your most valuable assets; keep it up-to-date and active. The Customer Card and Prospect Card help you to keep a firm hand on sales activities.

sult in a sale. The Prospect Register insures the dealer against loss of live leads because it controls the leads and does not permit salesmen to do as they please with them. Much business has been lost because outside salesmen are given complete control of their leads. Where sales control is well organized, the live leads are under the supervision of the management because, like stock or goodwill, they have monetary value.

Prospects sold and cards "killed" are recorded on this form. Before a card is "killed," the dealer or his sales manager should OK the "kill." No salesman should be permitted to "kill" or discard cards after they have been registered on this form. The fact that a lead is recorded indicates that it has good sales potentialities. Remember, that every person canvassed is not necessarily a prospect for your wares. Thus all contactees are not registered, just live leads. The decision as to what is a "live lead" depends upon the information written on the salesman's Daily Report, another form in this system. Some organizations permit their salesmen to make this decision; others assign this authority only to the management, usually after conferring with salesmen about their daily reports. The separation of live leads from deadwood is a phase of sales control that has much to do with minimizing selling expense. Too often, salesmen, lacking seasoned supervision, spend a lot of valuable time chasing deadwood, running up selling expense, when they could devote their time with more profit to leads with more likelihood of concluding a sale.

Periodically, a dealer should check the Prospect Card file against the Prospect Register to make sure that all listings are accurate. There is little use installing a sales control system unless you devote some time to it to assure accuracy and compliance with sound salesmanship.

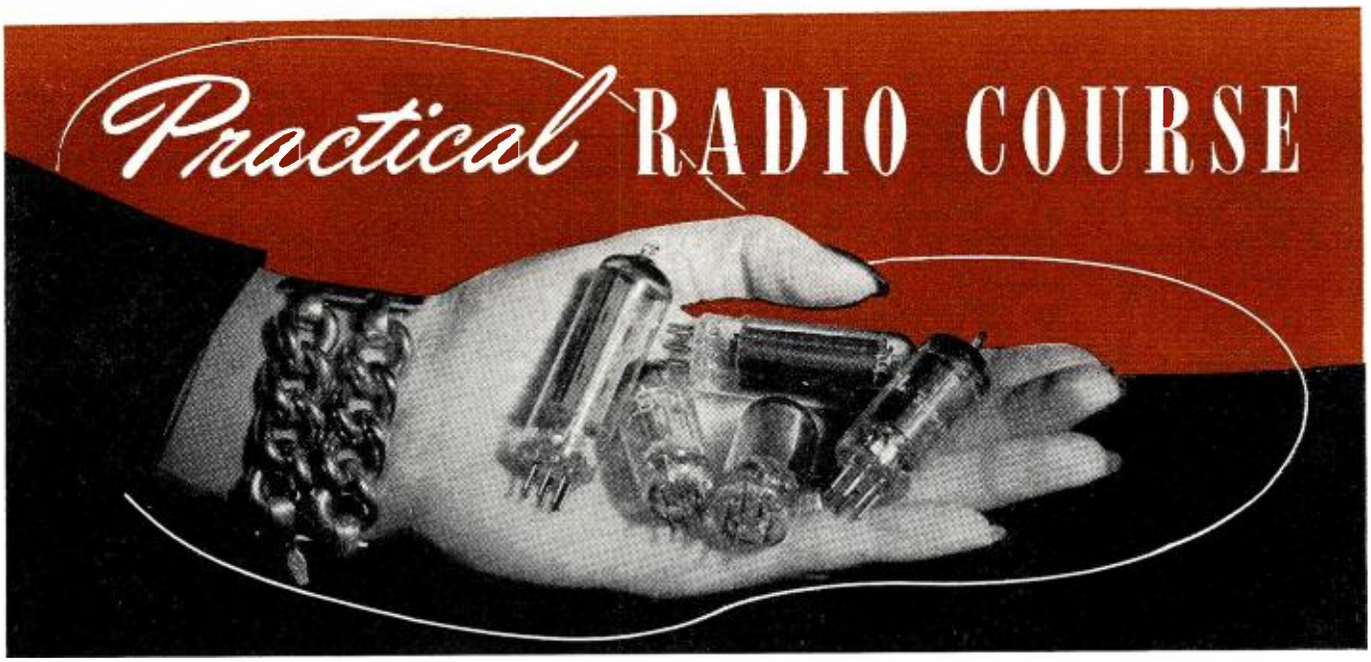
The Daily Report in the modern sales control system offers another improvement over the old-fashioned sales report in that it provides an automatic cumulative total of each salesman's work to date, which enables the dealer to keep close track of his outside salesmen, without going over a mass of records. Interviews, results of interviews, call-back dates, and other pertinent information is recorded, providing a precise picture of the day's selling activities in figures and facts for current consumption, also for use later in a statistical way on the sales analysis chart.

The Prospect Card should be filed according to the follow-up date, otherwise called a Tickler System. Many managements file their prospect cards alphabetically, but prospects are not contacted or followed up alphabetically, consequently, follow-ups are often not made on time because the cards do not come to attention systematically. The salesman either relies on his memory, makes notations on Daily Reports or in his personal notebook. These methods foster errors and lose sales. It is mighty important to follow up prospects on time, just as it is essential to prompt collections to follow up past-due accounts on time. The Prospect Card, operated with a Tickler System, eliminates the hazard of follow-up negligence. The form shown provides space for credit information, which gives the creditman an opportunity to investigate the prospect's credit standing in advance. Sometimes, because of a bad credit rating, a sale cannot be made, then much time has been wasted if this information is gathered after the sale is closed. By means of this form, time may be saved on bad risks. There are enough good credit risks desiring home appliances and radios in the postwar period to keep a dealer's outside salesmen busy; so it is unwise to waste time on bad risks. Now that the war is over, many individuals must take less money for their work. Dealers should not overlook this important fact and should check credits more carefully than during the war years when many wage earners were making big money, hence, were better credit risks.

The Prospect Card also provides space to record the trade-in allowance demanded and offered, the nature of the competition and the reason for not closing. The dealer should look over these prospect cards once a week and suggest ways and means to overcome a prospect's objections if the salesman doesn't seem to be getting anywhere with his line. Often this type of direction will save a sale. Sometimes the Prospect Card can be turned over

(*Continued on page* 170)

Practical RADIO COURSE



As soon as production permits, these new miniature tubes will be used in 5-tube, table model, a.c.-d.c. receivers. This new tube kit will consist of 35W4, 50B5, 12BA6, 12BE6 and 12AT6. They will replace the 35Z5, 50L6, 12SK7, 12SA7 and 12SQ7 respectively.

By ALFRED A. GHIRARDI

Part 53. Important factors which must be considered when choosing i.f. frequency of a superheterodyne.

IF superheterodyne receivers are to provide satisfactory reception, very careful design of the i.f. amplifier (see Fig. 1) is necessary because they are subject to certain serious interference effects (spurious responses) that are largely controllable by the design of this amplifier. Probably the most important single factor in the design of a successful superheterodyne that will be free from such spurious responses is the choice of the intermediate frequency to be employed.

Unfortunately there is no simple, clear-cut choice of the best i.f. to employ for any particular class of receiver service, for this choice is intimately tied up with a number of conflicting requirements that make it necessary for receiver designers to choose for this frequency value one that enables them to provide the best possible compromise as regards receiver cost and physical dimensions, adequate high amplification, and freedom from objectionable spurious responses due to various causes. Consequently, it is important to understand these controlling factors and the effect of the i.f. value upon each of them.

How I.F. Employed Affects Adjacent Channel Selectivity

In an AM receiver, adjacent-channel selectivity is the ability to discriminate against interfering signals on an adjacent broadcasting channel 10 or 15 kc. removed from the desired signal frequency. Detailed discussions of adjacent-channel (arithmetical) selectivity that were presented in two earlier articles[1] of this series clearly explained the reasons for the following very important inherent characteristics possessed by i.f. amplifiers:

1. The major portion of the adjacent-channel selectivity of practical superheterodynes resides in the i.f. amplifier and results from the frequency conversion action in the superheterodyne.

2. The lower the i.f. employed, the greater will be the percentage frequency separation between the wanted signal and any unwanted adjacent-channel signal after frequency conversion has taken place; consequently the greater will be the adjacent-channel selectivity and rejection of the unwanted adjacent-channel signals.

It is apparent that if the desirability of making the adjacent-channel selectivity as great as possible were the only factor involved, it would be advantageous to employ as low a value of i.f. as possible. Use of a low i.f. would have the further advantage that it would permit high gain per stage to be easily and cheaply obtained. However, several important conflicting considerations enter into the picture and, for a receiver designed to operate over a particular signal-tuning range, they place a definite practical limit on how low the i.f. may be made. The most important of these is the probability that image-frequency interference will occur.

Fig. 1. Elements of a typical single stage i.f. amplifier between the frequency converter and the diode detector of an AM receiver. It employs two double-tuned coupling transformers and a single pentode i.f. amplifier tube.

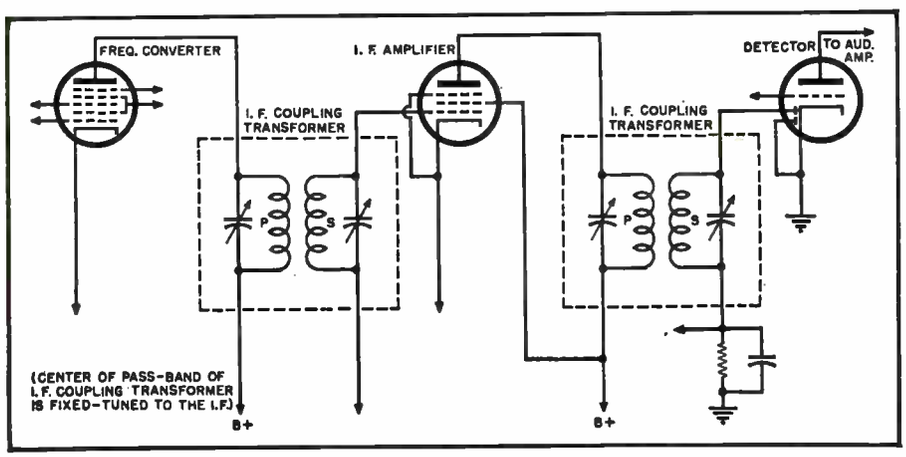


Image-Frequency Interference

It will be recalled from an earlier article of this series[2] that image inter-

[1] For detailed explanations of adjacent-channel interference and selectivity see Alfred A. Ghirardi, Practical Radio Course, Part 26 (RADIO NEWS, Sept. 1944) and Part 52 (RADIO NEWS, March 1947).

[2] For a detailed explanation of image-frequency interference see Alfred A. Ghirardi, Practical Radio Course, Part 27 (RADIO NEWS, Oct. 1944).

ference, the interference caused by any sufficiently strong received signals having a carrier frequency *higher*[3] (see Fig. 2A) than that of the desired signal by an amount numerically equal to *twice* the i.f. employed in the receiver ($f_{image} = f_{sig.} + 2f_{int.}$), is one of the outstanding undesired responses in superheterodynes. Figs. 2A and 2B show why a signal of this frequency will interfere with the desired signal. It is important that this type of interference be effectively reduced to a minimum in order to obtain satisfactory reception of desired signals.

It is evident that the i.f. value employed in the receiver has an important bearing upon whether or not image interference will be experienced during reception of any desired signal. The tabulation presented in Table 1 is interesting in this connection because it shows the AM broadcast signals that can be expected to be involved in image-frequency interference with one another when receivers employing the i.f. values indicated at the top of each column are used in the various localities specified in the left-hand column. For example, in New York City if a superhet receiver employing a 450 kc. i.f. amplifier is tuned to receive the 660 kc. signal from station WNBC, the 1560 kc. signal from station WQXR will tend to cause image-frequency interference with it. This is so because 1560 kc. is the *image frequency* for a superheterodyne receiver tuned to 660 kc. and employing a 450 kc. i.f. that is, (660 + (2 x 450) = 1560 kc. Therefore, an incoming signal of this image frequency will be converted to a 450 kc. signal by the frequency converter in the receiver and be passed and amplified (along with the desired signal) by the i.f. amplifier. Whether or not annoying interference will actually occur in this case depends upon the relative strength of the two signals received at the locality of the receiver's antenna, the image-rejection ratio provided by the r.f. preselector tuning circuits employed in the receiver, etc.

The tabulation of Table 1 also shows that in this same locality if the receiver employs an i.f. of 455 kc., image interference cannot occur between the signals of the aforementioned stations but it is apt to occur between the signals of stations WMCA (570 kc.) and WHOM (1480 kc.). On the other hand, if the receiver employs an i.f. of 460 kc., no image interference is apt to occur between any of these signals if the receiver is operated in New York City. However, when this i.f. is employed, image interference might occur between the signals of stations WEEI (590 kc.) and WMEX (1510 kc.) if the receiver were located in Boston and did not employ a sufficient degree of r.f. preselection.

This illustrates how important becomes the matter of what i.f. is employed in a receiver under actual present-day receiving conditions in various localities.

It is important to remember that once the "conversion" of the wanted signal and an unwanted interfering signal of image frequency to a "common" intermediate frequency has been effected in the frequency converter (see Fig. 2B), they are inseparable, and no subsequent degree of selectivity in the i.f. amplifier will attenuate one of the signals more than the other. The interfering signal of *image frequency,* after its conversion to the intermediate frequency, is just as acceptable to i.f. amplifiers as is the *desired* signal after its conversion to the same i.f. The i.f. amplifier does not discriminate between them in any way.

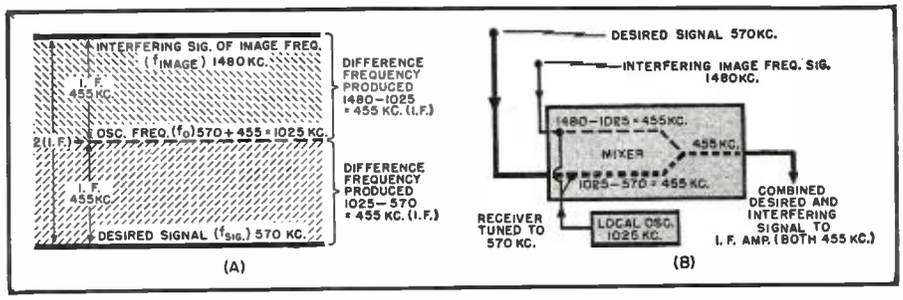


Fig. 2. (A) Should a superheterodyne receiver with an i.f. frequency of 455 kc. be tuned to 570 kc., a 1480 kc. image frequency interference will result. (B) How a desired and an image response signal can combine with the local oscillator output to produce two signals, both having a frequency equal to the i.f.

Locality	450 kc. I.F.	455 kc. I.F.	460 kc. I.F.	465 kc. I.F.
Boston, Mass.....			WEEI-590 WMFX-1510	
Charleston, W. Va.....		WCHS-580 WGKV 1490		
New York City.....	WNBC-660 WQXR-1560	WMCA-570 WHOM-1480		WMCA-570 WWRL-1600
Omaha, Neb.....	WOW-590 KBON-1490			
Syracuse, N Y.....			WSYR-570 WOLF-1490	
Spokane, Wash.....			KHQ-590 KGA-1510	
San Antonio, Tex.	KTSA-550 KABC-1450			

Courtesy RCA Service News

Table 1. Broadcasting station signals and their carrier frequencies that become involved in image frequency interference in certain cities when the various i.f. values indicated are employed in the receivers.

It is quite obvious then that either, or both, of two courses are open to the receiver designer:

1. The undesired interfering image-frequency signal must be eliminated *prior* to its reaching the frequency-converter stage, or,

2. An i.f. value must be such that no possible signal that could be received (at the locality) with sufficient strength to cause annoying interference will be of the correct frequency to qualify as an *image-frequency* signal.

Use of Preselector for Suppressing Image Signal

In the first method, sufficient r.f. preselection[4] (pretuning) is employed by providing specially designed variable-tuned r.f. preselector circuits ahead of the frequency converter. This provides sufficient r.f. selectivity ahead of the frequency converter so that the image-frequency rejection ratio will be high and all signals of image frequencies will be sufficiently attenuated so they do not cause interference. The action is illustrated in Fig. 3.

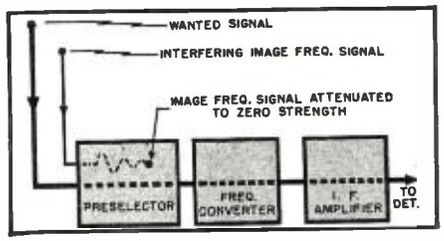


Fig. 3. Illustrating how an image frequency signal may be sufficiently attenuated by a preselector so that it does not reach the frequency converter.

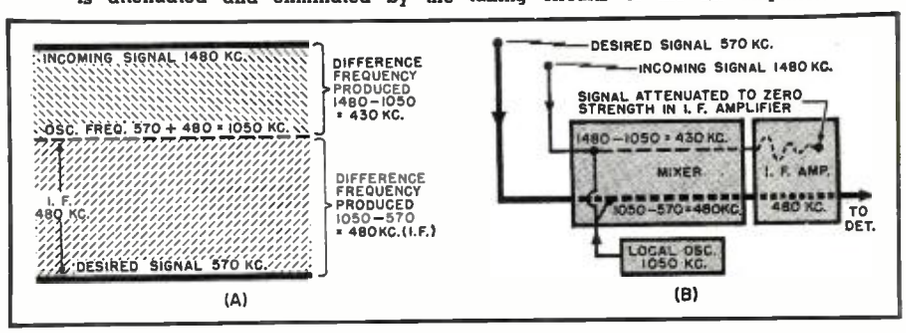
At AM broadcast-band frequencies (535 to 1605 kc.) it is usually sufficient to include a well-designed tuned r.f. preselector ahead of the frequency converter to completely eliminate all

(*Continued on page* 124)

[3] In superhets whose oscillator frequency is normally maintained higher than that of the incoming signal by an amount exactly equal to the i.f. for which the receiver is designed.

[4] For a detailed explanation of preselector circuits see Alfred A. Ghirardi, Practical Radio Course, Part 28 (RADIO NEWS, Nov. 1944).

Fig. 4. (A) How proper selection of i.f. value employed in a receiver can prevent a particular incoming signal from qualifying as an image frequency interfering signal. (B) Diagram illustrates how the 1480 kc. incoming signal of (A) is attenuated and eliminated by the tuning circuits of the i.f. amplifier.



SENSITIVE PROBE uses Crystal Diode

Complete details for constructing a multi-purpose a.f.-r.f. probe.

By RUFUS P. TURNER, W1AY
Consulting Eng., RADIO NEWS

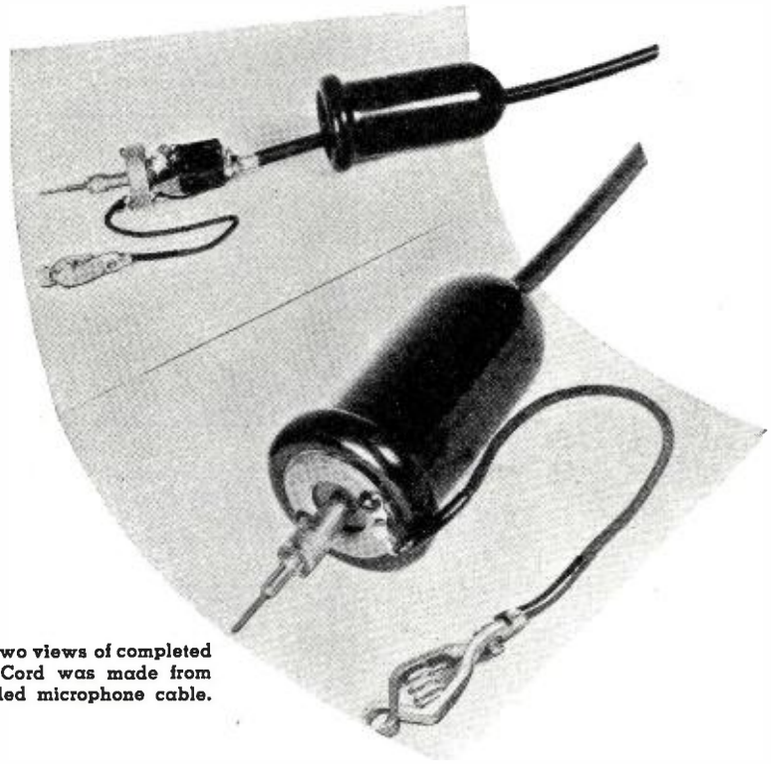


Fig. 1. Two views of completed probe. Cord was made from a shielded microphone cable.

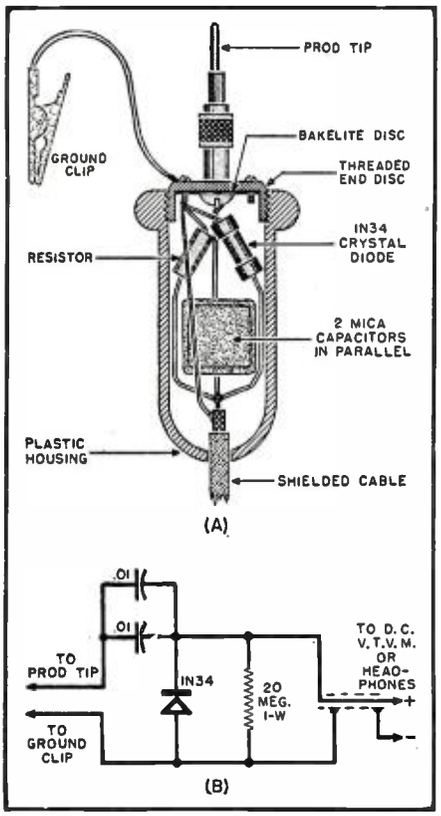


Fig. 2. (A) Structural details of probe. (B) Circuit diagram of probe. In using the IN34 crystal diode, all contact potential effects, common to conventional diode tubes, are eliminated.

A *SYLVANIA* 1N34 germanium crystal diode is the heart of the multi-purpose a.f.-r.f. probe shown in Fig. 1. This device will be useful to experimenters, amateurs, and servicemen. A crystal probe has the advantages that it can be made much more compact than the tube type probe, it requires no power supply of any kind, and it is free from the contact potential effects common to diode tubes. The 1N34 crystal diode may be used entirely safely whenever the inverse peak voltage does not exceed 50 volts.

The shunt capacitance of the 1N34 crystal diode is only 3 $\mu\mu$fd. in contrast to the 15 $\mu\mu$fd. (approximately) of the 6H6 tube ordinarily employed in home-made probes.

The probe illustrated here may be used in radio-frequency and audio-frequency voltage measurements or in a.f. and r.f. signal tracing by connecting its two output leads directly (or through a 1 megohm, 1 watt series resistor) to a d.c. vacuum-tube voltmeter such as the *VoltOhmyst*. Or it may be connected directly to a pair of headphones or to a magic-eye indicator tube. The probe may be used in measuring up to 100 megacycles, and it is provided with an .02 μfd. input capacitor which isolates the crystal from direct current components. The circuit schematic appears in Fig. 2B.

The probe shown in the photograph, is built into the plastic case of a hospital pushbutton. This housing was used because it is unusually rugged, being thick molded, and fits the hand comfortably, having originally been intended to be grasped by a bedridden patient for ringing the nurse call bell. The threaded metal disc through which the pushbutton originally extended was unscrewed from the plastic housing and the switch mechanism removed. A thin bakelite disc (to cover the pushbutton hole) was attached to the inside of the metal disc by means of two 5-40 screws easily seen in Fig. 1. A 6-32 screw passes through a hole drilled in the center of the bakelite disc and holds the prod tip. The cord is a length of shielded microphone cable. Other builders may prefer other types of housings. Much latitude is permissible in this direction. Indeed, the small sizes of the crystal diode and of present-day capacitors and resistors make it possible to reduce the probe size to the dimensions of a jumbo multimeter test prod.

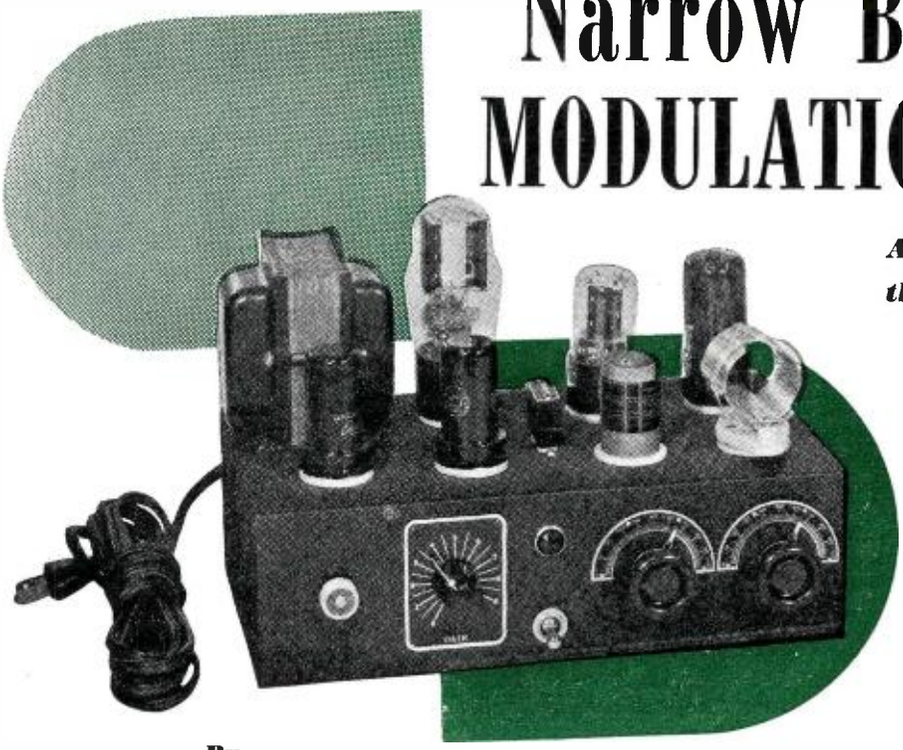
The crystal probe presents a high value of input impedance to the circuit under test. A low capacitance likewise is presented. These desirable characteristics reduce loading and detuning effects. Connected to high-resistance headphones, the probe is invaluable for tracing a signal through a radio circuit or audio amplifier; locating hum, oscillation, or noise; or localizing distortion. Connected to a d.c. vacuum-tube voltmeter or magic eye indicator, the probe makes possible the measurement of r.f. and a.f. voltages with negligible frequency error. It can serve also as a tuning indicator.

Here is a useful accessory which is inexpensive, easy to build, and simple to operate.

-30-

Narrow Band Phase MODULATION EXCITER

An inexpensive exciter unit that can be used to frequency modulate your present rig.



By
SOL STERMAN, W2JWX*
Newark Electric Company, Inc.

Front view of crystal controlled exciter unit shows parts placement. Jacks J_1 and J_2 are mounted on rear flange of chassis.

BELIEVING that many hams will want to incorporate a narrow band phase modulation exciter into their present rigs we are describing this unit which produces the effect of equivalent frequency modulation.

The unit, as shown, is intended to replace a 40 meter crystal or v.f.o. for exciting a transmitter operating in the 26, 11, or 10 meter bands. The crystal oscillator is on 80 meters and the output of the doubler stage is on 40 meters.

This exciter presents several advantages to the amateur. It practically eliminates most cases of broadcast interference; it eliminates the necessity for class B modulators and drivers with their associated power supplies, thus permitting any c.w. transmitter, up to 1 kw. input, to be used for phone transmission in the 10 and 11 meter bands; and input to the final amplifier may be the same as in the case of c.w. ratings.

Theory

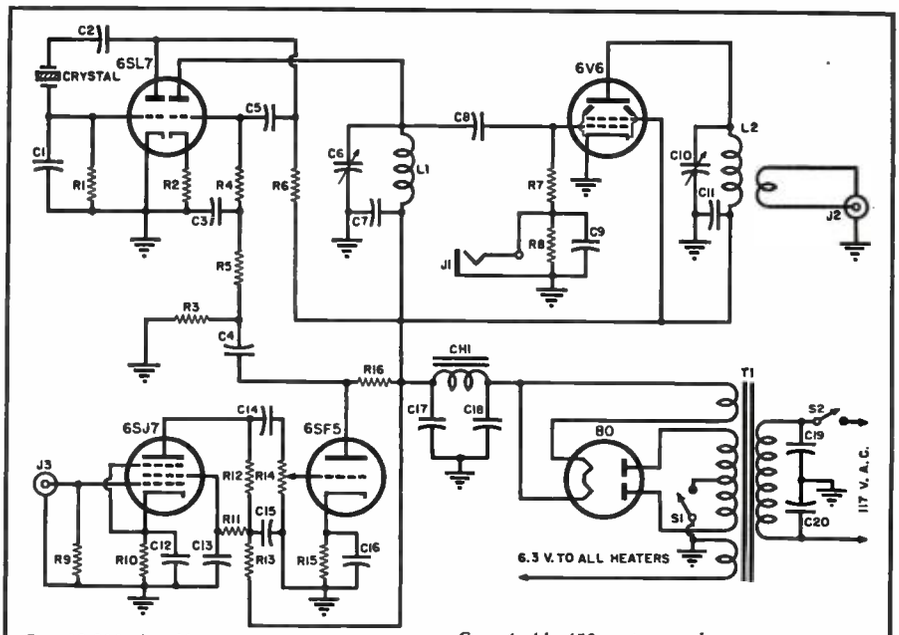
One half of the 6SL7 operates as a conventional Pierce oscillator while the second half is the phase modulator. This dual purpose tube is followed by a straightforward doubler. The two high gain audio stages are also conventional.

The output of the crystal oscillator is coupled by means of C_5 to the grid of the phase modulator section of the 6SL7 whose tank circuit is tuned to the crystal frequency. In this half of the 6SL7, r.f. is fed from the grid to the plate in two ways. One is by direct grid-to-plate capacity and the other by the electronic amplification of the triode. Degeneration due to the high unbypassed resistor in the cathode circuit keeps these two voltages nearly equal and slightly less than 180 degrees out-of-phase. The magnitude of the electronically amplified voltage will vary as the bias is varied by the audio input through C_4. This action changes the phase relationship between these two voltages and causes a current which is varying in phase to flow in the tank circuit.

The deviation produced by phase

(*Continued on page* 118)

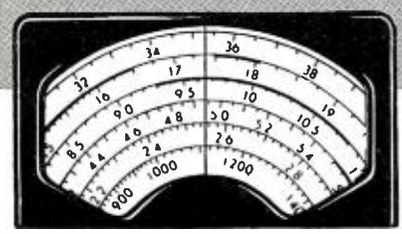
Schematic diagram of exciter unit. Either a crystal or dynamic mike can be used.



R_1—20,000 ohm, ½ w. res.
R_2—30,000 ohm, ½ w. res.
R_3, R_7, R_{16}—100,000 ohm, ½ w. res.
R_4—50,000 ohm, ½ w. res.
R_5, R_{12}—250,000 ohm, ½ w. res.
R_6—50,000 ohm, 1 w. res.
R_8—1000 ohm, ½ w. res.
R_9—5 megohm, ½ w. res.
R_{10}—1500 ohm, ½ w. res.
R_{11}—1.5 megohm, ½ w. res.
R_{13}—10,000 ohm, ½ w. res.
R_{14}—200,000 ohm pot.
R_{15}—2500 ohm, ½ w. res.
C_1—50 μμfd. mica cond.
C_2, C_3, C_7, C_9, C_{11}—.002 μfd. mica cond.
C_4, C_{14}—.01 μfd., 400 v. cond.
C_5, C_6—100 μμfd. mica cond.
C_8, C_{10}—50 μμfd. midget var. cond.
C_{12}, C_{16}—10 μfd., 25 v. elec. cond.
C_{13}—.1 μfd., 400 v. cond.
C_{15}—4 μfd., 450 v. elec. cond.
C_{17}, C_{18}—Dual 8/8 μfd., 450 v. elec. cond.
C_{19}, C_{20}—.05 μfd., 400 v. cond.
J_1—Open circuit jack
J_2, J_3—Female connectors
S_1—S.p.s.t. toggle sw.
S_2—S.p.s.t. sw. on R_{14}
CH_1—8 hy., 60 ma. filter choke
T_1—Power trans. 300-0-300 v. @ 60 ma.; 5 v. @ 2 amp.; 6.3 v. @ 2 amp.
L_1—46 t. #28 e., winding length 1" wound on 1" coil form (National XR-1)
L_2—40 meter end linked output coil (B & W type 40 JEL)
Crystal—See text
1—6SL7 tube
1—6SJ7 tube
1—6SF5 tube
1—6V6GT tube
1—80 tube

* The design of this exciter unit is based upon original circuits developed by the Fred M. Link Company of New York.

International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

THIS month's ISW Department is dedicated to The Czech Radio. Direct from M. Gregorova, Foreign Relations Department, The Czechoslovak Broadcasting Corporation, Praha XII, Stalinova 12, Prague (Praha), Czechoslovakia, we have just received a most interesting booklet (in *English*) dedicated to "listeners abroad," and bearing the title: *"The Czechoslovak Radio in War and Revolution."*

Here are some highlights from the booklet:

"The Broadcasting Company played a leading and often decisive part in the Prague Rising in May 1945. The call of the revolutionary announcers was one of the first and most authoritative calls to arms to the Czech nation in Prague and in the country. Broadcasting House in Stalinova trida, Prague, was heavily damaged inside and the inevitable repairs will take several months. In spite of this, there was feverish activity as the task of free broadcasting was expanding. Broadcasting House was sanctified by the blood of those who had come to the aid of the Broadcasting Company on May 5th, who had fought bravely inside the building and in the surrounding streets, and of whom more than one hundred had fallen in the struggle, and many had been wounded and some have been in hospitals for many months.

"The Prague Broadcasting Company has today employees who had been suffering for years under the Nazi boot—but they had been working in illegal movements, had fought and remained at their technical stations, in the studios and everywhere where they had been needed in the center of Broadcasting House and other stations, they had remained in close touch with faithful companions from the trunk exchange and broadcasting stations, that is with the postal employees. They carried on everywhere, regardless of bombing and shooting. They now work again together with their new colleagues of the Czechoslovak Broadcasting Company, who had fought and worked abroad, separated from their families for the last few years, who had been broadcasting or taking part in other related branches of the resistance movement abroad, for the liberation of the Czechoslovak people and the Republic. Many of those who have come back have not found their dear ones, for they had had to sacrifice their lives and starve in concentration camps for the courage of their relations. The Czechoslovak Broadcasting Company today also incorporates the great organization of 'Soldiers of the Czechoslovak Broadcasting Company' and protects the flag of the 'Broadcasting Battalion' of the Tyrs and Fugner Infantry Regiment 28, forever called after the heroes who defended Broadcasting House. When the building has been repaired, a marble disk commemorating all those employees who were executed or martyred and who fell during the May Revolution in the Battle for Broadcasting House, will be affixed over the entrance.

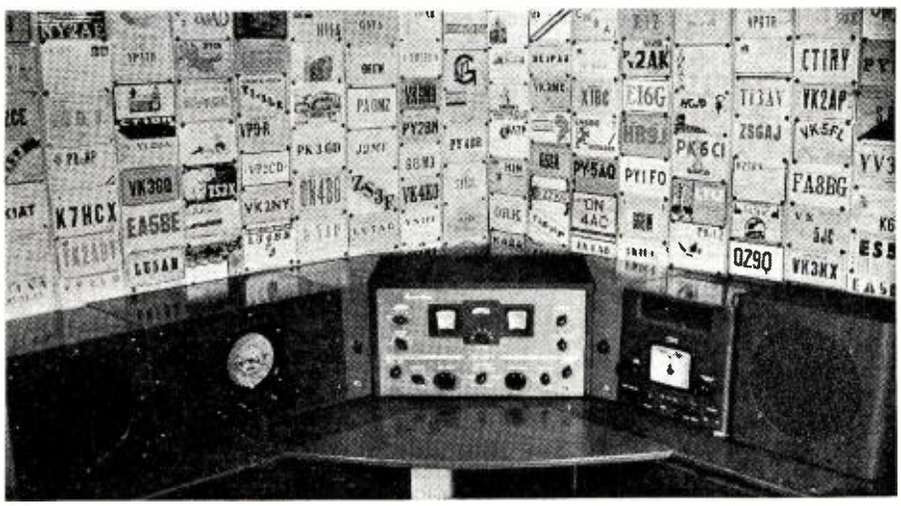
"The last German announcement to be broadcast on May 5 was the 'Unterhaltungsmusik' which the Czech announcers allowed the German announcer to make just before noon, after long discussions and constant threats by the German chiefs. After that, announcing was completely taken over by Czech announcers, even though the German intendant threatened them with immediate shooting. One of the greatest provocations, which strengthened the tension, was the very quick reading of the last news bulletin, when a unit of the Czech police entered the building. Outside Czechoslovak flags were beginning to come out.

At about 12:15 the Czechoslovak and American flags were flown on the mast of Broadcasting House; at the attempt to fly the British and Soviet flags, the Germans opened fire. The first revolutionary announcement was a call to the Czech police, the Czech gendarmes, and the Government Militia to come to the aid of the Broadcasting Company, as the Germans were murdering Czech people there. This was at about 12:33, and was one of the most powerful and most decisive signals of the national revolution. From the whole of Prague and the nearby countryside individuals and groups of determined Czechs started off to help their comrades in Broadcasting House. Many unarmed and inexperienced patriots were wounded by German assassins on the way. The battle in the wider circle round the building continued throughout the whole revolution until the coming of the Red Army, the battle in the building itself ended with the defeat of the Germans on the evening of the first day, after a battle of several hours during which Czech patriots fought from floor to floor, entering the building by the only free side entrance and over the roofs of the neighbouring houses.

"Of the later coordination of the revolutionary military forces and of the determination of the people of Prague, bears witness by the fact that, in the most difficult moments on Sunday, the tankists from industrial

(*Continued on page* 141)

This attractive corner is the SW Listening Post of Harry Kentzel, Sand Lake, New York. Receiver (center) is a new Hammarlund HQ129X.



Deluxe Amateur TRANSMITTER

By JAMES N. WHITAKER, W2BFB
Eng. Dept., Hammarlund Mfg. Co.

Part 2. Concluding article covering the design principles for a 1-kw. amateur type transmitter.

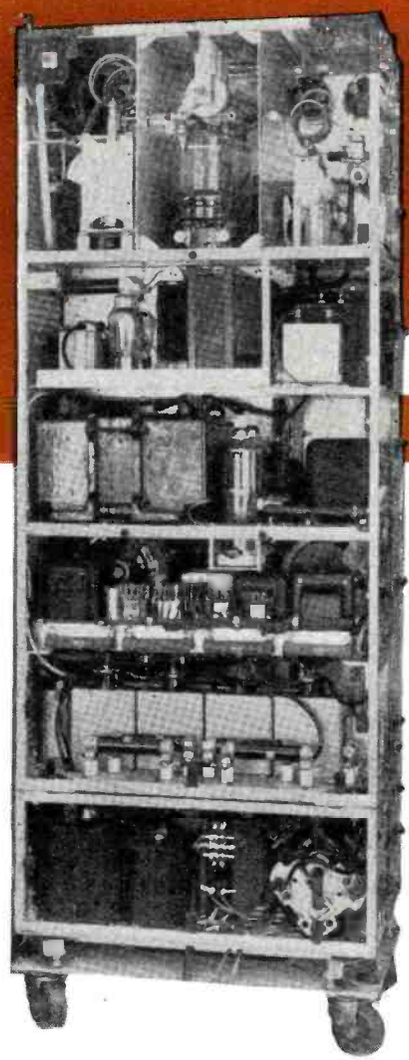


Fig. 1. Rear view of transmitter. Front view of this unit was shown last month.

IN CONTINUING the discussion of deluxe amateur transmitter design begun last month, we would like to point out to our readers that the circuit diagram for the complete transmitter was given in the April installment, along with a discussion of the oscillator and frequency multiplier stage. Reference .should be made to this discussion before proceeding to a consideration of the driver stage.

Driver Stage

The driver stage uses a 4E27 beam tetrode in a more or less conventional amplifier circuit. When using a tube of this type it is well to observe the manufacturer's recommendations for maximum grid drive. This value should never be exceeded, and satisfactory operation will generally be obtained with driving power considerably below the maximum permitted. In the present instance it was found that the grid current should not exceed 0.3 ma. for optimum operation. With this value of grid drive the 4E27 tube is capable of delivering approximately 225 watts of r.f. power to the final amplifier. The plate and screen grid power for the driver stage is obtained from the high voltage power supply which supplies plate power to the final amplifier. The full potential is applied directly to the anode of the tube while the screen grid potential is applied to the tube through a 100,000 ohm resistor. A 1200 ohm cathode biasing resistor is connected between the filament center tap and ground to provide normal operating bias for the tube. A 250,000 ohm grid resistor is also used to prevent excessive grid current when the plate potential is reduced and the drop across the cathode biasing resistor decreases correspondingly.

There has been much controversy regarding the use of the new beam type of tubes versus a neutralized triode. Unquestionably much of the reluctance to incorporate these new and wonderful tubes in equipment is due largely to a lack of understanding as to just how they may be satisfactorily incorporated in the equipment. The general complaint seems to be the difficulty in eliminating the tendency toward self-oscillation.

In designing any equipment using a beam tube, always bear in mind the fact that the power sensitivity of this new type of tube exceeds by far the power sensitivity of any tube heretofore known. It is this extremely high power sensitivity that makes this tube so highly desirable, and at the same time so apparently difficult to operate satisfactorily.

In order to successfully design an amplifier using a high-powered beam tube, it is extremely important to bear in mind that a very small amount of feedback, which in a triode amplifier would be practically undetectable will be a very serious amount indeed for a high gain beam tube.

The isolation of the input and output circuits must be as nearly perfect as possible. The r.f. bypassing must be complete with all leads as short as possible. Each filament terminal must be bypassed directly to the chassis as close to the socket terminal as possible. The screen grid must be bypassed to the filament terminals as well as to the chassis, and if the suppressor grid is not directly connected to the filament, it must also be bypassed directly to the filament as well as to the chassis.

If the isolation between input and output circuits is complete, the amplifier will operate as smoothly as a conventional neutralized triode amplifier and the driving power required will be almost unbelievably small compared to the power required to drive any other type of amplifier having an equivalent power output.

If the designer is unable to eliminate feedback entirely, there are several ways to suppress spurious oscillations. One way is to insert a 50 ohm, non-inductive resistor in the screen grid circuit, between the screen grid terminal and the bypass condenser. Another method is to insert a 50 ohm resistor (around which has been wound eight or ten turns of wire forming a small inductance shunted by a 50 ohm resistor) in the grid or plate circuit.

Any of these suppression methods are subterfuges, serving to remove the symptoms rather than the ailment, and are, in reality, an admission that the equipment has not been properly designed.

It is possible to obtain satisfactory operation from a triode amplifier when departing widely from the manufacturer's recommended ratings regarding driving power, grid bias, and plate voltage.

In a beam power amplifier, such departures are a direct invitation to trouble, and should be attempted only by those completely familiar with every detail of the operational theory of a beam tube. Perhaps one of the most difficult things for the amateur to grasp is that the grid drive must be kept well within the maximum limits specified by the manufacturer

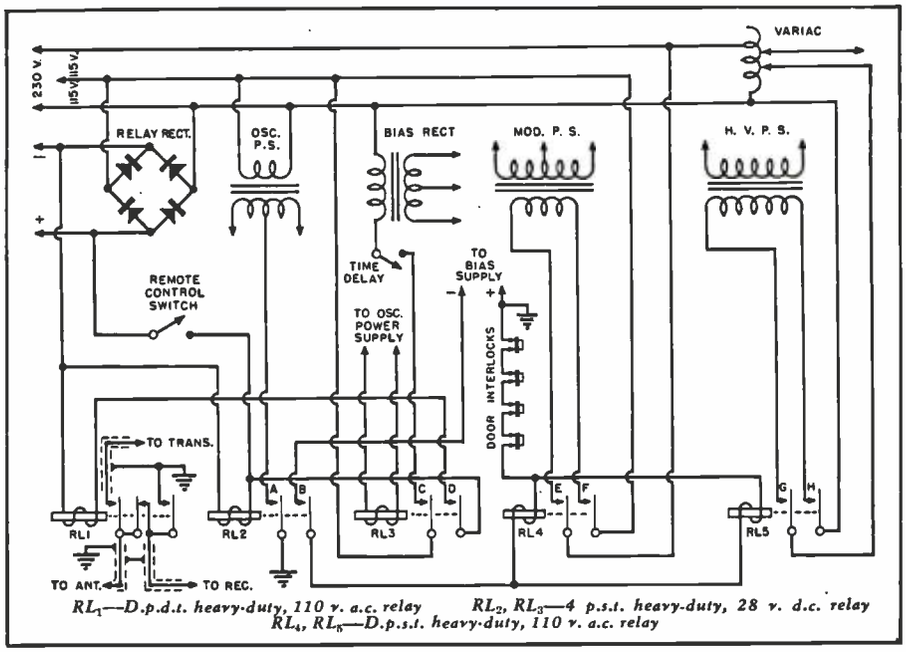


Fig. 2. Complete schematic diagram of remote control system. A copper oxide rectifier supplies power for the remote control relay and the antenna changeover relay.

of the tube. Excessive grid drive can not be tolerated by a beam tube regardless of other operating conditions, and the most satisfactory operation is generally obtained with a grid current of less than one milliampere. The manufacturer's maximum grid current rating is generally the maximum permissible current which will not damage the grid structure or cause sufficient heating of the grid leads to crack the glass seal.

Power Amplifier Stage

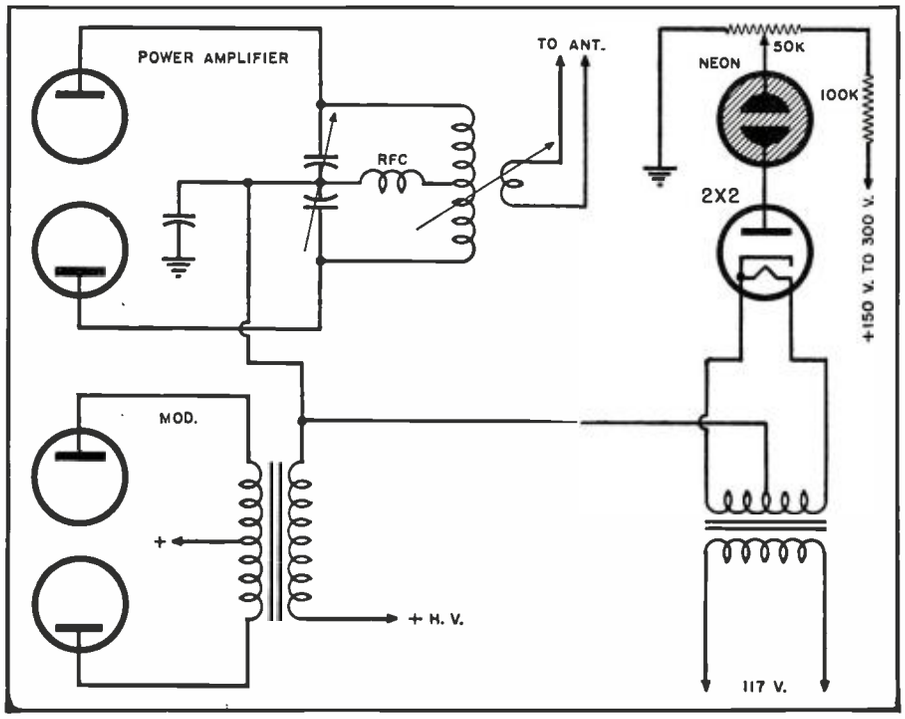
A rather wide selection of tubes is available for use in the power amplifier stage. The choice of tubes depends largely upon the efficiency desired and the power output needed. Since the 4E27 driver stage is capable of supplying sufficient power to drive almost any 1 kw. amplifier stage, any tube or tubes of sufficient power capabilities may be used. One point to bear in mind is that amateur transmitters are limited to a maximum plate input of 1000 watts. For this reason one must consider the efficiency of the final amplifier rather than economy of tubes in order to obtain the greatest possible power output with the permissible input. In order to obtain the best possible efficiency it is necessary to use tubes capable of considerably more power than is required. Another very good reason for using relatively high powered tubes is that the output need not be decreased in order to obtain satisfactory high-level modulation. This is not necessarily the most economical way to design a transmitter but it is the most satisfactory way of obtaining a maximum power output from a given input.

The power amplifier stage in a telephone transmitter should be a push-pull stage in order to discriminate against second harmonic radiations. Some objection may be raised because of the possibility of a third harmonic radiation from a push-pull amplifier but these radiations are never as serious as the second harmonic radiations because of discrimination against the higher frequencies in both the plate tank and antenna circuits.

In designing the power amplifier it is important to consider very carefully some arrangement for completely shielding the input and output circuits from each other and from the rest of the transmitter. The most satisfactory method of shielding is to arrange the power amplifier so that the input circuit, the tubes, and the output circuit are effectively in separate compartments with the neutralizing system in the compartment with the tubes. It will be found that with this arrangement the nearest approach to true neutralization is obtainable. If the shielding is not complete, the apparent neutralization will not be true neutralization since a certain amount of input-output coupling will be compensated for in the neutralizing. When this occurs there is danger of feedback, parasitic oscillations, and various other difficulties when the plate power, grid drive, or output coupling is changed. This is a condition which most commonly produces parasitic oscillations during modulation peaks which is easily understood when one remembers that high-level modulation actually varies the input power to the amplifier in accordance with the applied modulating power.

In a push-pull amplifier it is necessary to very carefully design the circuits to provide equal grid driving power to both tubes. The plate loading must also be equal. In practice it is very difficult to design a center tapped coil in such a way as to obtain a perfect electrical balance in each half of the coil. This may not be too serious at frequencies below 14 mc. but at higher frequencies irregularities which are almost unnoticeable may produce a serious unbalance. For this reason it is well to depend on a split stator tuning capacitor to provide electrical center tap rather than to bypass the center tap of the coil to ground. Tuning capacitors are manufactured to very close tolerances and are generally assembled with the aid of very accurate jigs and therefore, for all practical purposes, may be

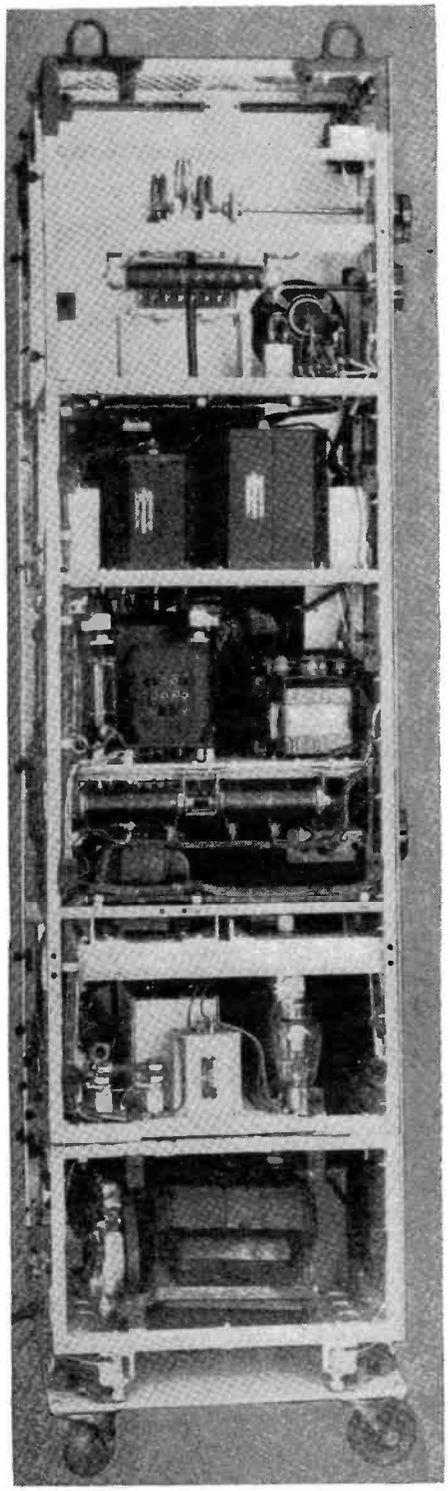
Fig. 3. Schematic diagram of the negative peak over-modulation indicator. The neon bulb flashes, indicating when a predetermined modulation percentage is reached.



considered as being perfectly balanced electrically as well as mechanically insofar as capacity is concerned.

Any tuned r.f. circuit is more efficient when the tuning capacitor is connected directly across the inductance. In order to do this it is usually necessary to insulate the rotor of the variable capacitor from ground instead of grounding the rotor section and connecting one side of the inductance to the rotor through a fixed capacitor. This is more important in the higher power stages because of the higher circulating currents but it is important in any stage since there is always a certain amount of loss in even the highest grade of mica capacitors. This is also important in high power stages as it prevents grounding the high voltage power supply in the event that a flash-over of the capacitor occurs.

Fig. 4. Left side view of transmitter.



The antenna coupling circuit should be variable by means of a dial or knob accessible from the front panel. The number of turns and diameter of the coupling coil will depend upon the method of feeding the antenna and if the connection to the transmitter is by means of a coaxial transmission line, the coupling coil will be smaller or will contain fewer turns than if a higher impedance line is used. Where the same antenna is to be used for the receiver and the transmitter, the antenna changeover relay should be mounted inside the transmitter and as close as possible to the coupling coil. The relay and the connection should be adequately shielded from the power amplifier plate tank circuit. The location of the antenna changeover relay adjacent to the output coupling coil is very important where coaxial transmission line is used. If the relay is located outside the transmitter, it will cause a discontinuity of impedance which may result in serious standing waves along the transmission line.

Power Supply System

The power supply systems for a high-powered transmitter do not necessarily have to be complicated. Primary consideration should be given to designing the power supplies so that there will be a minimum of reaction between stages. This is particularly true of the reaction between the oscillator and the amplifier stages. It is always well to provide a separate power supply for the oscillator and multiplier stages rather than to attempt to use a common power supply for the entire transmitter. It is also well to use some sort of voltage regulation in the oscillator power supply although this is not absolutely necessary when using the oscillator circuit previously described. It should not be necessary in any case to use an elaborate vacuum tube voltage regulator. A regulator tube such as the OD3/VR150 or two such tubes connected in series should be ample. The intermediate or driver amplifier and the final amplifier may be operated successfully from a common power supply. It is very desirable to do this where a variac or some other means of primary power control is used.

The class "B" modulator tubes should be operated from a separate power supply unless the main power supply has unusually good regulation and the class "B" modulator tubes are operated with zero bias. Where grid bias is required for the modulator tubes a power supply should be provided to supply this bias and this power supply should be very heavily loaded to prevent a change in bias due to varying grid current.

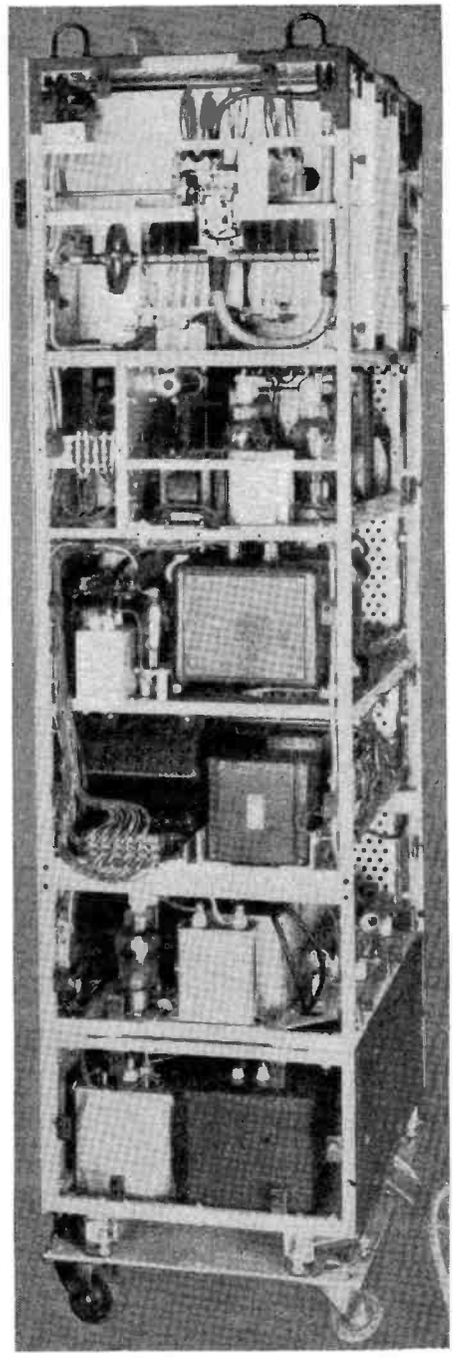


Fig. 5. Right side view of transmitter.

In the transmitter being described a small power supply provides the power for both the oscillator and multiplier stages. The main high voltage power supply provides power for the driver and final amplifier stages. The main power supply is equipped with a variac in the primary circuit to permit easy adjustment of the input power. The class "B" modulator stage has its own power supply and a bias rectifier system provides 60 volts of negative bias for the modulators. The bias supply is loaded with a 250 ohm resistance causing a normal drain of approximately 0.24 amperes. This high bleeder current assures a minimum of fluctuation in the bias supply due to the varying grid current of the modulator tubes. The bias supply also provides power for some of the relays.

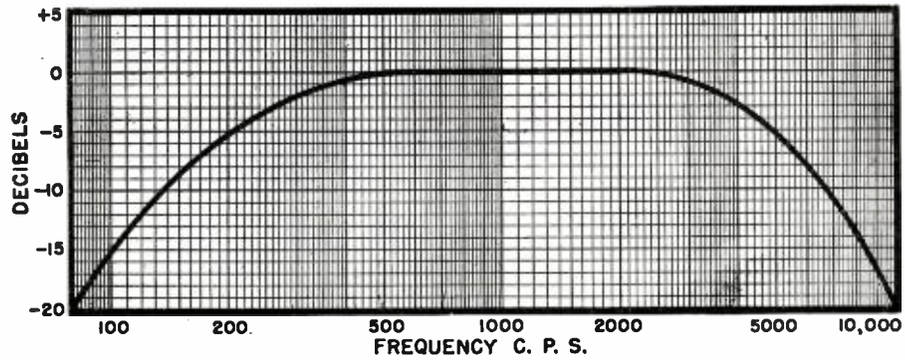


Fig. 6. Audio response curve of speech amplifier. Note that the output falls off rapidly below 300 cycles and over 3000 cycles. This is ideal for voice transmission.

Remote Control System

A positive acting remote control system should be provided in any transmitter in order that the transmitter may be started and stopped from the operating position by means of a toggle switch or other simple device.

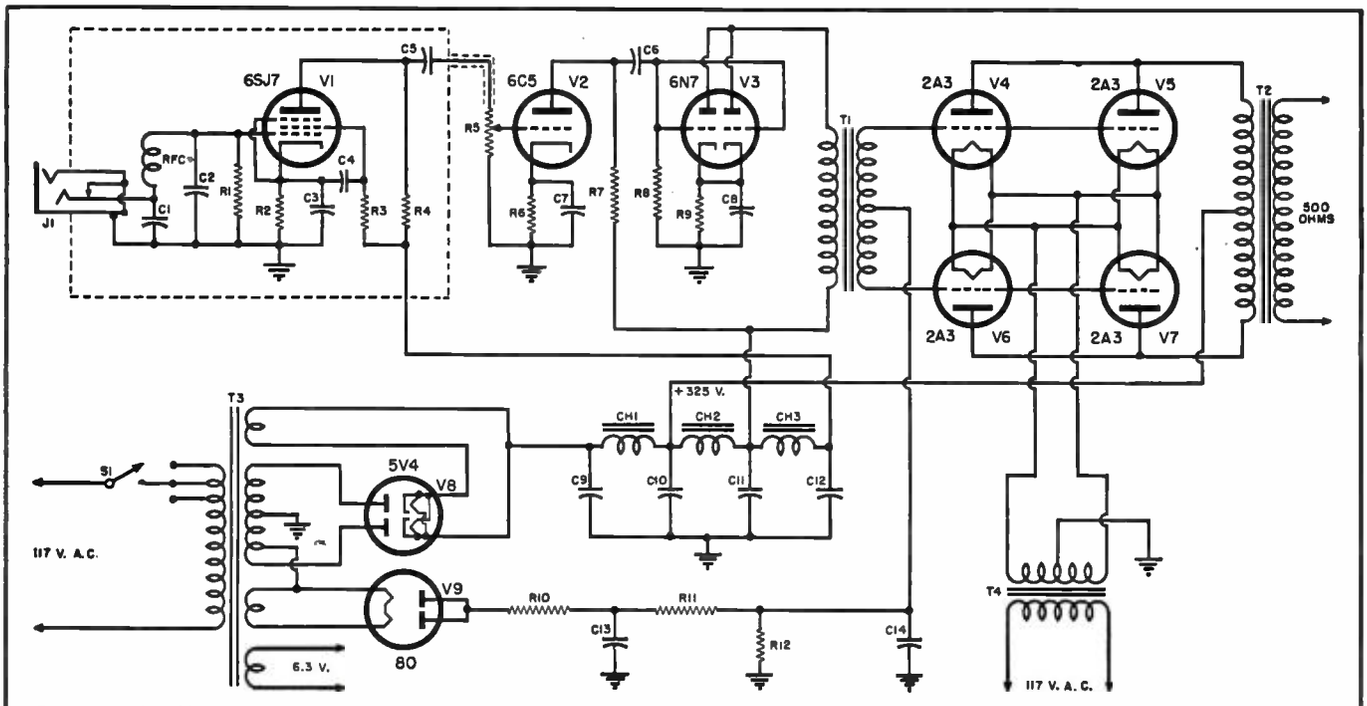
A number of relay combinations may be worked out to suit the particular installation once the proper sequence of operations has been determined. The system should provide a means for applying power to the various parts of the transmitter in such a sequence as to prevent the application of power to the power stages in the transmitter before power has been applied to the oscillator and multiplier stages. It must also provide means of transferring the antenna from the receiver to the transmitter before power is applied to the final stages. The system must also provide a means for removing the power from the final stages before the power is removed from the oscillator and multiplier stages and sufficient time must elapse between the removal of the power from the final stages and the operation of the antenna changeover relay to assure that there will be no power in the antenna circuit when the antenna changeover relay is operated.

The control system in the transmitter being described uses a total of five relays for performing all operations. A copper oxide rectifier supplies power for the remote control relay and the antenna changeover relay. The circuit is shown in Fig. 2.

Relay RL_2 is the remote control relay, receiving its power from the copper oxide rectifier, through the remote control switch. The operating coil of relay RL_3 is connected in the oscillator power supply circuit as a filter section, and receives power when the oscillator power supply is energized. Power for relays RL_4 and RL_5 is obtained from the bias supply, through contacts B of relay RL_2.

The operation of the system is as follows: When the remote control switch is closed, relay RL_2 operates, closing contacts A and B. Contacts A are in the center tap of the oscillator power supply transformer. When these contacts close, the power builds up in the oscillator power supply, energizing the operating coil of relay RL_3. Relay RL_3 operates closing contacts C and D. Contacts C close the primary power circuit of the bias supply, through the time delay switch, and contacts D operate the antenna changeover relay. When the power builds up in the bias supply, relays RL_4 and RL_5 operate, since contacts B of relay RL_2 are closed. When contacts E, F, and G, H of relays RL_4 and RL_5 close, power is applied to the modulator and the main high voltage supplies, and the transmitter is in operation.

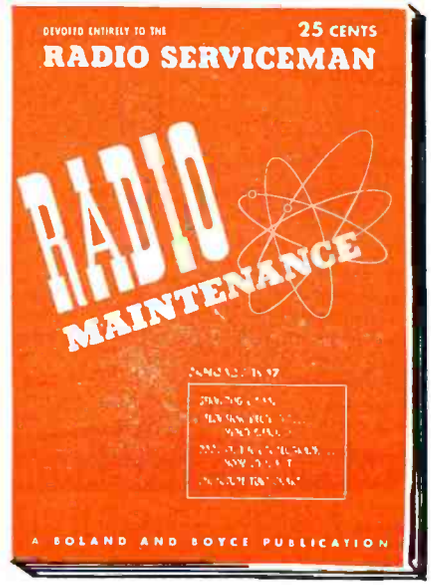
Fig. 7. Schematic diagram of speech amplifier. The unit has an over-all gain of 100 db. and an undistorted output of 31 watts.



R_1—5 megohm, ½ w. metalized res.
R_2—1500 ohm, ½ w. metalized res.
R_3—2 megohm, ½ w. metalized res.
R_4—500,000 ohm, 1 w. metalized res.
R_5—250,000 ohm pot.
R_6—5000 ohm, 1 w. metalized res.
R_7—100,000 ohm, 1 w. metalized res.
R_8—250,000 ohm, 1 w. metalized res.
R_9—800 ohm, 1 w. metalized res.
R_{10}—2000 ohm, 20 w. w.w. res.
R_{11}—4000 ohm, 20 w. w.w. res.
R_{12}—2500 ohm, 20 w. w.w. res.
C_1, C_2—100 μμfd. mica cond.
C_3, C_7, C_8—8 μfd., 50 v. dry elec. cond.
C_4, C_6—.01 μfd., 400 v. mica cond.
C_5—.002 μfd., 600 v. mica cond.
C_9—6 μfd., 1000 v. Dykanol or Pyranol cond.
C_{10}—10 μfd., 600 v. Dykanol or Pyranol cond.
C_{11}, C_{12}—125 μfd., 350 v. elec. cond.
C_{13}—3 μfd., 600 v. Dykanol or Pyranol cond.
C_{14}—50 μfd., 50 v. dry elec. cond.
RFC—1.5 mh. pi-wound r.f. choke
CH_1—15 hy., 300 ma. filter choke
CH_2, CH_3—25 hy., 50 ma. filter choke
T_1—Audio trans. Single plate to P.P. grid
T_2—Output trans. P.P. plate (1500 ohms plate-to-plate) to 500 ohm line. 35 watt output
T_3—Power trans. 475-0-475 (77 v. tap) @ 300 ma.; 6.3 v. @ 5 amps.; 5 v. @ 3 amps.; 5 v. @ 3 amps.
T_4—Fil. trans. 2.5 v. c.t. @ 10 amps.
J_1—Input jack
S_1—S.p.s.t. toggle sw.
1—6SJ7 tube
1—6C5 tube
1—6N7 tube
1—5V4 tube
1—80 tube
4—2A3 tubes

NEXT MONTH
IN RADIO MAINTENANCE

June Issue



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As we have shown, the sequence of operation is as follows: The oscillator power supply comes up first, then the antenna changeover relay operates, then the bias supply comes up, and finally the power comes up in the modulator and p.a. power supplies.

When the transmitter is shut down, the remote control switch removes the operating power from relay RL_4, which immediately opens contacts A and B of relay RL_2. Contacts B of relay RL_2 open, removing operating power from relays RL_4 and RL_5, causing contacts E, F, G, H to open, removing the primary power from the modulator and main power supply.

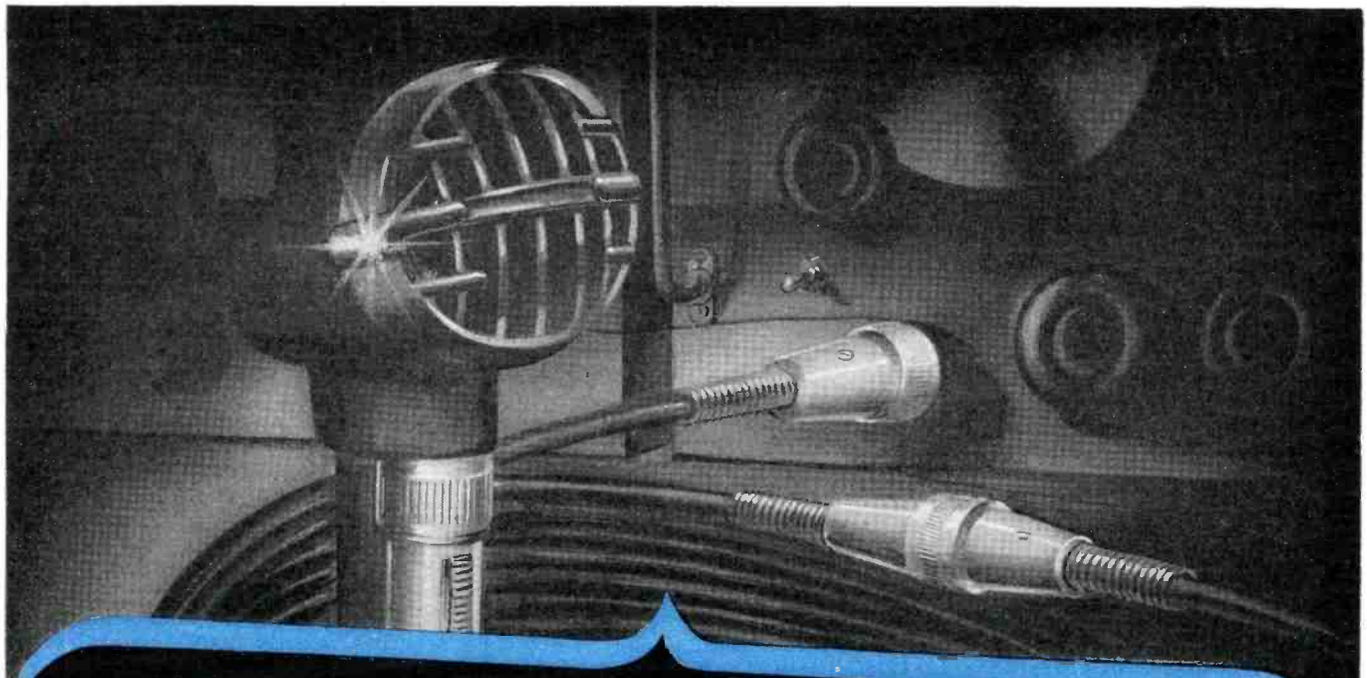
As the power in the oscillator power supply dies down, the operating coil of relay RL_3 is de-energized, permitting contacts C and D to open. The opening of contacts C removes the power from the bias supply, and the opening of contacts D operates the antenna changeover relay RL_1.

From the above, we find that the sequence of operation for shutting down the transmitter is not exactly in the reverse of the starting sequence, but is as follows: The oscillator and all high voltage power supplies are shut off simultaneously; then the antenna relay operates and the bias supply is shut off after the oscillator power supply dies down, whereas in starting up, the oscillator power comes on, then the bias comes on and the antenna changeover relay operates, and lastly the high voltage power supplies come on.

With this arrangement, failure of the bias supply will remove the high voltages, and failure of the oscillator supply will shut down the entire transmitter. In this manner, the tubes are all protected from loss of bias, and from loss of excitation due to oscillator power supply failures.

Over-Modulation Indicator

Any transmitter used for telephony should be equipped with a very positive means for indicating over-modulation. An indicator which shows average modulation is not satisfactory for voice operation because of peaks which occur in normal voice frequencies. In order to be certain that serious over-modulation does not occur during the peaks of the voice frequencies, the over-modulation indicator must indicate over-modulation peaks. When an r.f. amplifier is fully modulated, the plate voltage swings from zero to twice the normal value. When over-modulation occurs the plate voltage will actually swing from a negative value to more than twice the normal positive value. Because of this action a negative peak over-modulation indicator may consist of simply a high voltage rectifier and a neon glow lamp as shown in Fig. 3 with a bias voltage applied between the neon lamp and ground. The rectifier filament supply transformer should be insulated for approximately three times the normal plate supply voltage of the transmitter. The filament of the rectifier is connected to the side of the



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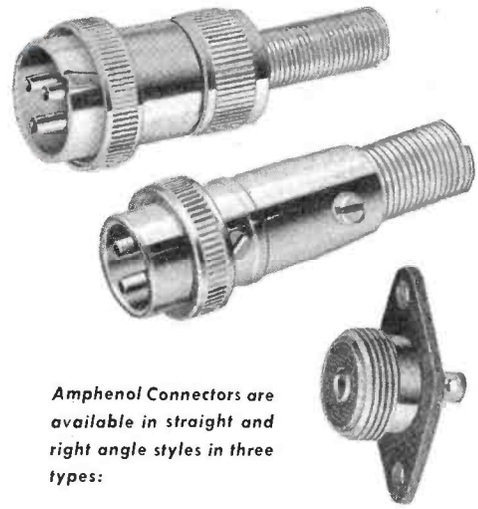

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SERIES 91: Three and four contact microphone style, used on all types of portable apparatus. Since 1934, the standard of the sound industry.

SERIES 80: For standard single and two wire shielded cables such as: coaxial and microphone cables, twisted pairs, concentric lines, photo cell leads, etc.

SERIES 75: For standard single conductor shielded cable. Widely used in amplifiers, transmitters, photo electric devices, home recorders and similar equipment.

AMERICAN PHENOLIC CORPORATION
1830 South 54th Avenue • Chicago 50, Illinois

AMPHENOL

COAXIAL CABLES AND CONNECTORS • INDUSTRIAL CONNECTORS, FITTINGS AND CONDUIT • ANTENNAS RADIO COMPONENTS • PLASTICS FOR ELECTRONICS

modulation transformer secondary which feeds power to the modulated amplifier. The plate of the rectifier tube connects to one side of an ordinary neon glow lamp. The other connection to the neon glow lamp is to a positive bias. Since the starting voltage of the standard neon glow lamp which is on the order of 30 to 50 volts has been overcome by a biasing voltage, the glow lamp will flash on over-modulation peaks which are hardly detectable by any other means.

The current drawn by a standard neon lamp is very small, and therefore a bias adjusting potentiometer of 50,000 ohms is satisfactory. The bias potential may be taken from any convenient low voltage source such as the oscillator power supply.

With the main high voltage power supply off, adjust the neon bias to a value where the lamp just starts to glow.

With this adjustment, the lamp will flash whenever a modulation peak reaches exactly 100%, regardless of the plate voltage applied to the r.f. amplifier.

If the bias is not used, the over-modulation indicator will be less accurate, but will still be quite satisfactory for use where the d.c. plate potential applied to the r.f. amplifier is 1000 volts or more. If the starting voltage of the neon lamp is 50 volts, and the d.c. plate potential applied to the r.f. amplifier is 1000 volts, the lamp will flash when the peak modulating voltage becomes negative by a value of 50 volts, representing 5% over-modulation on a peak, which can be tolerated. The percentage of over-modulation detectable with an unbiased neon lamp system becomes increasingly less as the d.c. plate potential applied to the r.f. amplifier is increased, and will be 2.5% for a d.c. plate potential of 2000 volts, 1.6% for 3000 volts, etc.

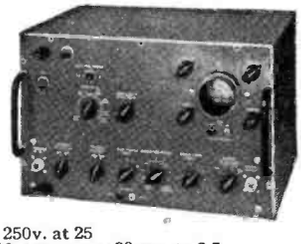
Speech Amplifier

The speech amplifier in a large transmitter should be a separate unit and should be connected to the transmitter proper by means of a standard 500 ohm line. The amplifier should have sufficient gain to permit the use of any of the commercially available crystal microphones. The noise output from the amplifier should be at least minus 60 db. The audio frequency response of the amplifier should not be flat. Since we are interested only in voice frequencies, those frequencies below 200 cycles and above 3000 cycles should be appreciably attenuated. This may be conveniently accomplished by the proper selection of coupling capacitors and resistors in the amplifier without the use of special filter circuits. The amplifier designed for use with the transmitter described has a gain of 100 db. and has an undistorted output of 31 watts. The noise level with the gain control full on and the microphone disconnected is approximately minus 70 db. The audio response as is indi-

(*Continued on page* 165)

RHS TELEVISION—SCOPE—POWER EQUIP'T

NAVY MODEL Q SYNCRO-OSCILLOSCOPE



105 - 120v. - 60 cyc. operation
Sweeps: 4, 15, 250, 1000 micro-second triggered sweeps, 25 to 3000 cps. saw-tooth sweeps.
Trigger output: +150 or —75 volts, 100 to 3200 cps.
Trigger input: +10 to 150 volts.
Sawtooth-output: 250v. at 25 to 3000 cps. Amplifier response: 30 cps. to 2.5 megacycles. Grey wrinkle enamel cabinet, 9 tubes including 2AP1 scope tube.
Used as a regular scope plus the advantage of observing high speed wave shapes as in pulse and television work.
COMPLETE with tubes, cables and carrying case.....**$89.50**

OIL CONDENSERS: G.E., AEROVOX, CD., etc.

1 mfd. 600v....	$0.35	.5 mfd. 2000v....	$2.10
2 mfd. 600v....	.60	1 mfd. 2000v....	.95
4 mfd. 600v....	.75	2 mfd. 2000v....	2.10
8 mfd. 600v....	1.10	3 mfd. 2000v....	2.95
10 mfd. 600v....	1.40	4 mfd. 2000v....	3.95
1 mfd. 1000v....	.90	15 mfd. 2000v....	4.95
2 mfd. 1000v....	1.05	12 mfd. 3000v....	6.95
4 mfd. 1000v....	1.10	05 mfd. 3000v....	1.95
8 mfd. 1000v....	2.00	25 mfd. 3000v....	2.95
10 mfd. 1000v....	2.40	1 mfd. 3000v....	3.50
15 mfd. 1000v....	2.60	1 mfd. 5000v....	6.85
20 mfd. 1000v....	5.95	2 mfd. 4000v....	7.60
24 mfd. 1500v....	8.95	1 mfd. 7000v....	3.95

TRANSFORMERS—115v ac 60 cyc

Hi-Voltage Insulation

6500v at 4 ma.....	$ 9.95
6000v at 2 ma.....	7.95
3950v at 4 ma. tap at 1250v-1 ma.....	7.50
3710v at 10 ma.; 2.5v at 3A; 2.5v at 3A.....	9.95
2500v at 10 ma.....	6.50
Xformer, 1600v at 4ma., 700v ct at 150ma., 6.3v at 8A. 115 v 60 cyc.....ea.	8.50
442-0-442v at 1000 ma.....	9.95
2.5v. at 10 amps. 10 KV test.....	3.25
6.3v at 6.6. amps.....	3.25
6.3v at 21.5 amp.; 2.5 at 2 amp.; 6.3 at 2 amp.	6.95
2.5v at 3 amp. 15 KV test.....	3.95
5v at 115 amp.....	14.95
5v at 190 amp. 35 KV test.....	17.50

FILTER CHOKES— HI-VOLTAGE INSULATION

12 Hy.—100 ma.....	$2.35	12 Hy.—300 ma.....	$3.95
4 Hy.—250 ma.....	3.95	15 Hy.— 30 ma.....	1.95
10 Hy.—150 ma.....	3.95	20 Hy.— 90 ma.....	2.25
4 Hy.—600 ma.....	5.95	.006 Hy.—5 amps....	6.95
15 Hy.—100 ma.....	2.95	10 Hy.—250 ma.....	2.49

NATIONAL DRIVE UNIT ONLY

PW-O or NPW-O.....**$2.95**

RELAY

Sigma No. 4RJ 2000 ohms SPDT. Can adjust to to less than 1 ma.....**$1.98**

TUBES (Brand New) ARMY-NAVY INSPECTED

1E7G....	$1.25	836.....	$2.95
2AP1....	4.95	837.....	3.75
2D21....	1.50	838.....	5.95
2V3G....	1.75	829A.....	3.99
211.....	6.95	841.....	1.75
3AP1....	5.95	861.....	89.95
3BP1....	6.95	866.....	.99
311.....	6.95	872A.....	2.75
5BP1....	6.95	884.....	1.50
5BP4....	6.95	885.....	1.50
6AB7....	1.25	8001.....	8.95
6AC7....	.95	8003.....	9.95
6AG5....	1.10	8005.....	4.95
6AG7....	1.25	8016.....	1.95
6AJ5....	1.98	8025A....	4.95
6AK5....	1.60	9JP1.....	14.95
6AL5....	.99	954.....	.99
6AR6....	1.29	955.....	.99
6C4.....	.75	956.....	.99
6C5.....	.90	957.....	.99
6F6.....	.99	958.....	1.19
6J4.....	2.25	959.....	1.19
6J5.....	.90	9001.....	1.19
6J6.....	.99	9002.....	.99
6L6.....	1.59	9003.....	.99
6Q4.....	1.25	9004.....	.99
6SL7.....	.99	9005.....	1.10
6SN7.....	.99	9006.....	1.15
6V6.....	1.19	15E.....	4.95
6SH7.....	.89	1619.....	.99
7A4.....	1.45	1625.....	.89
801.....	2.30	1626.....	.89
806.....	15.95	250TH...	14.95
803.....	9.95	2050.....	1.50
804.....	8.95	2051.....	1.50
805.....	5.50	257B.....	14.95
807.....	1.05	30.....	.89
808.....	6.95	35T.....	3.50
809.....	2.25	304TH...	16.95
810.....	3.55	726A/C..	7.50
811.....	2.95	100TH...	7.95
813.....	7.95	1N21.....	.35
814.....	6.95	1N23.....	.35
815.....	3.95	2C26A....	.99
VR90/30.	.99	3E29.....	3.75
VR105/30	.99	CK1005..	1.98
VR150/30	.99	HF200...	14.95
VT127A..	3.00	HK24G..	1.49

POWER SUPPLY FOR MARK 1-11-111 BC-19 OR OTHER EQUIPMENT

Use as plating unit, battery charger, etc. 12 Amp-12v D.C. from 110v A.C. Unnecessary to tear set apart. Leave set portable.
COMPLETE READY TO PLUG IN.....**$32.50**

METERS—G.E., WESTON, etc. 3½

0-5 Ma. D.C.	0-8 Amps. R.F.
0-50 Ma. D.C.	0-15 Amps. R.F.
0-100 Ma. D.C.	0-1.5 K.V. w/shunt
0-300 Ma. D.C.	0-3.5 K.V. w/shunt
0-500 Ma. D.C.	0-350 V. D.C.
0-8 V. A.C.	0-15 V. A.C.

Your choice any 3½" METER...$3.95

2½" METERS

0-130 V. A.C.	0-1 Ma. D.C.
0-20 V. D.C.	0-8 Amp. D.C.

Your choice any 2½" METER..$2.95

BLOWER

Hi-air blast, designed for transmitting tube service. Motor operates on 100-125v 60 cycle at 7000 RPM. Noise free with self contained chokes and filters. Enclosed in satin finish, aluminum cabinet. Measures 4" high x 2¾ x 3¼". Many uses.
Super buy at.....$5.95

PHOTOFLASH KIT

Build your own—Save $100.00 to $200.00!

Improved version of unit described in December, 1946 Radio News can be synchronized to camera. Contains complete diagram, all parts, Xformers, tubes, capacitors, resistors, etc., including the amglo 51Q4X repeating flash tube.
(Complete Parts Kit).....**$49.95**

SELENIUM RECTIFIERS

Full Wave Bridge Types

INPUT	OUTPUT		
up to 18v A.C.	up to 12v D.C.	1 amp..	$ 2.49
up to 18v A.C.	up to 12v D.C.	5 amp..	4.95
up to 18v A.C.	up to 12v D.C.	10 amp..	7.95
up to 18v A.C.	up to 12v D.C.	15 amp..	10.95
up to 18v A.C.	up to 12v D.C.	30 amp..	16.95
up to 36v A.C.	up to 28v D.C.	1 amp..	3.95
up to 36v A.C.	up to 28v D.C.	5 amp..	7.95
up to 36v A.C.	up to 28v D.C.	10 amp..	13.95
up to 36v A.C.	up to 28v D.C.	15 amp..	19.95
up to 115v A.C.	up to 100v D.C.	.25 amp..	2.95
up to 115v A.C.	up to 100v D.C.	.6 amp..	6.95
up to 115v A.C.	up to 100v D.C.	5 amp..	19.95

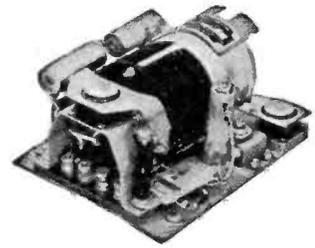
HIGH CAPACITY CONDENSERS

4000 mfd.—18WVDC.....	$1.95
4000 mfd.—30WVDC.....	2.95
1000 mfd.—15WVDC.....	.99

MCW—CF1—OSCILLATOR UNIT

Utilizes one 12SL7 gt twin triode as a combination 200KC calibration oscillator and frequency tripler. one 12-SA7 tube as a converter and one 12 SL7 gt tube as a signal detector and MCW audio oscillator supplying a 1000 cycle audio note. The CF1 unit employs a multivibrator circuit to obtain a 50 KC fundamental and harmonic, incorporating a 200 KC crystal as the controlling standard and will yield from 50 KC to 18 megacycles. This unit can be adapted into an excellent frequency meter, range 50 KC to 18 megacycles by adding an external power supply Shipped with tubes, schematic and crystal.
SPECIAL PRICE.....**$14.95**

CARBON PILE REGULATOR



115V. 60 Cycles, 500 Watt LOAD, 750 W. AIR BLAST

Uniform voltage to all equipment at any load to 500 watts. Regulates voltages to test bench and sets under test. Line voltage regulator for output of gas driven generators. Regulates line voltage from outlets in the average home. Used in rural areas where line voltage surges.
Excellent Buy at.....**$14.95**

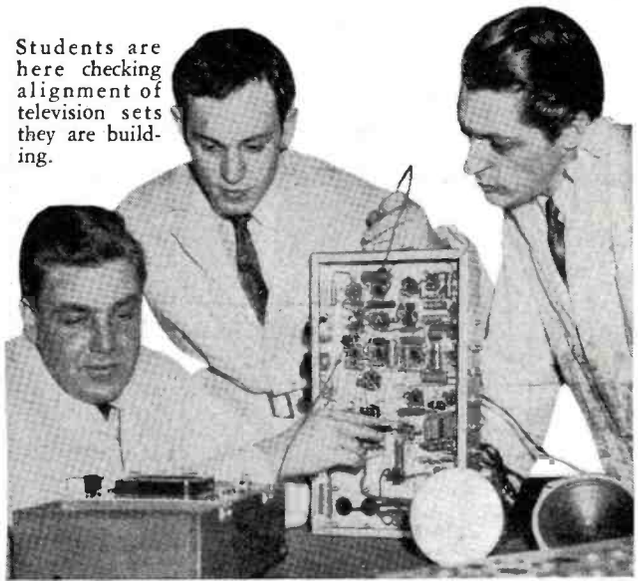
All material is new and guaranteed, unless otherwise specified.
No orders for less than $2.50—20% deposit required with all orders.

RADIO HAM SHACK Inc.

63 DEY STREET • NEW YORK 7, N. Y.

Big News! America's Famous 150 Openings for

Many Thousands of Dollars Worth of New Equipment Enables Us to Increase Our Enrollment Quota—Personal Instruction by Expert Teachers on Big, Modern Television Equipment—Students May Keep the Television Receivers They Build.



Students are here checking alignment of television sets they are building.

The latest test equipment is available in volume to all students at N.Y.T.I. of N.J. Just learning how to use the latest types of television test equipment is an important part of your training.

IF YOU are interested in a big-money career in TELEVISION—here is good news! We have just purchased more thousands of dollars of up-to-the-minute television equipment. This enables us to accept 150 *additional* students in May, June and July. *New classes begin every 2 weeks.*

Television is a highly technical subject. You can't expect to make the best progress unless you get expert, PERSONAL instruction and study with the *right apparatus*. You've actually got to *handle* the big, technical equipment YOURSELF. You've got to be in daily PERSONAL contact with your teachers. You've actually got to BUILD television receivers to understand them — and don't let anybody tell you differently!

Here's the Best Way to Learn Television

At the New York Technical Institute of New Jersey—one of America's great technical schools—you can do all that. The school is located right in

Here you see one of the television laboratories in full swing. The class is building television receivers, using many advanced types of test devices.

Television School Will Have May, June & July

APPROVED For G.I. Training

Eight of these latest RCA High-Frequency Sweep Generators are in almost constant use by students in Advanced Television.

Newark, N. J.—smack in the heart of the television industry. It is lavishly equipped with the very latest television test equipment. It maintains a large staff of expert instructors—many of whom are also actively associated with the television industry.

Here you "live" right WITH these experts. They are all regular fellows who have come up "through the mill." They know your problems and they also *know* television. Working with these men makes it easier to understand even the most technical side of television. They help you with the 77 different electronic experiments which each student must complete before he starts to build his very own television receiver—and which he may *keep* as his own property, if he chooses.

School Approved for G.I. Training

N.Y.T.I. of N.J. is approved for training under the G.I. Bill of Rights. The government pays up to $500 a year for a veteran's educational expenses and pays $90 a month to veterans with dependents and $65 a month to those without dependents for their living expenses. (Of course, you *don't* have to be a veteran to attend the school.)

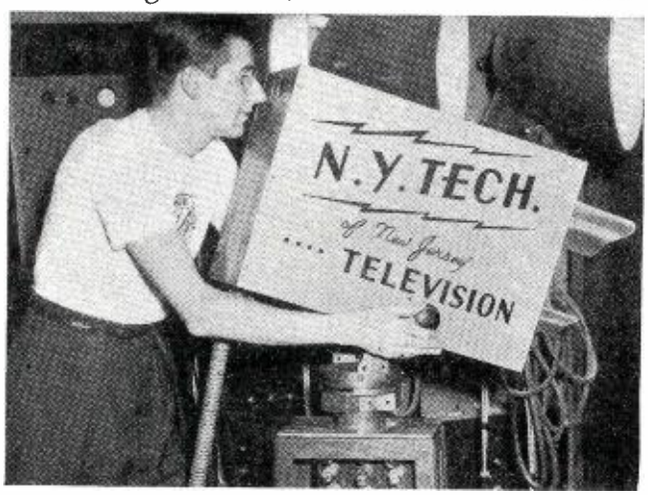
We Will Teach You the Mathematics You Need

N.Y.T.I. of N.J. is ideally located for Television Training—right in Newark, in the heart of the country's great radio and electronics industry, just 20 minutes from N. Y. City. The school is near such leading television, radio and electronics manufacturers as R.C.A., Western Electric, General Electric, DuMont, Federal, Westinghouse and Edison. It is also near some of the biggest television transmitting stations.

Here at the N.Y.T.I. of N.J.—you can really start from scratch and become a television expert. No high school diploma is required. All you need is a grammar school education and a sincere desire to learn, plus a willingness to make an all-out effort. If you are rusty in mathematics, we can teach you the radio and television math you will need.

Send for Our Special FREE Bulletin

The school issues a Special Bulletin, which describes and illustrates its facilities and equipment. The FREE Bulletin also describes classes which may be attended, housing conditions, costs, hours, etc. You can have it by mailing the coupon below to—*New York Technical Institute of New Jersey (Dept. 15), 158 Market Street, Newark, N. J.*



Here an ex-G.I. is shown taking pictures with N.Y. Tech's Iconoscope Television Camera. When it comes to television —you can't beat N.Y.T.I. of N.J.

New York Technical Institute of New Jersey, Dept. 15, 158 Market Street, Newark, New Jersey

Please send me your FREE Bulletin describing the famous Resident School of the New York Technical Institute of New Jersey located in Newark, N.J.—including its facilities, equipment, courses offered, costs, hours, etc.

☐ Check here if you are a Veteran of World War II.

Name..... *Age*.....

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Zone

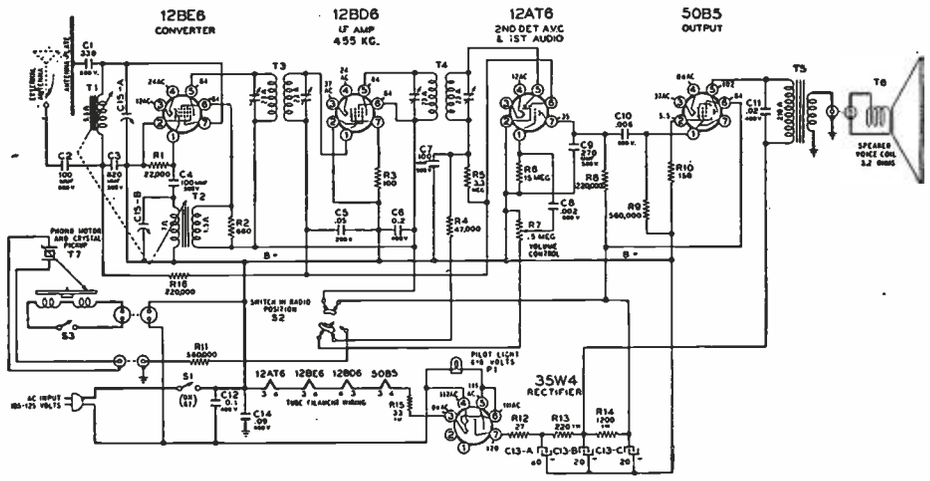
City..... *(if any)* ..... *State*.....

(N.Y.T.I. of N. J. employs no salesmen to call.)

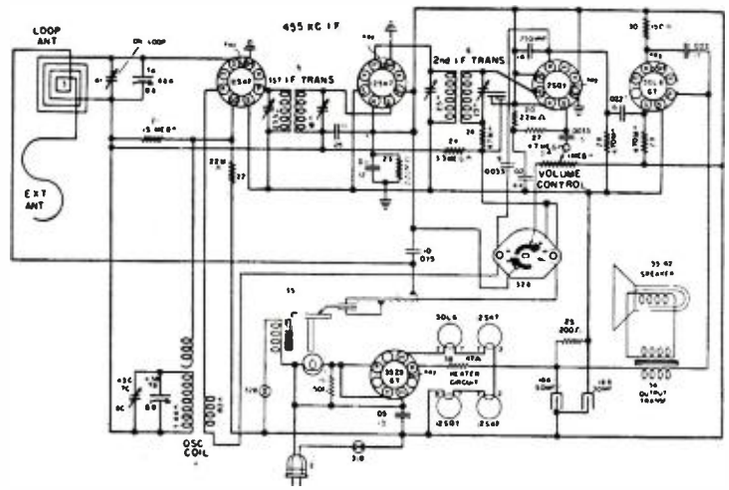
the RN CIRCUIT PAGE

(FOR PARTS LISTS SEE PAGE 94)

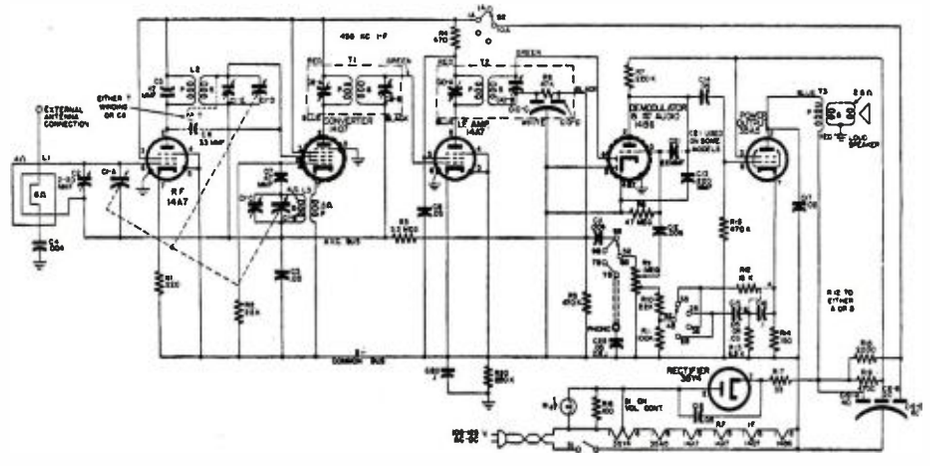
RADIO NEWS, MAY, 1947 — BELMONT MODEL 5D110



RADIO NEWS, MAY, 1947 — CROSLEY MODELS 56TZ, 57TQ

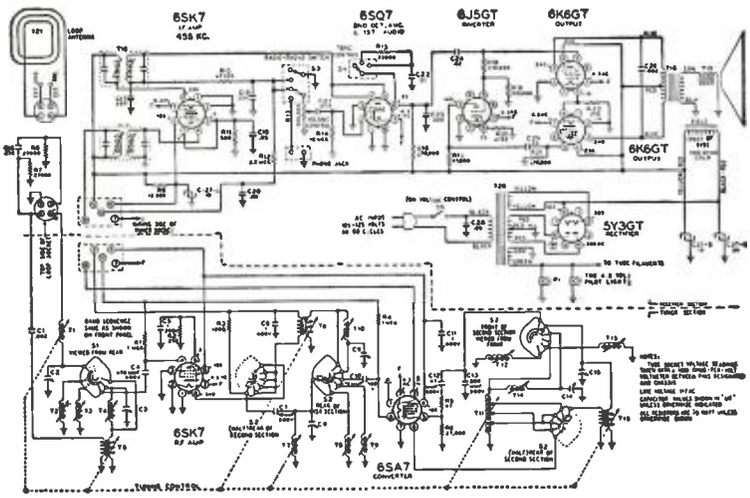


RADIO NEWS, MAY, 1947 — BENDIX MODELS 636A, 636C, 636D

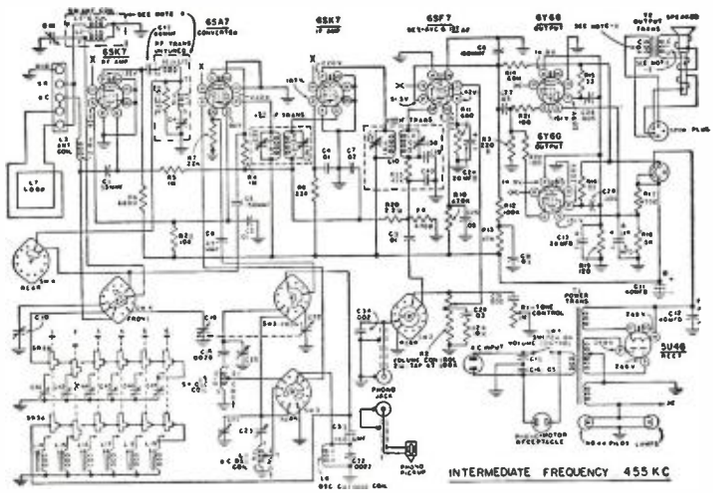


Here, and on following pages, are circuit diagrams and parts lists of many new postwar radio receivers. Radio News will bring to you other circuits as quickly as possible after we receive them from manufacturers.

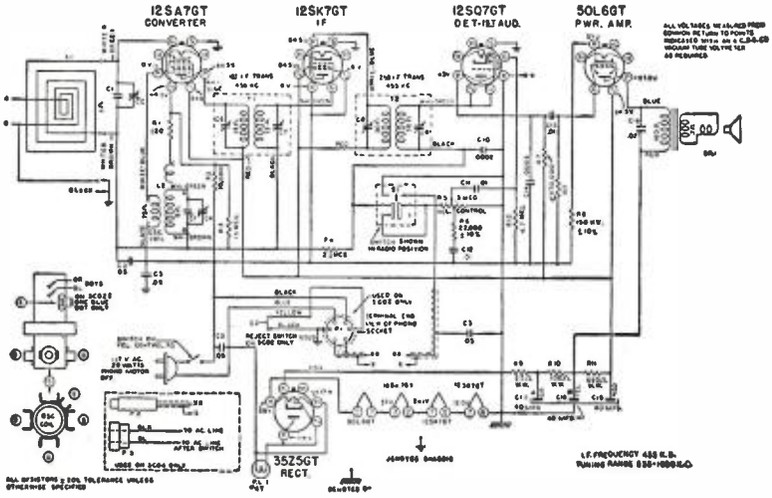
RADIO NEWS, MAY, 1947 **WARD MODELS 64BR-1808A**



RADIO NEWS, MAY, 1947 WESTINGHOUSE MODELS H-110, H-111, H-137, H-138



RADIO NEWS, MAY, 1947 **ZENITH MODELS 5RO80, 5RO86**

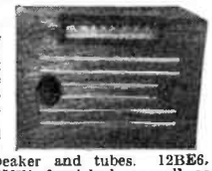


McGEE OFFERS YOU COMPLETE RADIO-AMPLIFIER and PHONO-KITS

RADIO SERVICE MEN: EXPERIMENTERS, STUDENTS, ETC.—McGee offers you complete radio and amplifier kits. Every kit is carefully designed to our rigid electronic specifications. All chassis are punched and designed to fit their respective cabinets. Matched kits of tubes are furnished, nothing else to buy. Schematic diagrams and photos of the completed chassis are furnished for rapid, easy assembly.

NEW SUPER MIDGET KIT
550 to 1650 K.C.

OUR SUPER VALUE



Build this new super Midget Radio. Has beautifully made, highly polished walnut cabinet. Size 7½ x 4½ x 5½. Attractive slide rule dial. Incorporates a standard superhet circuit with 456 KC IFS & AVC. Has 2 gang condenser and loop ant. Every part including Alnico V.P.M. speaker and tubes. 12BE6, 12BA6, 12AT6, 50B5 & 35W4 furnished as well as photo and easy to follow diagram. Weight 5 lbs. Kit Model K-PT.....Net Each **$12.95**

RADIO-PHONO COMB. KIT

Build this beautiful portable combination radio phonograph. We furnish everything. Beautiful two tone portable case, latest rim drive phono motor, Astatic crystal pick-up. All parts to build high quality 5 tube AC-DC radio. Tunes broadcast 550 to 1650 KC, has tone control, loop antenna, 6" Alnico 5 PM speaker. Tubes 12SA7, 12SK7, 12SQ7, 50L6 and 35Z5. Simple diagram furnished. Kit Model RP-12. Wt. 20 lbs. .....Your Cost **$29.95**

3-WAY PORTABLE RADIO KIT

Build this powerful, 5 tube, 3-way portable kit. Operates on 110 volts AC or DC or self contained batteries. Receives broadcast 550 to 1650 K.C. Incorporates a standard superhet circuit with AVC and loop Ant. Has Alnico 5 PM Speaker, 2 gang condenser. All parts and batteries are furnished including tubes 117Z6, 1R5, 1T4, 1S5 and 3S4. Has attractive leatherette portable cabinet size 7x9x9. Weight 14 lbs. Kit model 3-ZA.....Net **$17.95**

BATTERY RECORD PLAYER KIT

Something new in portable record players. Has spring wound phono-motor. Latest type light weight crystal pick-up, and ready wired and tested push-pull 3S4 amplifier. Furnished with a heavy duty Alnico V PM speaker. This kit can be put together in a few minutes time and will make a swell record player with superb tone and volume. Requires no AC power. Operates on self contained batteries. Priced complete with batteries and tubes, ready to assemble. Dealers' Net Model AK 10. **$19.95**

KIT J-17 PORTABLE SINGLE RECORD PLAYER NET $17.95

OFFERED IN THE SAME CASE AS THE MODEL AK-10 shown above, except it is designed for 110 volt AC operation. Has standard 3-tube AC DC wired and tested amplifier (with tubes). 5 in. Alnico 5 PM speaker and 78 RPM AC rim drive phono. motor and light weight crystal pick up. You can assemble this in a few minutes' time into a ready, salable item. Weight 18 lbs.

KIT J-18 Portable Automatic record player. Beautiful portable leatherette case and latest single post automatic record changer and a powerful 3-tube AC (Trans Type) Wired and Tested amplifier with tone and volume control. Everything inc.; tubes furnished. Has heavy duty 6" Alnico V P.M. speaker. We have sold hundreds of these to our dealers and they keep coming back for more; a real value. Weight 28 lbs. Kit J-18.....Net complete EACH **$33.95**

KIT J-15X SINGLE RECORD PLAYER

Attractive ready cut walnut cabinet, with latest 78 RPM phono motor and light weight crystal pick-up. Complete with a ready to play (wired and tested) 3 tube AC-DC amplifier; with tubes and 4" Alnico 5 PM speaker. You can assemble this kit in a few minutes. Wt. 10 lbs. Dealers Net.....**$13.95**

G.I. RECORDER MECHANISMS

Latest 1947 General Industries recording assemblies with 4 ohm magnetic cutters and crystal play back arms.

Model 12445—78 RPM. Net.....**$24.50**
Model 13700—33 and 78 RPM. Net..... **28.95**
Model 13810—Automatic changer with cutter, 78 RPM. Net..... **40.10**

COMPLETE RADIO KITS
FACTORY ENGINEERED

NEW PLASTIC CABINET AC-DC SUPERHET KIT. Cabinet size 7x6½x10½". Attractive slide rule dial. 2-gang tuning condenser. Receives broadcast 550 to 1650 KC. Has latest Alnico 5 PM speaker Loop antenna; all parts simplified diagram and tubes 12SA7, 12SK7, 12SQ7, 50L6 and 35Z5 furnished. Kit P-48. Wt. 9 lbs. ...Net **$12.95**

4 TUBE 1½-90 VOLT FARM RADIO KIT. Offered in same cabinet as the above Kit Model P-48. The same high gain broadcast superhet circuit. Complete with 4 tubes; 1R5. 1T4, 1S5, 3S4 and diagram. Less battery pack. Kit model PB-48. .....Your Cost **$10.95**

DELUXE AC-DC KIT J-D5 Beautiful walnut cabinet and all the parts to build a broadcast 5 tube AC-DC radio. Superhet with slide rule dial, 2 gang tuning condenser and loop aerial. Everything furnished; includes speaker and tubes 12SA7, 12SK7, 12SQ7, 35Z5 and 50L6 and diagram.

Kit J-D5. Wt. 10 lbs.....Net **$14.95**
KIT K-5D. Similar cabinet to above J-D5 except it is AC Trans. type and has 6 volt tubes. ...Net **$16.95**

KIT K-7A. Easily assembled into a fine working, attractive, transformer type AC, broadcast receiver; 550 to 1700 KC. Has push-pull audio, tone control and 6½" Alnico 5 PM speaker. Beautifully made 14" walnut cabinet. Incorporates a standard superhet circuit, with AVC and loop antenna. All parts, schematic and tubes 6SA7, 6SK7, 6H6, 6SN7, 2-6G6's and 5Y3 furnished. Nothing else to buy. Wt. 17 lbs.

Dealers Net **$19.95**

OUR LEADER KIT $9.95. 2 gang cond. AC-DC 4 tube TRF kit 550 to 1000 KC Kit K-4R, a TRF job with a walnut cabinet and 5" alnico 5 PM speaker. All parts furnished; including tubes and diagram. Has direct drive dial and a very simple standard circuit. An ideal kit for the student or experimenter. Just a few hundred to sell. Wt. 8 lbs. .....Very Special at only **$9.95**

WALNUT CABINET RECORD PLAYER

Beautifully made, highly polished walnut cabinet with hinged lid. Plays 10" records with lid closed. Latest rim drive phono motor and high output. Astatic crystal pick-up. High power 3 tube AC-DC phono amplifier (wired and tested). Heavy duty 4" Alnico 5 PM Speaker. Single record player kit.

Model WL-3. Wt. 15 lbs. .....Your Cost **$19.95**

SMALL RADIO-PHONO KIT

After carefully designing the record player and cabinet shown above (Model WL-3), we decided that it should also be offered as a radio-phono combination. The cabinet is both attractive and small (12x12x8). The radio kit part of this unit is similar, except for the dial, to our Kit Model K-PT shown in column 1 of this page. We furnish all parts, tubes, phono motor, pick-up, etc. Easy to follow diagram. Kit Model WL-3R. Wt. 16 lbs. .....Net. **$29.95**

HOME RECORDER KIT J-K6.

Dealers.....Net **$59.95**
Consists of latest General Industries dual speed 33 or 78 RPM record-play-back mechanism. Beautifully made to fit walnut cabinet and a complete kit of parts to build a high quality recording amplifier with push-pull 6V6 outputs. All parts, tubes, 5" PM speaker. Astatic crystal mike and diagram furnished. This amplifier can also be used as a 15 watt PA system. Provisions made to connect 12" PM Speaker. (12" G. E. PM Speaker and wall baffle **$16.95** extra). Net Kit J-K6 **$59.95.** JK-6 in Portable Leatherette Case and 6" PM Speaker **$5.00** extra. Wt. 33 lbs.

KIT J-19 SINGLE RECORD ATTACHMENT. Attractive walnut finished base with motor cut out, latest 78 RPM rim drive phono motor and light weight, high output crystal pick-up. Easily attached to any radio or amplifier.

Kit J-19 Dealers.....
...Net **$9.95** complete
Model B-4 phono oscillator (fits under base).
Dealers .....Net **$3.69**

8-TUBE RADIO-AMP. KIT

Build this High-Fi Radio Amplifier

- **Standard Superhet Circuit covering Broadcast 550 to 1700 K.C.**
- **New Positive Drive Permeability Tuning.**
- **Offered with 12 or 15 in. PM Speakers. Push-pull 6V6 Output stage giving 15 watts of full range audio.**
- **Dual Tone Controls (Bass and Treble).**
- **Inputs for both Mike and Phono pick-up.**

Here is something new in radio. A real 15 watt power amplifier with bass and treble controls. Has extra gain stage for crystal or dynamic mikes. And on the same chassis, a standard superhet radio receiver. We furnish all parts, knobs, escutcheon plate and tubes: 6SA7, 6SK7, 6SR7, 6SN7, 6SJ7, two 6V6 and 5Y3. No cabinet. Extra care in designing the power supply section assures low hum level, making this unit ideal for recording as well as P.A. use. We furnish everything as well as schematic diagram and photos of the completed chassis. Weight 35 lbs. PRK-10 Radio Amp. Kit with 12 P.M. Speaker.....Net **$29.95**
PRK-10X Radio Amp. Kit with 15 In. $30.00 value Cinnaudagraph P.M. speaker.....Net **$42.95**
If you desire a more powerful Audio section in the above kit we offer either the PRK-10 or PRK-10X with a full 200 mill power transformer and push pull 6L6 tubes in the final giving 25 watts of full range audio for $10.00 extra on either kit.

MUSICAL AMP-KIT

Build this 10 watt AC-DC musical amplifier. Designed with the new selenium rectifier in a unique voltage doubler circuit. Has gain stage for crystal or dynamic mike and Inputs for instrument or phono pick-ups. Variable tone control. Priced complete with 12" speaker and case as shown and tubes 2—50L6, 12SL7, 12SJ7. All parts, rectifiers and punched chassis and wiring diagram furnished.
Kit Model MM-10.....Net **$22.95**
Crystal Mike and desk stand.....**$7.95** extra

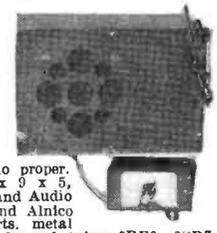
20-WATT PORTABLE AMP KIT

Build this 20 watt portable public address system. We furnish all parts and an easy to follow diagram. Attractive leatherette 3 piece case (snaps together to form one package). Has 12 Alnico 5 PM speaker. Inputs for mike and phono pick-up. Tone control. Full 150 mill power transformer. All parts, resistors, controls and condensers and tubes furnished. 5U4. 2—6L6GA 6SC7. 6SH7. 25 ft. of speaker cable included. Amplifier Kit model XX-20 with one 12" PM speaker **$34.95**
With two 12" PM speakers. Net..... **43.95**
Crystal Mike and 20 ft. of cable. Extra... **7.95**

20-WATT UTILITY AMP. KIT

Build this 20 watt utility 110 volt AC, 20 Watt power amplifier. Ready punched aluminum chassis, size 12 x 6 x 2½ inches. Has two input circuits, one mike and one phono. Mike stage has 135 DB gain, for crystal or dynamic mike. Has bass and treble controls. Designed for use with PM speakers; has 8-16 ohm output transformer. All parts, controls, transformers and easy-to-follow diagram furnished, including tubes: 2-6SN7, 6J5. 2-6L6GA. 5Z3. Kit Model 20-LX. Net.....**$17.95**
12" G. E. 12 watt Alnico 5 PM speaker, $9.50 extra. Astatic crystal mike and desk stand. $7.95 extra.

BUILD THIS AUTO-RADIO
550 to 1650 K.C.



We furnish you a complete kit of parts to build a 4-tube superhet car radio. The UNDERDASH remote control case (Size 2½ x 2 x 5) Houses the permeability tuning unit and converter tube. The output from this remote control (I.F.-Freq.) is fed through 30" length of small coax to the radio proper. The metal case, size 6 x 9 x 5, Houses the I.F. Detector and Audio Stages; Vibrator supply and Alnico 5 P.M. speaker. All parts, metal case, vibrator, power supply and tubes 6BE6, 6SD7, 6SQ7, 6K6 & Sync. Vibrator. furnished. Diagram and photo furnished for easy assembly. (Kit Model CR-4.)
Net **$19.95**

McGEE RADIO COMPANY *Write for Catalog*

Send 20% Deposit—Bal. Sent C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI
ON PARCEL POST ORDERS INCLUDE AMPLE POSTAGE

AIRCRAFT RECEIVERS $2.95 — AIRCRAFT TRANSMITTERS $9.95

WESTERN ELECTRIC AIRCRAFT SURPLUS

ALL OF THE RECEIVERS AND TRANSMITTERS LISTED BELOW ARE IN GOOD CONDITION. THE RECEIVERS ARE NEW, THE TRANSMITTERS ARE USED BUT GUARANTEED PERFECT. ORDER SURPLUS WITH CONFIDENCE FROM McGEE.

AIRCRAFT RECEIVERS

These Army surplus aircraft receivers may be operated from a 24 volt AC filament supply and any low power 250 volt B supply; or the tubes changed to the 6 volt type. There is plenty of room for a power transformer and rectifier tube; in place of the dynamotor. This receiver is very selective and sensitive; has RF stage and BFO. Made by Western Electric and you never saw finer wiring. Offered complete with tubes; 12K8, 3-12SK7, 12SR7 and 12A6, but less 28 volt dynamotor. Specify the frequency you desire. We have about 1500 available.

BC-454-B—3 to 6 MC superhet receiver with all tubes. Net..... **$5.95**
Less tubes. Net..... **2.95**

BC-453-B—200 to 500 KC superhet receiver with all tubes. Net..... **5.95**
Less tubes. Net..... **2.95**

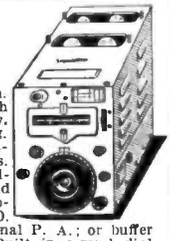
BC-455-B—6 to 9 MC superhet receiver with all tubes. Net..... **5.95**
Less tubes. Net..... **2.95**

28 volt dynamotor (snaps on receiver chassis) Net **$1.95.** 3 for..... **5.50**

(Shipping weight of above rec. 8 lbs.)

Aircraft Transmitters

BC-457-A 4 to 5.5 MC
BC-458-A 5.3 to 7 MC



This really fits the ham's dream. Ideal for a 55 watt transmitter with 575 volts at 250 MA plate supply, or VFO to drive a high power rig. It's a companion unit to the 454-455-453 series aircraft receivers. Made by Western Electric and really rugged. The oscillator will hold the frequency, even under rough operating conditions. Has 12J5 M. O. and 2-1625 (807) in parallel as final P. A.; or buffer to feed into a high power rig. Built in crystal dial calibration checker. Antenna loading inductance. Complete conversion data to VFO or FM oscillator is covered in CQ magazine; May '46 issue. Why not use this for your VFO? It's a real buy. 1000 to sell; at the ridiculous price; with tubes.

BC-457-A Transmitter 4 to 5.5 MC. Complete with 4600 KC crystal and tubes..... Your Cost **$9.95**
BC-458-A Transmitter 5.3 to 7 MC. Complete with 6200 KC crystal and tubes..... Your Cost **$9.95**
Special. Both of above on shock mounting rack..... **$18.95**
2" 0 to 10 antenna current meter in case; ideal for loading above transmitter..... Each **$2.49**
Transmitter shipping weight, 12 lbs.

BC-456-E Western Electric Modulator Unit $2.95

Companion unit of BC-457-A and BC-458-A. Complete with 12J5 and VR150 and 1625. Gives necessary output to modulate above transmitters. We have a few more modulators than transmitters and are offering them at a ridiculously low price. You can salvage many parts from this modulator unit. Offered complete with tubes. Very special **$2.95.** 3 for **$7.95.**
Dynamotor 28 volts input; 250 volts 160 MA output continuous. Snaps on modulator **$2.95** each; 3 for **$7.95.**

JAN OR REGULAR BRAND TUBES
CARTONED OR UNCARTONED

SPECIAL at .49			SPECIAL at .69		
30/44	27	1S5	1J6	6F6	1V
76	26	1T4	1D5	6Y6	75
37	6H6	3S4	1H4	12SF7	77
5Y4G	6AC7	1L4	30	12SQ7	24
5Y3GT	6SH7	3A4	5Z3	46	78
6C8G	56	1R5	6SA7GT	38	12SA7
6F8G	6B4G		6SK7GT	6SJ7	12SK7
1633	80		6SQ7GT	6G6	12SQ7
1634	6K7	50B5	5U4	6C5	12SR7
12SN7	12J5	12AT6	5T4	12Z3	12A6
6SN7		12BA6	6K6		
6SD7		12BE6			
42	6D6	35W4			
41	6C6				

VERY SPECIAL JAN 6L6M..... .99

NAVY RBZ RECEIVERS

RED HOT. We have about 200 of the navy miniature portable short wave receivers left, covering 2 to 5.5 M.C., offered complete with batteries and head phones and canvas carrying case. We will also include a 5 to 13 M.C. tuning unit which can be wired in. Very special all for only..... **$14.88**
Shipping weight 7 lbs.

BC-654 TRANSMITTER RECEIVER
NET $16.95

Portable voice and CW transmitter and receiver for portable, mobile, and fixed station operation. 7-tube superheterodyne receiver with 3.5 microvolt sensitivity on voice and 0.5 microvolt sensitivity on CW, and 100 milliwatts undistorted power output. 455 KC IF. Uses 3—1N5GT, 1—1A7GT, 2—3Q5GT, 1—1H5GT tubes. 6-tube transmitter with antenna tuning network, Colpitts thermal compensated oscillator, class C final with 2—307A tubes in parallel, and crystal oscillator for checking frequency every 200 KC. 25 watts output on CW and 11.2 watts output on voice. Frequency range, transmitter and receiver, 3800 to 5800 KC. Ideal for Hams! Comes complete with cover; set of tubes installed, 5 spare tubes and 3 spare pilot lights. Less power supplies. These units are used but in good condition. Shipping weight 50 lbs. Net price with all tubes and spares..... **$16.95**

NET price, less the 1½ volt receiver tubes but with trans. tubes..... **$12.95**

PHONO-OSCILLATOR 2-TUBES
NET $3.69

Complete, wired and tested. 800 to 1500 KC. Model B-4. Has audio gain stage for proper power output. Complete with tubes ready to operate..**$3.69**

MIKE-OSCILLATOR

800 to 1500 KC
Mike Oscillator model C-4. Not only does the unit work as a phono-osc., but has added gain stage for a crystal mike. Priced complete, wired and tested with 3 tubes and fader control.
Net **$4.95.** Crystal Mike.....**$4.90** extra

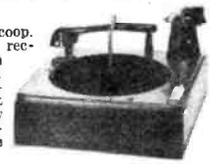
DELUXE MIKE OSCILLATOR

800 to 1500 KC Phono-Mike Oscillator. Makes any receiver a PA system. Record player or Recording amplifier. 3 stage high output unit with power transformer for AC operation only. High gain input stage for crystal or dynamic mike. Control on panel for fading recording to voice, simulating an actual broadcast station. Used by dealers and servicemen for demonstrations, tests and for home entertainment. Model DL-5 Complete with 3 tubes, wired and tested.
Net **$7.95.** Crystal Mike.....**$4.90** extra

DETROLA CHANGER
$14.95

Very Special. Detrola automatic changer (plays 12 10-in. or 10 12-in. records). New and factory cartoned. Dealers' net $14.95. Attractive walnut made to fit base.
Net **$2.49**

AERO AUTOMATIC CHANGER SCOOP
PRICE $13.95



This is a real changer scoop. Plays 12 10-in. or 10 12-in. records. Has all plastic arm with latest crystal cartridge. Brand new and factory cartoned. We have plenty at the scoop price of only **$13.95.** Attractive walnut made to fit base **$2.49** extra.

PHONO-MOTOR. Latest rim drive 78 RPM 110 volt type with turntable scoop price 100 to sell. Net **$3.19**
G.I. Heavy Duty dual (adjustable) speed gear driven motor 110 volt AC governor type.....Net **$15.49**
Astatic or shure light weight crystal pickups. Net **$2.29** Each
Double 40 Watt Fluorescent Ballast made by General Transformer **$3.98**

SCOOP IN RADIO TUBES

6 & 12 VOLT LOCTAL TUBES 50A5 35A5

7A4	7B7	7B5	7J7	7E6	7Y4	**79c**
7A6	7C7	7B6	7R7	7E7	7Z4	**EACH**
7C5	7Q7	7C6	7V7	7A7	7H7	
14Q7		14B6			35Y4	**79c EACH**
14A7		14H7			14R7	

1½ VOLT LOCTAL TUBES

1LD5	1LB4	**99c**
1LH4	1LN5	**EACH**
1LA4		

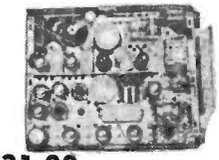
1LA6	1LC6	**$1.49 EACH**

Regular net on these tubes is $1.81. These tubes are all of leading make.

450 M. C. BC-645 15-TUBE I. F. F.

Easily Converted to a Voice—CW—Transmitter—Receiver

MADE BY GENERAL ELECTRIC



★ Factory Printed—Conversion Diagram
★ New ★ Pictured with Cover Removed
★ With 15 Tubes. NET $15.95. Two for $31.00

ANOTHER HOT WAR SURPLUS SCOOP

ARMY BC-645 I.F.F. UNIT. Early in the war, when radar picked up a plane, there was no way of knowing whether it was friendly or not. That was before BC-645 was invented. BC-645 sent out a signal that identified the plane as American. It probably saved more lives than any other piece of electronic equipment made. With some modifications the set can be used for 2-way communication, voice or code, on the following bands: ham hand 420-450 mc., citizens radio 460-470 mc., fixed and mobile 450-460 mc., television experimental 470-500 mc. Equipment capable of doing the jobs of the modified set sells for hundreds and hundreds of dollars. The 15 tubes alone are worth more than the sale price. 4-7F7, 4-7H7, 2-7E6, 2-6F6, 2-955 and 1-We316A. It now covers 460 to 490 mc. Each BC-645 is shipped with a Belmont factory printed conversion diagram, showing how to make AC power supply modulator and how to make Transmitter and Receiver changes. Most Hams and experimenters already have the few parts necessary. New BC-645 with tubes less power supply. Shipping weight 25 lbs. Extra WE316A Tubes $1.29 each. 12 Volt Dynamotor **$4.95**

ARMY PARTS SALVAGE SCOOP
NET $2.95. TWO FOR $5.00

Army PE-157 Vibrator type power supply, 2 volt-6 volt type. We have found no immediate use for this as a unit, but for salvage, it's a dream. Chuck full of transformers, resistors, condensers, relays, etc. One relay, which is a 10,000 plate type, is worth more than the sale price. Also there is a 4" heavy duty PM speaker with a dustproof waterproof cone and a handy dual section selenium rectifier rated at 1½ amps. Has a handy, usable hinged lid metal case, size 6x6x12. A red hot value priced less vibrators. Shipping weight, 20 lbs. 2,500 to sell.

McGEE RADIO COMPANY

Write for Catalog

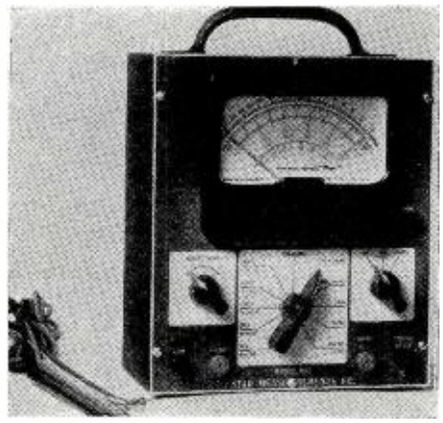
Send 20% Deposit—Bal. Sent C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI
ON PARCEL POST ORDERS INCLUDE AMPLE POSTAGE

What's New in Radio

NEW V.O.M.

Star Measurements Company of New York has recently introduced its new low-priced volt-ohm-milliammeter to the service field.

The Model M 11 Star Tester covers



voltage ranges up to 1000 volts, both a.c. and d.c. Current ranges up to one ampere and resistance ranges up to five megohms are also included. Calibrated db. scales provide for measurements as high as 54 db.; the zero power level is based on a 6 mw. level in a 500 ohm line. In all, 27 separate ranges of measurement are provided.

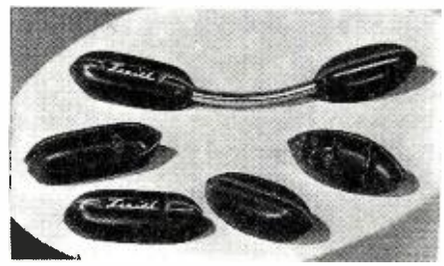
The instrument features a large 4½", 400 microampere *Marion* meter, an etched aluminum panel, and a gray crackle finish metal cabinet for use under all operating conditions. The entire unit weighs four pounds and comes complete with test leads and batteries.

Prices and complete data wil be furnished by *Star Measurements Company,* 442 East 166th Street, New York 56, New York.

PLASTIC PARTS

G. Felsenthal & Sons of Chicago, molders and fabricators of plastics, are presently offering their services to radio manfacturers for the processing of plastic parts for the industry.

Lightweight, high impact polystyrene was used in the tone arm pickup assembly illustrated. Both heads are injection-molded and assembled to the



metal arm by means of cement. Tradenames and other identifying marks are etched in the mold and the recessed letters filled in with white paint in a separate operation after molding.

The company invites inquiries by manufacturers regarding their plastic problems. Complete specifications and information about the part to be molded should accompany requests for additional data. Address all requests to *G. Felsenthal & Sons,* 4100 W. Grand Avenue, Chicago 51, Illinois.

MODULATION METER

A new instrument, designed for use in the amateur phone bands falling between 3.5 and 54 mc., has been announced by *Sylvania Electric Products Inc.*

This modulation meter which operates without vacuum tubes and requires no batteries or a.c. line power can also be used by forestry, emergency, police, and marine services using AM transmitters.

This compact, lightweight instrument is used for monitoring signals with respect to modulation. Modulation percentage is indicated on a direct-reading, hermetically-sealed meter which is flush-mounted on a panel approximately 4" square. Elimination of vacuum tubes, batteries, and the need for a.c. line input is accomplished through the application of the *Sylvania* germanium crystal diode, Type 1N34.

The meter permits determination of the modulation percentage of either a sine-wave-modulated or a voice-mod-

ulated carrier, as well as giving an indication of carrier shift. It enables the user to avoid over-modulation.

The Model X-7018 modulation meter is supplied with a 75 ohm twin-lead transmission line for use with an external link circuit; handy toggle switches; trimmer condenser for convenient peaking of input circuit and a jack to disconnect meter and insert phones for audible signal check.

Sylvania Electric Products Inc. at 500 Fifth Avenue, New York 18, New York will furnish additional information upon request.

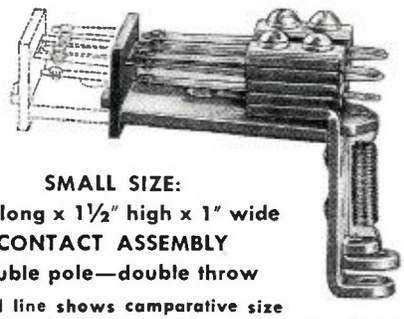
SIGNAL GENERATOR

Northeastern Engineering, Inc. of Manchester, New Hampshire has recently announced a new signal generator, Model 700A.

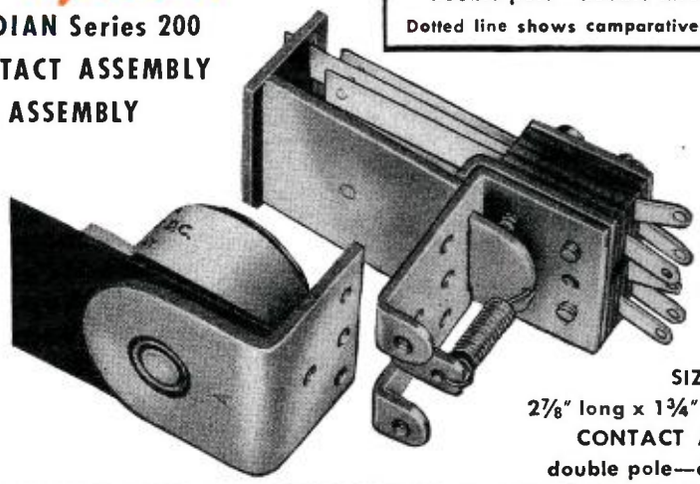
This generator covers the range from 160 kc. to 20 mc. on fundamental

GUARDIAN *presents . . .*

a new **MIDGET**
CONTACT ASSEMBLY
Interchangeable
with the GUARDIAN Series 200 STANDARD CONTACT ASSEMBLY AND COIL ASSEMBLY



SMALL SIZE:
1⅝" long x 1½" high x 1" wide
CONTACT ASSEMBLY
double pole—double throw
Dotted line shows camparative size

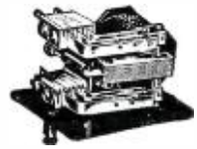


SIZE
2⅞" long x 1¾" high x 1" wide
CONTACT ASSEMBLY
double pole—double throw

Popular RADIO RELAYS in the GUARDIAN line:

K-100 Keying Relay For low voltage control of high voltage transmission. Guardian Series K-100 Relay will follow key or bug at highest WPM rate attainable. High speed response, strong magnet and return spring give clean make and break, produce best CW note. Coils: 5 to 16 v., A.C.; coils for other voltages on specifications.

B-100 Break-in Relay For break-in operation on amateur transmitters. The Guardian B-100 Relay has laminated field piece and armature. Fine ¼" silver DPDT contacts, capacity to 1500 watts, 60 c., non-inductive A.C., and in A.C. primary circuit of any inductive power supply delivering up to 1 KW, inclusively.



T-100 Time Delay Relay. In radio transmitter circuits, Guardian's T-100 Time Delay Relay prevents damage of rectifiers and tube filaments by preventing plate current before filaments are sufficiently heated. Laminated field piece and armature. Mounted in dust-proof metal box.

L-250 Overload Relay Provides accurate, fixed overload protection against current surges and continuous overloads. Guardian's L-250 Relay replaces expensive, time-wasting fuses. Attracts armature on 250 mils. Max. drop across coil—10 v. Guardian's L-500 Relay attracts armature at 500 mils. Max. drop across coil—5 volts. Ideal for experimenters on new circuits.

A-100 Antenna Relay A low loss AlSiMag insulated relay. For single wire fed installations specify the A-100-C, SPDT unit. Two A-100-C in place of one A-100 in open wire line systems will avoid possible impedance mismatch. A very popular relay with radio amateurs.

SEE THESE AND OTHER GUARDIAN RELAYS AT BOOTH 51, MAY 12-16, STEVENS HOTEL, CHICAGO, ILL.

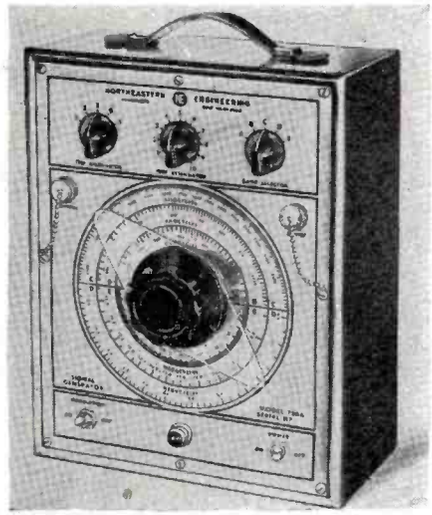
Ask your jobber for the new midget contact switch assembly which is interchangeable with the Guardian's Series 200 coil assembly. Your jobber carries a complete line of Guardian radio relays. If unable to attend Radio Parts Show, write for Bulletin R-6.

GUARDIAN ELECTRIC

1630F W. WALNUT STREET **CHICAGO 12, ILLINOIS**

A COMPLETE LINE OF RELAYS SERVING AMERICAN INDUSTRY

frequencies in five bands; band A from 160 kc. to 370 kc.; band B from 370 to 1080 kc.; band C from 1080 kc. to 2500 kc.; band D from 2.5 mc. to 7.3 mc. and band E from 7.3 mc. to 20 mc. The dial of the unit is also equipped



to indicate a sixth band (band F) which has been calibrated in degrees for special calibrations.

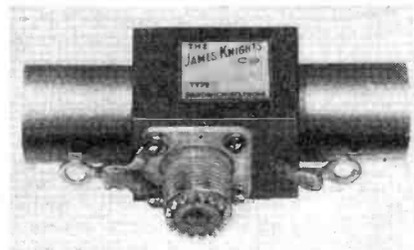
Modulation of the unit is approximately 30 per-cent at 400 cycles with provision being made for external modulation. The signal generator uses two tubes and operates on 105-125 volt, 60 cycles.

Additional data on this unit will be supplied by *Northeastern Engineering, Inc.* of Manchester, New Hampshire upon request.

ANTENNA COUPLER

A universal type antenna insulator-connector for making a secure weatherproof junction between *Amphenol* "RG" type flexible coaxial line and any current fed antenna or array has been announced by *James Knights Company* of Sandwich, Illinois.

Known as the J-K Impedacoupler, this unit may also be used with *Amphenol* "flat lines" or with the usual



type of open wire lines. Equipped with an *Amphenol* type 1R receptacle, the unit requires only the addition of an *Amphenol* type 1SP cable connector on the end of the coaxial line for quick, positive connection without fanning and without disrupting the terminal impedance of the line.

An insulator block provides optimum dielectric properties and ample strength to withstand the pull of the antenna and support the weight of the coaxial line.

The insulator is drilled at both ends for bolts or rivets for holding tubing

(*Continued on page* 136)

TELEVISION-

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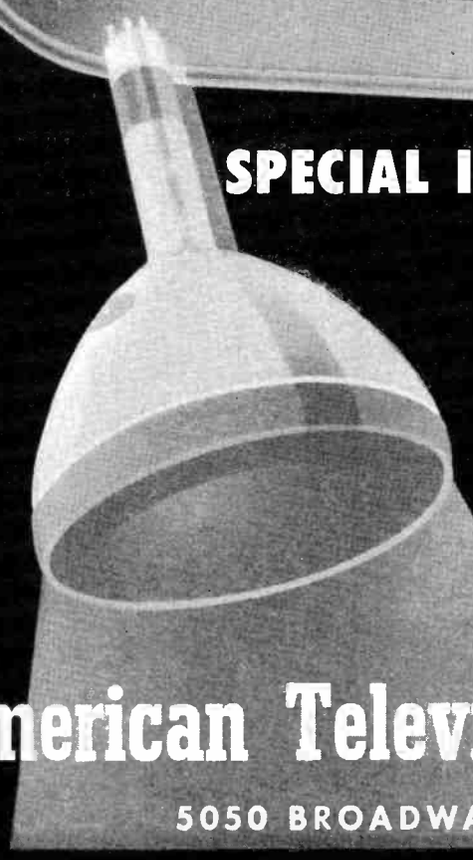

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A NOVEL INPUT CIRCUIT

By ZYGMUNT HOF

Transformerless matching from a low impedance microphone to the input tube of an amplifier is accomplished by a grounded grid circuit.

MANY servicemen are faced with the problem of matching p.a. amplifiers with dynamic microphones where the impedance of the mike proves to be 500 ohms while the amplifier has only a high impedance input—all this without an available matching transformer!

If such a problem is facing you, this special input circuit, which is a cousin to the cathode-follower, may be used. Known as the grounded grid amplifier, to use this circuit the input impedance must first be calculated.

Using a pentode, Fig. 1A shows the actual circuit and Fig. 1B the equivalent circuit. The mike may be seen connected between the cathode and grid, the latter being grounded. It is equivalent to a generator of a voltage E, with internal resistance, R_m, connected in series with the load resistance.

From Fig. 1B:

$$i_1 + i_2 = G_m e_g$$

$$R_a i_1 = E + i_2 (R_m + R_1)$$

$$e_g = E + R_m i_2$$

From these equations:

$$Z_{Input} = \frac{e_g}{i_2} = \frac{R_a + R_1}{\mu - 1} \text{ (approx.)}$$

where: μ = amplification factor
R_a = plate resistance
G_m = mutual conductance
R_1 = load resistance

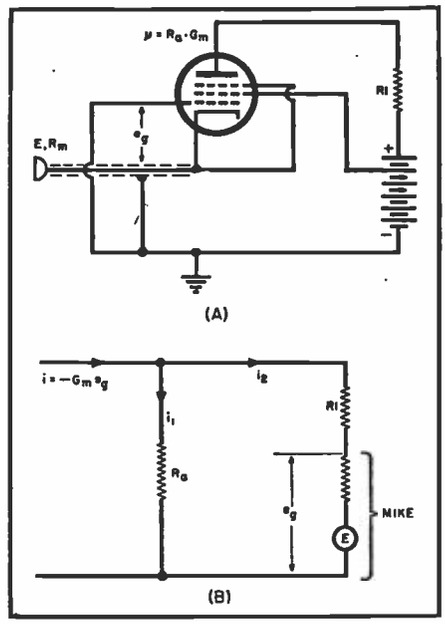
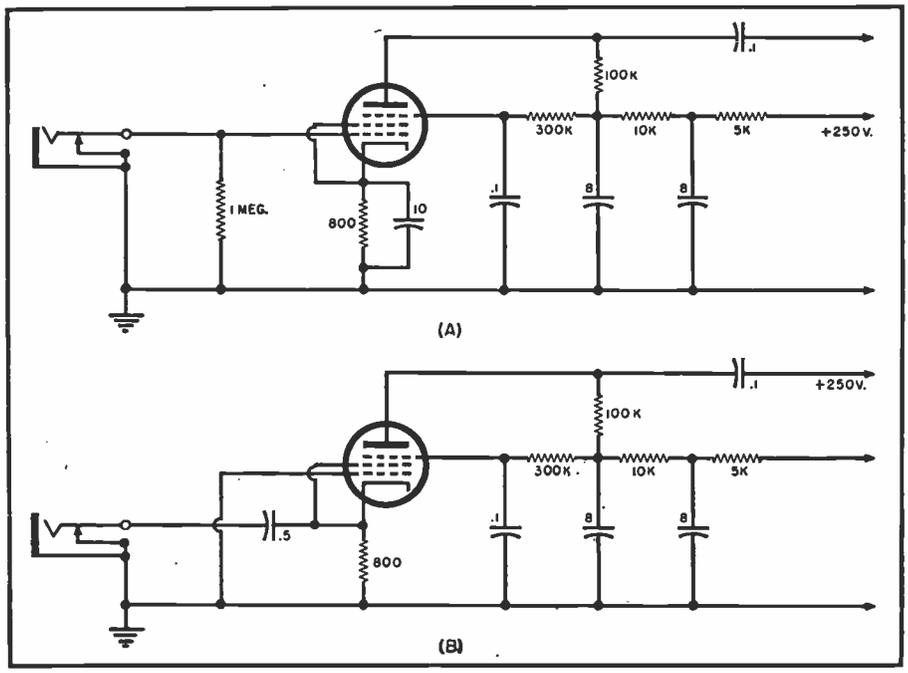


Fig. 1.

According to the formula, most pentodes, under recommended operating conditions, will be found to have an input impedance of around 1000 ohms in this circuit.

The particular p.a. amplifier used in this case had a 6SJ7 in the first stage.

Fig. 2.



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Study of the schematic diagram of the unit (Fig. 2A) shows an amplifier of conventional arrangement and values for a supply voltage of 250 volts.

If the 6SJ7 stage is converted to a grounded grid amplifier, as shown in Fig. 2B, the input impedance of the 6SJ7 is $(0.1 + 1.5) \times 10^6/2500$ or 640 ohms. Fig. 3 shows that the actual impedance, looking toward the mike, consists of the input impedance of the tube with open cathode circuit in shunt with the cathode bias resistor. The value of the combination is given by the following equation.

$$Z_t = \frac{Z \times R_k}{\sqrt{Z^2 + R_k^2}} = 500 \text{ ohms.}$$

When the results of this calculation indicated that the microphone and circuit input impedance were sufficiently matched, the necessary wiring changes were made. The only additional component required was a .5 μfd., 400 volt condenser in place of a cathode bypass condenser and the grid resistor in the amplifier.

Incidentally, since the first stage of the amplifier had a separate filament winding this was disconnected from ground and kept floating in order to keep a hum voltage from developing between cathode and ground. This was necessary inasmuch as this connection would have paralleled the input.

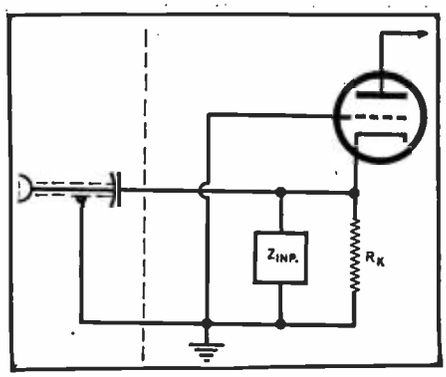


Fig. 3.

As a result of the perfect matching, the grounded grid circuit worked without noise, without any unwanted pick-up and with excellent frequency response and volume.

By choosing a suitable tube with a variable cathode resistor, a separate grounded grid input stage can be built (by using the equations and Fig. 2B) for microphones with an impedance of from 200 to 1000 ohms and added to existing amplifiers.

The simplicity and trouble-free operation of this circuit and the important saving in components should make this circuit popular with servicemen and experimenters.

-30-

DRESSING UP THE ANTENNA CONNECTION

ONE of the unsightly trappings of amateur radio is the usual antenna feeder line inside the house. Outdoors, the two-wire feeder may be as neat as a pin, but it takes a turn for the worse after it comes through the wall. Full of kinks, it either clutters up the floor or dangles from the ceiling. A lot of "72-ohm" lines are just as unlovely to behold as the open-line jobs. The womenfolks object to this sort of thing, and rightly so.

The new coaxial cable and fittings which have become available to the public since the war ended offer a means of correcting this evil, and the accompanying photograph shows one way they can be used to do the job.

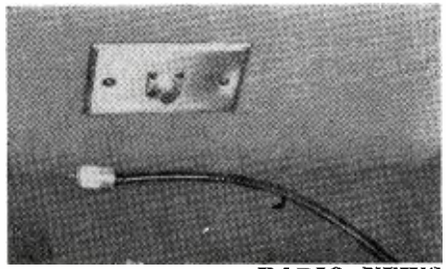
In this case, the antenna coupler is located down cellar just inside the sill through which the 2-wire feeder enters. The coupler is not re-tuned often, so can be remotely located in this manner. The coupler is link coupled to a section of *Amphenol* type "RG" concentric (coaxial) cable which, in turn, is run up through the wall and connected to a female coaxial connector (Amphenol 83-1R; Signal Corps No. SO-239) mounted in the center of a plain brass outlet plate on the baseboard as shown in the photograph. A ⅝-inch round hole in the brass plate will clear the rear protrusion of the coaxial connector, and a 1¼-inch round hole is all that is needed in the baseboard. The cable may be pushed up through the floor or fished through with a length of wire or string.

Another section of "RG" type cable, seen on the floor in the photograph, is used to connect the baseboard outlet to the transmitter. Each end of this second cable terminates in a male coaxial connector (Amphenol 83-1SP; Signal Corps No. PL-259), one of which may be seen on the end of the cable in the photograph.

The final amplifier plate tank also is link coupled to a female connector on its chassis. When the transmitter is to be put on the air, the cable plugs are inserted into floor and chassis connectors, the cable thus being run between the transmitter and "outlet." When transmissions are completed, the cable may be disconnected and stored out of sight. Even when this cable is connected between the transmitter and base plug and lies along the floor, its sleek, black coat makes a trim appearance. For this reason, some operators may prefer to leave it connected.

If a doublet antenna is used for transmitting, no antenna coupler is needed. The "cellar" length of coaxial cable then may be run through the wall of the house directly to the center of the antenna and the system is greatly simplified. -30-

The coaxial antenna outlet on the baseboard has the same neat appearance as the familiar power outlet. The coaxial cable for connecting to the transmitter is shown on the floor beneath the outlet.



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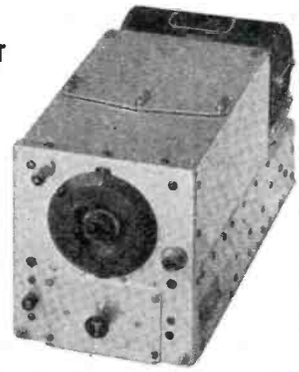

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RC10AE105M	R_4, R_5—1 megohm, ¼ w. res.
RC41AE682K	R_6—6800 ohm, 2 w. res.
RC10AE223M	R_7, R_8—22,000 ohm, ¼ w. res.
RC10AE474M	R_9, R_{10}—470,000 ohm, ¼ w. res.
RC10AE681M	R_{11}—680 ohm, ¼ w. res.
RC10AE104M	R_{12}—100,000 ohm, ¼ w. res.
RC10AE473	R_{13}—47,000 ohm, ¼ w. res.
RC10AE684M	R_{14}—.68 megohm, ¼ w. res.
RC10AE330K	R_{15}, R_{16}—33 ohm, ¼ w. res.
RC41AE472M	R_{17}—4700 ohm, 2 w. res.
RC41AE153M	R_{18}—15,000 ohm, 2 w. res.
V-3282	R_{19}—120 ohm, 3 w. res.
RC10AE225M	R_{20}—2.2 megohm, ¼ w. res.
RC10AE101M	R_{21}, R_{22}—100 ohm, ¼ w. res.
RC41AE103M	R_{23}—10,000 ohm, 2 w. res.
RC10AE103M	R_{24}—10,000 ohm, ¼ w. res.
RCM20A330M	C_1—33 μμfd. mica cond.
RCP10W4103A	C_2, C_3, C_4—.01 μfd., 400 v. cond.
RCM20A151M	C_5, C_6—150 μμfd. mica cond.
RCP10W4203	C_7—.02 μfd., 400 v. cond.
RCM20B470M	C_8—47 μμfd. mica cond.
RCP10W4104A	C_9—.1 μfd., 400 v. cond.
V-3170	C_{10}—S.w. ant. trimmer
V-3216	C_{11}, C_{12}, C_{13}, C_{14}—40/40/20/5 μfd., 350/350/25/250 v. elec. cond.
V-3241	C_{15}, C_{16}—Dual line filter cond.
RCM20A680M	C_{17}—68 μμfd. mica cond.
RCM30C282H	C_{18}—.0028 μfd. s.w. padder
V-3233	C_{19}, C_{20}—2-gang var. cond.
V-3217	C_{21}, C_{22}, C_{23}—3-gang trimmer
V-3236	C_{24}—20 μfd., 25 v. elec. cond.
RCP10W4503A	C_{25}—.05 μfd., 400 v. cond.
RCP10W4303A	C_{26}—.03 μfd., 400 v. cond.
RCP10M4503A	C_{27}—.05 μfd., 400 v. cond.
RCP10M6502A	C_{28}, C_{29}—.005 μfd., 600 v. cond.
V-3191	C_{30}—Broadcast ant. trimmer
RCP10W6202A	C_{31}—.002 μfd., 600 v. cond.
RCM30B222M	C_{32}—.0022 μfd. mica cond.
RCM20C181J	C_{33}—180 μμfd. mica cond.
RCP10W6202M	C_{34}—.002 μfd., 600 v. cond.
V-3224	L_1, L_2—S.w. ant. coil
V-3238	L_3—Ant. loading coil
V-3243	L_4, L_5—Broadcast and s.w. osc. coil
V-3313	L_6—Osc. coil

BENDIX MODELS 636A, 636C, 636D

Part No.	Code and Description
RC1H16	R_1—220 ohms, ½ w. res.
RC1H40	R_2, R_{10}—22,000 ohm, ¼ w. res.
RC1H68	R_3—3.3 megohm, ¼ w. res.
RC1H20	R_4—470 ohm, ¼ w. res.
RC1H58	R_5, R_{15}—470,000 ohm, ¼ w. res.
	R_6—47,000 ohm, ¼ w. res.
RC1H54	R_7, R_{20}—220,000 ohm, ¼ w. res.
RC1H70	R_8—4.7 megohm, ¼ w. res.
RV4S00	R_9, S_1—1 megohm pot. & sw.
RC1H51	R_{11}—100,000 ohm, ¼ w. res.
RC1H38	R_{12}—15,000 ohm, ¼ w. res.
RC1H34	R_{13}—6800 ohm, ¼ w. res.
RW1B14	R_{14}—150 ohm, 1 w. wirewound res.
RW1A06	R_{16}—100 ohm, 1 w. wirewound res.
	R_{17}—33 ohm, ½ w. res.
RC4G28	R_{18}—2200 ohm, 2 w. res.
RC1H32	R_{19}—4700 ohm, ¼ w. res.
CV0C00	C_{1a}, C_{1b}, C_{1c}, C_{1d}, C_{1e}—Var. cond.
CP4T40	C_3, C_9, C_{14}, C_{15}, C_{18}, C_{22}—.05 μfd., 400 v. cond.
CP6T16	C_4—.004 μfd., 600 v. cond.
CM5A14	C_5, C_7—47 μμfd., mica cond.
CC9A16	C_6—3.3 μμfd. ceramic cond.
CP4T20	C_{11}, C_{12}—.006 μfd., 400 v. cond.
CM5A05	C_{13}—220 μμfd. mica cond.
CP2T51	C_{16}—.1 μfd., 200 v. cond.
CP4T34	C_{17}—.02 μfd., 400 v. cond.
CP4T51	C_{20}—.1 μfd., 440 v. cond.
CE3A00	—20/40/60 μfd., 150/150/150 v. elec. cond.
T10C01	T_1—First i.f. trans.
T10D01	T_2—Second i.f. trans.
TA0O01	T_3—Audio output trans.

ZENITH MODELS 5RO80, 5RO86

Part No.	Code and Description
63-579	R_1—220 ohm, ¼ w. res.
63-589	R_2—10,000 ohm, ¼ w. res.
63-976	R_3—15 megohm, ¼ w. res.
63-600	R_4—2.2 megohm, ¼ w. res.
63-1348	R_5—.5 megohm vol. control
63-644	R_6—22,000 ohm, ¼ w. res.
63-597	R_7—470,000 ohm, ¼ w. res.
63-686	R_8—150 ohm, ½ w. wirewound res.
63-1219	R_9—22 ohm, ½ w. wirewound res.
63-1220	R_{10}—100 ohm, 1 w. wirewound res.
63-1221	R_{11}—680 ohm, 1 w. wirewound res.
63-602	R_{12}—4.7 megohm, ¼ w. res.
22-1419 or 22-1356	C_1—2-gang var. cond.
	C_2—Broadcast ant. trimmer (on C_1)
22-829	C_3—.05 μfd., 200 v. cond.
	C_4—Broadcast osc. trimmer (on C_1)
22-1017	C_5—.05 μfd., 200 v. cond.
	C_6—First i.f. trans. pri. trimmer (on T_1)
	C_7—First i.f. trans. sec. trimmer (on T_1)
	C_8—Second i.f. trans. pri. trimmer (on T_2)
	C_9—Second i.f. trans. sec. trimmer (on T_2)
22-953	C_{10}—.0002 μfd., 600 v. cond.
22-669	C_{11}—.01 μfd., 600 v. cond.
22-826	C_{12}—.01 μfd., 200 v. cond.
22-854	C_{14}—.0005 μfd., 600 v. cond.
22-196	C_{15}—.01 μfd., 600 v. cond.
22-1379	C_{16}—.02 μfd., 400 v. cond.
22-1381 or 22-1552	C_{17}, C_{18}, C_{19}—40/40/40 μfd., 150/150/150 v. elec. cond.
95-919	T_1—First i.f. trans.
95-906	T_2—Second i.f. trans.

WARD MODELS 64BR-1808A

Part No.	Code and Description
BEC-9B1-31	R_1, R_4—1 megohm, ½ w. res.
BEC-9B1-55	R_2—270 ohm, ½ w. res.
BEC-9B1-64	R_3—1500 ohm, ½ w. res.
BEC-9B1-46	R_5—47 ohm, ½ w. res.
BEC-9B1-79	R_6—27,000 ohm, ½ w. res.
BEC-9B1-1987	R_7, R_8—27,000 ohm, ½ w. res.
BE10662	R_9—12,500 ohm, 3 w. res.
BEC-9B1-23	R_{10}—47,000 ohm, ½ w. res.
BEC-9B1-59	R_{11}—560 ohm, ½ w. res.
BEC-9B1-33	R_{12}—2.2 megohm, ½ w. res.
BEA-10A-10810	R_{13}, S_1—500,000 ohm vol. control & sw.
BEC-9B1-37	R_{14}—10 megohm, ½ w. res.
BEC-9B1-22	R_{15}—33,000 ohm, ½ w. res.
BEC-9B1-2091	R_{16}—270,000 ohm, ½ w. res.
BEC-9B1-82	R_{17}—47,000 ohm, ½ w. res.
BEC-9B1-94	R_{18}—470,000 ohm, ½ w. res.
BEC-9B1-86	R_{19}—100,000 ohm, ½ w. res.
BEC-9B1-70	R_{20}—4700 ohm, ½ w. res.
BEC-9B1-29	R_{21}—470,000 ohm, ½ w. res.
BEC-9B1-55	R_{22}—270 ohm, 1 w. res.
BEB-8F-10767	C_1—.002 μfd., 500 v. mica cond.
BE-124143	C_2, C_3—Dual 67-123 μμfd./95-175 μμfd. ant. trimmers
BEB-8F3-121	C_4, C_{10}—470 μμfd., 500 v. cond.
BEC-8D-10771	C_5—.1 μfd., 200 v. cond.
BEC-8D-10760	C_6, C_{11}—.1 μfd., 400 v. cond.
BEB-8F5-101	C_7—10 μμfd., 500 v. silver mica cond.
BEA-8G-7205	C_8—120-220 μμfd. r.f. trimmer
BEA-8G-7206	C_9—60-110 μμfd. r.f. trimmer
BEB-8F3-109	C_{12}—47 μμfd., 500 v. mica cond.
BEB-8F-10763	C_{13}—200 μμfd., 500 v. silver mica cond.
BE-124145	C_{14}—7-35 μμfd. osc. trimmer
BE-124144	C_{15}—15-27 μμfd. osc. trimmer
BEC-8F3-12	C_{16}—470 μμfd. mica cond.
BEC-8F3-10	C_{17}, C_{18}, C_{23}—220 μμfd. mica cond.
BEC-8D-10770	C_{19}, C_{20}—.05 μfd., 200 v. cond.
BEC-8D-10785	C_{21}—.006 μfd., 600 v. cond.
BEC-8D-10761	C_{22}—.01 μfd., 400 v. cond.
BEC-8D-10774	C_{24}, C_{25}—.02 μfd., 400 v. cond.
BEC-8D-10778	C_{26}—.002 μfd., 600 v. cond.
BEA-8C-10272	C_{27A}, C_{27B}, C_{27C}—10/10/20 μfd. 450/450/450 v. elec. cond.
BEC-8J-11388	C_{28}—.05 μfd., 600 v. cond.
BE-111195	T_1—Broadcast ant. coil
BE-111191	T_2—12 mc. ant. coil
BE-111192	T_3—15 mc. ant. coil
BE-111189	T_4—6 mc. ant. coil
BE-111190	T_5—9 mc. ant. coil
BE-10959	T_6—9 mc. r.f. coil
BE-10962	T_7—Broadcast r.f. coil
BE-10960	T_8—12 mc. r.f. coil
BE-10961	T_9—15 mc. r.f. coil
BE-10958	T_{10}—6 mc. r.f. coil
BE-110157	T_{11}—9 mc. osc. coil
BE-110159	T_{12}—15 mc. osc. coil
BE-110158	T_{13}—12 mc. osc. coil
BE-110156	T_{14}—6 mc. osc. coil
BE-110161	T_{15}—Broadcast osc. coil

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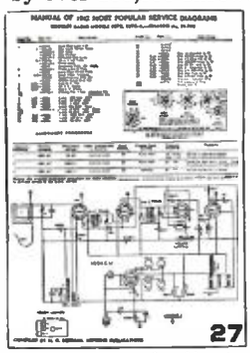

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BEB-203-1813-3	*T_{16}—Output i.f. trans.*
BEB-203-1813-2	*T_{17}—Input i.f. trans.*
BEB-12C-10234-1	*T_{18}—Output trans.*
BE104202-D	*T_{20}—Power trans.*
BED-212-11429	*T_{21}—Loop ant. assembly*

CROSLEY MODELS 56TZ, 57TQ

Part No.	Code and Description
AC-138333	*3—Antenna loop assembly*
AW-135730	*4—Osc. coil assembly*
AW-135729	*5—First i.f. trans.*
AW-135731	*6—Second i.f. trans.*
B-135570	*7A, 7B, 7C—Two section var. cond. & trimmer*
39001-76	*9, 15—.003 μfd., 600 v. cond.*
39001-17	*10, 11, 13—.05 μfd., 600 v. cond.*
39001-19	*14—250 μμfd., 600 v. cond.*
39001-80	*16, 17, 44—.02 μfd., 600 v. cond.*
B-136770	*18A, 18B—50/30 μfd., 150/150 v. elec. cond.*
39373-16	*19, 30—150 ohm, ½ w. res.*
39373-60	*20, 22—22,000 ohm, ½ w. res.*
39373-109	*21—15 megohm, ½ w. res.*
39373-80	*23—220,000 ohm, ½ w. res.*
39373-100	*24—3.3 megohm, ½ w. res.*
39373-144	*25—1200 ohm, 1 w. res.*
Part of #6	*26—47,000 ohm, ½ w. res.*
39373-35	*27—4.7 megohm, ½ w. res.*
39373-87	*28, 29—470,000 ohm, ½ w. res.*
B-135692	*31A, 31B—1 megohm vol. control & sw.*
W-137367	*38—47 ohm, 1 w. res.*

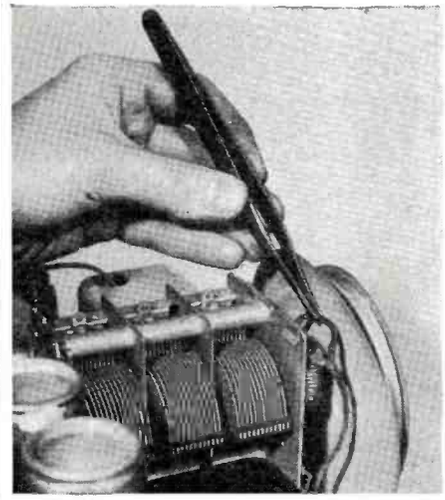
BELMONT MODEL 5D110

Part No.	Code and Description
C-9B1-78	*R_1—22,000 ohm, ½ w. res.*
C-9B1-60	*R_2—680 ohm, ½ w. res.*
C-9B1-50	*R_3—100 ohm, ½ w. res.*
C-9B1-82	*R_4—47,000 ohm, ½ w. res.*
C-9B1-34	*R_5—3.3 megohm, ½ w. res.*
C-9B1-302	*R_6—15 megohm, ½ w. res.*
A-10A-10720	*R_7, S_1—500,000 ohm vol. control & sw.*
C-9B1-90	*R_8—220,000 ohm, ½ w. res.*
C-9B1-95	*R_9—560,000 ohm, ½ w. res.*
C-9B1-52	*R_{10}—150 ohm, ½ w. res.*
C-9B1-43	*R_{12}—27 ohm, ½ w. res.*
C-9B2-54	*R_{13}—220 ohm, 1 w. res.*
C-9B2-63	*R_{14}—1200 ohm, 1 w. res.*
C-3B2-44	*R_{15}—33 ohm, 1 w. res.*
C-8F3-119	*C_1—330 μμfd., 500 v. mica cond.*
C-8F3-113	*C_2, C_4—100 μμfd., 500 v. mica cond.*
C-8F3-247	*C_3—820 μμfd., 500 v. mica cond.*
C-8D-10770	*C_5—.05 μfd., 200 v. cond.*
C-8D-10942	*C_6—.2 μfd., 400 v. cond.*
C-8D-10789	*C_8—.002 μfd., 600 v. cond.*
C-8F3-118	*C_9—270 μμfd., 500 v. mica cond.*
C-8D-10785	*C_{10}—.006 μfd., 600 v. cond.*
C-8D-10774	*C_{11}—.02 μfd., 400 v. cond.*
C-8D-10760	*C_{12}—.1 μfd., 400 v. cond.*
A-8C-10077	*C_{13A}, C_{13B}, C_{13C}—40/20/20 μfd., 150/150/150 v. elec. cond.*
C-8D-11251	*C_{14}—.09 μfd., 400 v. cond.*
A-8E-10723	*C_{15A}, C_{15B}—Dual ant. and osc. trimmer cond.*
C-211-10171	*T_1, T_2—Tuner unit*
B-13A10728	*T_3—Input i.f. trans.*
B-13B-10729	*T_4—Output i.f. trans.*
B-12C-10074-1	*T_5—Output speaker trans.*

DRESS DIAL LIGHT WIRES

DIAL light wires often contact rotating tuning mechanism and cause scratching noises as well as damage to the insulation on the wires.

Such wires should be dressed as shown to avoid rubbing contacts. H.L.



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B. 15° bend in wave guide 15" 4.40
C. 30° bend in wave guide 10" long..... 3.95
D. 90° bend in wave guide 15" long also 90° bend in coupler..... 5.00

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Flexible Section 1" long Choke to Choke.....$3.00
Mitred elbow and "S" section cover to choke.. 3.50
T-section choke to cover..... 4.50
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10 CENTIMETERS

Wave Guide, per ft. $2.00
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Coax Coupler 9/16" to ¾" coax..... 2.50
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SO RADAR

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SO Radar antenna assembly (10 Cm) dipole, parabolic reflector, 24 in. diameter. Drive and selsyn motors, wave guide couplings, rotary joint. Masking dome 30x30x40". Used and in good condition.....$ 45.00
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SO Radar indicator unit, with CR tube, focusing and deflection coils, azimuth scale, all controls, tubes and components used and good condition $100.00
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In fact we have the complete SO Radar New and Used. Ask us for quotations.

SO 13 Radar Complete, used, with new Ant.$500.00
Signal Generator, 27000 to 3000 MC Regulated power supply. 115V/60 c. Contains output meter. Made by Western Electric. Value $400. Our price.....$ 75.00

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Drive Cable 2.50
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New ARC-5 Transmitters; 25 watts CW; 15 watts phone. Tubes (included): 2-1625; 1-1629; 1-1626; 1 crystal. Ranges. (Specify frequency desired): .5-8 Mc; .8-1.3 Mc; 1.3-2.1 Mc; 4-5.3 Mc; 5.3-7 Mc; Power: 24-28 VDC.....$12.00
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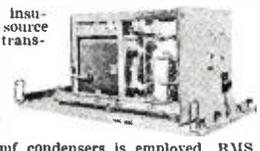
The DP-12 is a Navy direction finder, made by RCA with a frequency range of 100-1500 Kc. The input voltage is house current (115v/60c). The tube line up is 3-6C6; 4-6D6; 2-76; 1-6AF6; 1-1523. This unit is equipped with loop output junction box, flexible transmission line, input transformer, deck bearings, cable drums, operating pedestal, hand wheel, azimuth scale, loop antenna assembly, and loop pedestal. A Buy for Sea Going Vessels. Value $2500. New $195

HI-VOLT TRANSFORMERS

2 KVA Transformer and choke—115v 50 to 70 Cycle input, single phase. Output 17,000 V. @ 144 Ma. choke 4,000 H. @ 0 current. DCR 4.500 ohms. Dimensions 26"x29"W.x13"D. Amertran $94.50

3200 volts, AC 150 M. A. 115 volt. primary, 60 cycles. Designed for half wave operation with 150 M.A. output each, two transformers hooked up with secondaries in series and primaries in parallel will give 3,000 volts, output at 300 M.A. from a full wave rectifier. These are conservative, continuous commercial ratings $7.25

RA-58-A HI-VOLTAGE POWER SUPPLY



Ideal for breakdown insulation testing, or as a source of power for a pulse transmitter. This unit supplies continuously variable voltages between 500 and 15,000 volts DC at 35 ma. A voltage Doubler circuit using two 705a rectifiers and two 1 mf condensers is employed. RMS ripple voltage at maximum power is 6%. THIS UNIT OPERATES FROM 115 v/60c. Variable voltage is obtained by means of a Variac in the primary circuit of the high voltage transformer. Size is 21"x17½"x29" deep. Net weight 314 lbs. $116.00

We have unbelievable bargains in 400 cycle transformers. Ideal for pulse work. At this price you can figure out your uses for them. Most sizes at 50 cents each. Send us your voltage requirements.

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Visors for 5 inch scopes.....$0.75
Tube shields for 2A1'1..... .98
Broadcast band push-button tuning units inductive types 1.49
Mushroom rubber earphone cushions for lightweight set—2 pair for..... .89
Oscilloscope chassis, completely punched for use with a 2 inch tube. Octal sockets included 15"x11"x9" 1.50
Phones, leather covered head bands 8,000 ~ impedance, 6 ft. cord & plug, detachable cushions—new 1.95
Used, in good condition..... 1.00
140 mmf split stator variable midget condenser. 1.49
Silver button mica condensers. 175-185 mmf. ea. .05
Lots of 100 ..... 4.50
Silver button mica condensers; 500 mmf. ea..... .10
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Whip antenna—2 sections fasten together—Ideal for 10 meters 1.25
B-29 computer amplifier contains 8-6SN7s, 5 neons, 8 relays completely wired. New..... 9.95
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6 Hy Choke 60 MA. to match above..... .05
I-F Crystal filter for BC-312, BC-342 Resonant at 470 kc. Crystal included..... 6.95

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4 mf 300 vdc..... .35
4 mf 400 vdc..... .55
5-5 mf 400 vdc..... 1.15
2 mf 550 vdc..... .30
.25 mf 600 vdc..... .25
.85 mf 600 vdc..... .30
1 mf 600 vdc..... .35
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2 mf 600 ac/1000. .95
4 mf 1500 vdc.... 1.39
1 mf 2000 vdc.... 1.20
.1-.1 Mf. 7000 vdc GE Pyr. 2.00
10-10-10 mf synchro cap. 90v/60c 2.50

HI-VOLT MICA CONDENSERS

F3L .0003 mfd 8000v list $29.00.....$3.75
Solar type SX .0015 mf 3000v list $9.95..... .75
Sankamo G-3 .006 mf 10ky list $87.50..... 17.50
.0008 mf 5000vdc C-D 599-611..... .80
.0002 mf 5000vdc Aerovox..... .75
.0004 mf 3000vdc Faradon..... .70

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Tube Type	Approx. List	Your Cost	Tube Type	Approx. List	Your Cost
3BP1	$15.00	$3.95	837	$2.80	$1.35
3FP7	27.00	3.50	872A	7.50	2.45
5BP1	20.00	4.95	241B-WE	85.00	40.00
5BP4	27.00	7.95	861	155.00	50.00
5CP1	45.00	4.95	3B24	12.00	3.95
705A	22.50	6.75	3C45		5.95

Sockets for 5CP1, 3BP1, & 5BP1 and similar types of tubes.....$9.95

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12 hy-12 hy @ 150 ma., 15 amp. rating. Price $3.35
12 hy @ 165 ma 200 ohms DCR made by Thordarson. Price 2.00
50 hy @ 100 ma 850 ohms DCR made by Jefferson. Price 2.00

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Modulation, xfmr; typical for 211's cl. A50W...$1.35
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COMMUNICATIONS EQUIPMENT CO.

131-A Liberty St., WH 4-7658, New York City 7, N. Y.

Two-Tube Ham Super

(*Continued from page 49*)

setting of R_6. This method of adjustment is considerably simpler than removing or adding turns from the tickler coil L_5.

When adjustment of the i.f. has been completed, a set of coils for the desired bands should be plugged in and the signal generator set to some point within the range of these coils. As a representative figure for the 3.5 mc. band the antenna condenser is set at approximately half capacity while the oscillator bandset condenser C_3 is set to slightly greater than half capacity. With these settings, the 3.5 mc. band covers from 0 to 90 on the bandspread dial. For 7 mc. operation the antenna condenser C_2 should be set to slightly greater than half capacity and the oscillator bandset to about three-fourths capacity. The 7 mc. band will cover approximately 65 degrees in this case. For 14 mc. operation the antenna condenser C_2 is set to about two-thirds capacity and the oscillator to about approximately the same position as for the 7 mc. band. The 14 mc. band in this case covers 60 degrees on the bandspread.

The 28 mc. band uses the same set of coils as are used for 14 mc. making a total of only 6 coils necessary to cover the four popular bands. For this range the antenna condenser C_2 will be set near minimum capacity and the oscillator bandset about one-fourth meshed. The band covers approximately 62 degrees in this case.

After a signal has been tuned in, the regeneration control should be adjusted. If the station heard is a c.w. station, the proper adjustment for the regeneration control is with the second detector just weakly oscillating. This will give a marked "single signal" effect. If the received station is using phone, the regeneration control should be set just below the point of oscillation.

It will be found that the setting of the antenna condenser is rather broad and it is possible to tune across a considerable portion of any band without the necessity for readjustment. After the desired signal has been located, however, this condenser should be peaked for maximum response.

There will be a slight interaction between the regeneration control and the antenna condenser. For best results, both should be repeaked when necessary.

On the 3.5, 7 and 14 mc. bands the oscillator operates approximately 1600 kc. above the signal frequency. On the 28 mc. band the oscillator operates on the low frequency side of the signal. It will be found that in some cases the same signal may be heard at two settings of the oscillator bandset condenser C_3. This will be useful occasionally if interference is encountered.

Performance of this receiver is quite satisfactory for most applications and although the audio output is low and insufficient to drive a speaker, worthwhile selectivity and sensitivity are attained. The total cost is approximately fifteen dollars.

—30—

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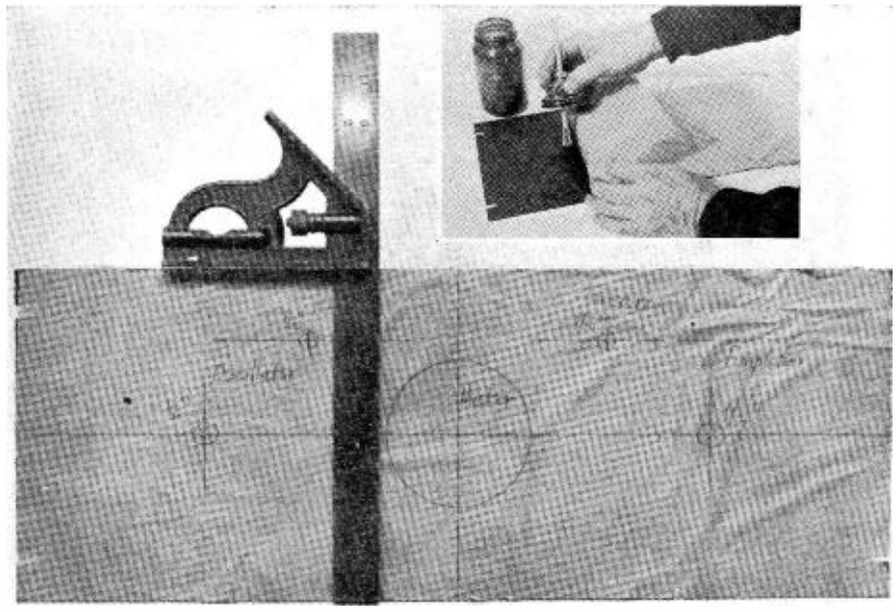
LAYING out parts holes on the crackled surface of a standard 19-inch relay rack panel is a difficult and eye-straining job. It can be greatly simplified, and the surface of the panel saved from scratch marks, if a piece of brown wrapping paper is cemented on the panel by means of rubber cement. Don't use ordinary glue or paste; the paper will shrivel up. The paper in which the panel itself is wrapped by the manufacturer is ideal for the purpose. Do all the marking in pencil, as shown; drill the holes and then simply pull off the paper.

If any rubber cement remains on the panel, roll it off with the ball of a finger. It will help to clean the surface. . D.J.B.



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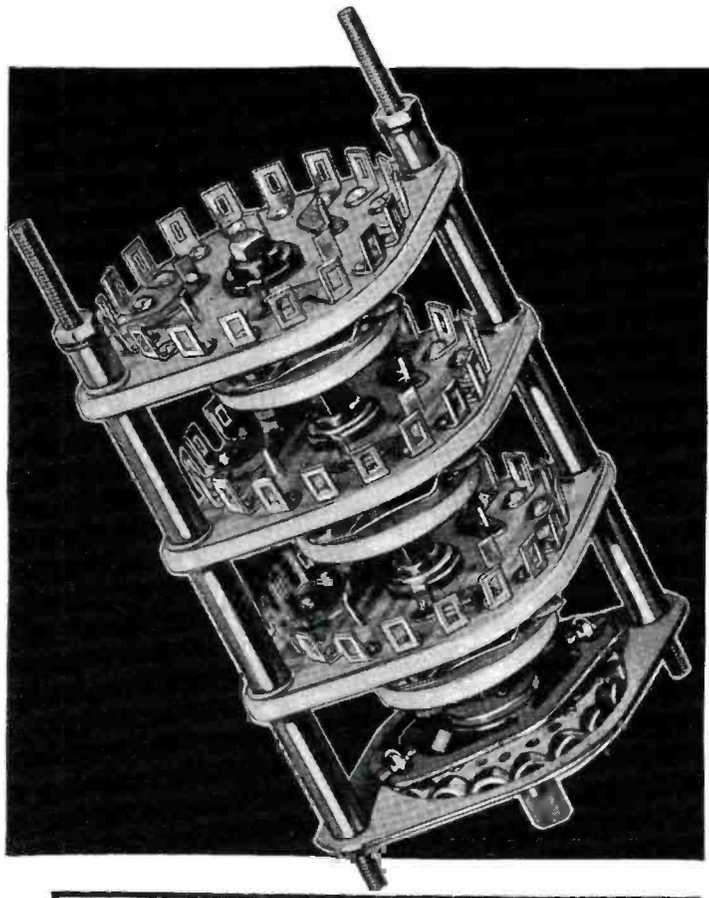

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Tests prove that these power switches have a minimum life operation of 25,000 cycles without failure. Switches have single hole bushing mounting, and tie rod extensions at front and rear serve as locating keys and added mounting support. Furnished with cadmium plated, steel and brass parts. Units in non-corrosive metals also available.

RATINGS: 7½ amperes at 60 cycles, 115 volts A.C. Minimum voltage breakdown between critical points is 3,000 volts RMS, 60 cycles. See how these fine Centralab switches can fit your industrial and electronic needs. Write today for Centralab's complete switch bulletin number 722!

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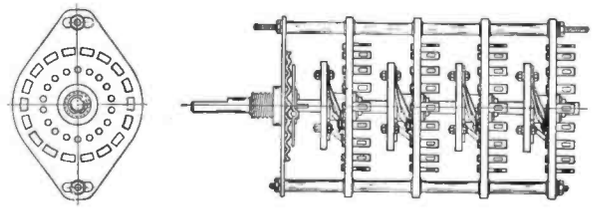

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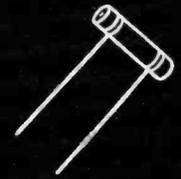

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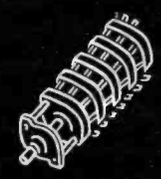


Selector Switches
Bulletin 722

Centralab
CRL
Division of GLOBE-UNION INC., Milwaukee

Sound Recording

(*Continued from page* 63)

on film, we find the low cost of the magnetic system has much to offer in producing a picture more economically. The simplicity of handling this type of recording compares favorably with other forms of wire, tape and magnetic disc recording. Immediate monitoring is available with magnetic recording on film. No processing is necessary and the magnetic recording medium can be erased by demagnetizing. The sound strip may be used over and over until the quality and coordination of sound is perfect. No serious distortion with overmodulation is probable and any part of the sound track can be edited simply by erasing and dubbing in new sound.

There are two main disadvantages to magnetic recording on film: The recording head contacts the record surface which results in the possibility of wear, and the technical performance is not quite equal to the advanced optical methods now used by the large studios. However, it should be pointed out that the above facts are based on the present state of the art. As magnetic recording on film is perfected, it may even supplant the optical systems now commonly employed.

The method for recording and reproducing magnetic sound on film is illustrated in Fig. 9. A magnetic head assembly is employed and is mounted rigidly on an adjustable holder. In fact there are three heads each having an individual arm and a spring holding the head against the film while the latter rides against the brass drum. The upper head is used for erasing and removes sound from the magnetic track previous to the recording of new sound. The erase coil is fed with the conventional supersonic frequency of approximately 40 kc. Recording is accomplished at the center head. This contains a main audio winding plus an auxiliary high frequency coil. This

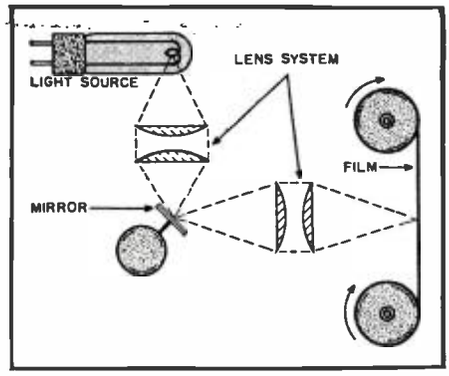


Fig. 7. The essential elements used for variable area optical recording.

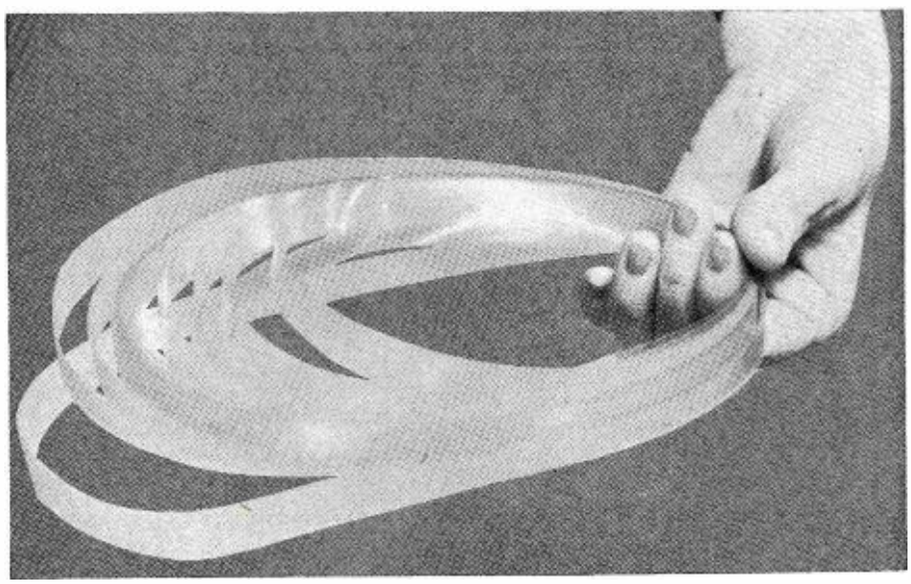
coil is connected in series with the erase coil to secure proper high frequency excitation. The third head is the monitor or playback head. This feeds directly through the amplifier and follows the picture by approximately fifty milliseconds.

Sections of various films are illustrated in Fig. 10. A magnetic material of approximately one-half mil in thickness is added to the emulsion on the film. The relative positions for the magnetized sound track are illustrated for various types of film, mainly the 8, 16, and 35 millimeter.

Magnetic recording on film bids fair to become extremely popular with the amateur projectionist. Home talking movies have become an economical reality and it is expected that with further improvements inexpensive projecting systems will be developed and will gain much popularity even with the novice.

There are other methods now employed for magnetic recording and these include magnetic recording on separate film. This is particularly suited for nonsynchronized work; for example, an eight millimeter film could be used with a full width sound track. This would be played on a second machine and would be synchronized with the other machine carrying the picture. Editing is very

Fig. 8. Endless loop of 35 mm. film used in the Filmgraph recorder.



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WILL SWAP—New G.E.-813, never used for new or slightly used RCA-8005. McMorrow Wilkin, 132 Oakwood Ave., Troy, N. Y.

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WANTED — Collins T47A/ART-13 with dynamotor and cables. State price and condition. J. J. Lee, W1GEH/6, 441 Ellis, San Francisco 2, Calif.

WANTED—Will pay cash for all parts variable condenser, including pulleys, dial plate, pointer, etc., for Bosch model 510, serial #328804. Charles B. Twiss, 164 Meridian St., Groton, Mass.

WANTED—Thordarson T-15D79 driver transformer, must be in new condition. Top price. Joseph Cairo, 6516 Cornelius St., Philadelphia 38, Penna.

WANTED—Rider's manual abridged 1 to 5. Also Rider's service books. Richard Clark, 157 Grand Ave., Grand Rapids, Mich.

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WILL TRADE—10" dynamic speakers; power transformer with four filament windings, 200 mils; other transformers; var. condensers. Need second-hand instruments: sig. generator; hi-range volt-ohmist; tube tester; short wave receiver, 3-band. S. Egelberg, 1485 Vyse Ave., Bronx 60, N. Y.

WANTED—Communications receiver SX-28 or similar. Swap three Lionel trains O27 gauge with accessories, $315 value. Clarence Cook, 115 Chadwick St., Medina, N. Y.

WANTED—University RCP-12 chandelier-type speaker baffle. Ralph Senechal, 586 Hampton Rd., Hayward, Calif.

WANTED—2 Handie-talkies 144 mc-148 mc in working order; National receiver RC-40 good working order. Roger Mayrand, 1828 Valois St., Montreal 4, Canada.

WANTED—Radio control box BC-450A complete with instruction book. Will trade for SCR-274N also 6-12 V Sig. C. battery charger. Will pay reasonable price. John A. Seaman, Gentry, Ark.

WANTED—Meissner signal shifter with coils for all bands. Charles Costa (W2SIF), Box 97, Woodstock, N. Y.

WANTED—Class B transformers for 46's. Preferably from BC-223A; also SW-3. W6YRT, P. O. Box 769, Elsinore, Calif.

WANTED—Used S-20-R or S-22-R receiver, any condition. Will swap Army field set valued at $40 or cash. Carlton Cleveland, 1110 Fullerton St., Chicago 14, Ill.

WANTED—5" 'scope; schematic or service manuals, parts for CW-23012, CW-23098 Navy remote controls for Navy RU-16 rec. and GF-II transmitter. M. B. Hemby, 1240 Green St., San Francisco 9, Calif.

WANTED—Condenser tester; filament transformer, 5V-25 amps., 5000V, 110V a-c primary; power transformer 3000-0-3000, 350 MA, 110V a-c primary. Baney Radio Service, 115 Cleveland St., Butler, Pa.

WANTED—Used instruments: sig. generator; hi-range volt-ohmist; tube tester; or small s.w. receiver, three bands, plug in coils. Stanley Egelberg, 1485 Vyse Ave., Bronx 60, N. Y.

FOR SALE—SW-3-AC complete with power supply, 20, 40, 80-meter band spread coils, tubes $25; FB rig, xtal osc, 6L6's push-pull 40-watts, all coils, ready to go on air, $35. Bou Radio Service (W3ESX), 3131 N. Percy St., Philadelphia 33, Pa.

FOR SALE—2-meter super-regen. receiver. Closed metal cabinet, 5" p.m. speaker in front panel. 955, 6C5, 6F6-self quenched detector. F. Craven, 2216 S. 7th St., Philadelphia 48, Penna.

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FOR SALE—Kato rotary converter 110V d-c to 110V, 60cy. a-c. 150 watts continuous. Never used, perfect condition, $37. Charles B. Wakeman, 495 Yale Station, New Haven, Conn.

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WANTED—1-25B8 also 2-6B5. Must be new, preferably in carton. M. L. Grigsby, Granger, Iowa.

WANTED—Gud receiver covering 10-160 meters. National SW-3 or FB7X will do. Have Collins 32-RA 100-watt phone, 150-watt cw transmitter, 4-channels MOPA or Xtal; also BC-348, ES BC-221AC-W2SXV, 141 Sanford Ave., Lyndhurst, N. J.

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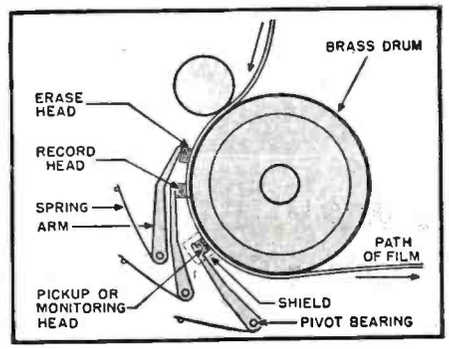

Fig. 9. Triple head assembly for recording and reproducing (magnetically) on film.

simple and the film may be cut and spliced in the usual way.

Magnetic Recording on Tape, Disc, and Wire

Fundamentally the recording on paper tape, paper disc, or wire is the same. The main difference lies in the mechanical means for driving the material to be magnetically recorded, in the means for playing back the sound, and in the employment of different techniques for recording the sound on the material.

Magnetic materials are drawn past a recording head. As the material passes the head, it becomes and remains magnetized. The amount of magnetism remaining in the material at each instant is governed by the signal impressed upon the recording head. In playing back, the magnetic material is drawn past a playback head. In many systems the recording and playback heads are the same, Fig. 11. The magnetization, which is variable, exists in the material and induces a corresponding voltage in the coil of the playback head. The functions of recording and playback are incorporated into a single record-playback head in most magnetic recorders.

It is a simple matter to erase any signal from any of the magnetic materials now employed. A strong field is set up within the erase head and this is impressed upon the material. This erases the old signal and makes the material ready to receive new signals. Basically, the tape, disc, and wire recorders consist of the magnetic material, the record-reproduce head and the erase head. In addition, of course, are the various types of driving systems used to draw the material through or over the head and the conventional amplifying and reproducing systems.

A supersonic oscillator, usually from approximately 30 to 40 kc., serves

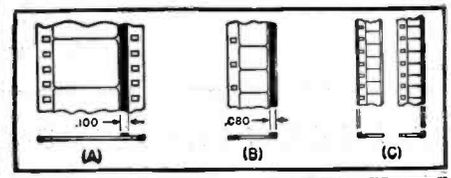

Fig. 10. Sections of 35, 16 and 8 mm. film showing the actual position of the magnetic sound tracks.

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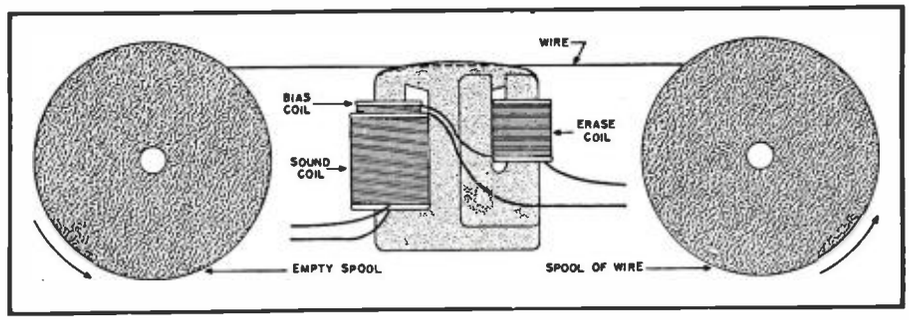


Fig. 11. Combined record-playback head assembly for wire.

the double purpose of providing high frequency for both the demagnetizing head and for the recording head. The material is first run through the erase head. Here it is demagnetized and made ready for the recording. The audio signal from the sound source appears at the recording head. The application of a supersonic signal to the recording head provides a bias. This is essential to overcome the nonlinearity of the normal magnetization curve of the magnetic materials. Fundamentally these materials are the same. They differ only in their type of construction. These materials may be in the form of steel tape, wire, magnetized coating upon paper tape, or upon paper discs, or in fact the magnetized material may be coated or impregnated into various alloys.

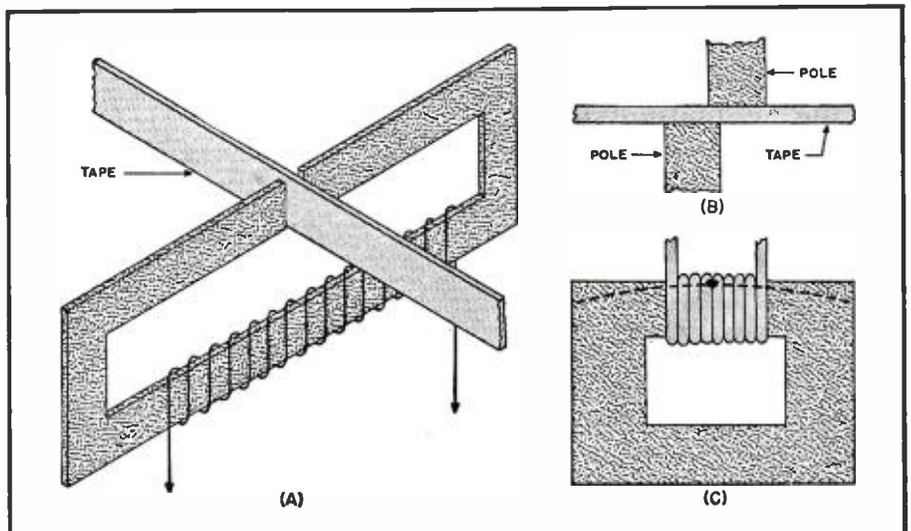
Insofar as quality of recording-reproduction is concerned, we find that speed is an all-important factor. The higher the speed, generally, the greater will be the fidelity. This will be completely explained in following articles.

The development of record-erase heads has gone on at a rapid pace. Beginning from cumbersome units often measuring four inches square, new tiny heads have been developed which are no larger than a regular two cent postage stamp. The magnetic field in these new units has been concentrated and condensed to a very small area. The slot, for example, in the case of a wire recorder head, often is not more than one-thousandth of an inch in width. The traveling wire passes through this slot and encounters the magnetic field set up by the head as in Fig. 11.

Three basic types of magnetic recording heads are illustrated in Fig. 12. In magnetic recording, frequency response, noise level, and signal amplitude are affected by the type of magnetic material used. At fixed speed and at lower frequencies, the retentivity, which is the measure of residual flux density, will determine the magnitude of the output voltage from the reproducing head. Generally speaking, the lower or bass notes must be suppressed when using magnetic recording. This too applies to the cutting of slow speed electrical transcriptions by means of lateral styli on discs.

Frequency response from the above systems, as mentioned, depends largely upon the speed of the magnetized material as it passes the head. A frequency response of between 60 and 8000 cycles per second can usually be obtained from most of the above machines. Recording time depends upon the material used and upon the physical size of the containers for the magnetized material. For example, the average wire recorder has enough stainless steel wire to operate for approximately 66 minutes at a speed of 2 feet per second. This type of recorder is being used to dictate this entire series of articles.

Fig. 12. Simplified diagrams of (A) record-reproduce head for transverse recording on tape, (B) offset, thick pole pieces which improve characteristics of head shown in (A), and (C) closed type wire record-reproduce head.



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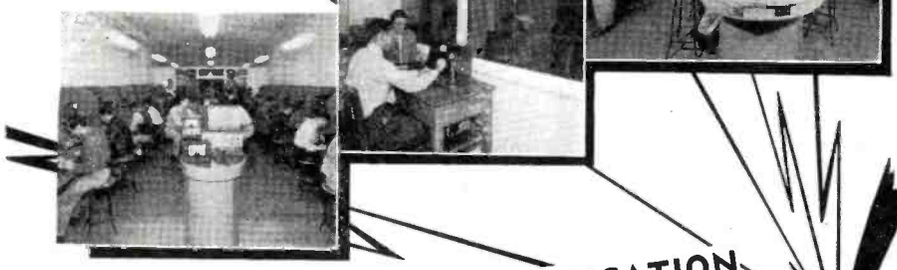

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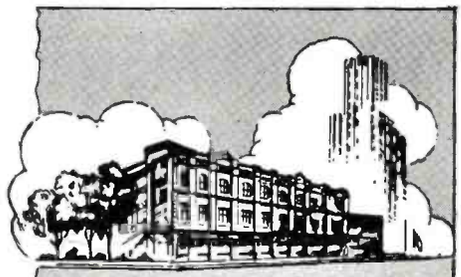
The Radio courses offered by the Tyler Commercial College are highly specialized to enable you to enter many branches af radio, both as your vocation or your profession. The present courses listed represent a partial list of the extensive and complete training offered by the Tyler Commercial College who have had over 30 years experience in the Radio Training Field.

They invite you to examine the content of their catalogue and determine for yourself how rodio training at Tyler Commercial College will enable you to find your own ploce in one of the many interesting ond profitable jobs in the vast rodio industry.



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Some of the paper tape machines run three or four hours. They employ regular 8 or 16 millimeter reels such as are used in movie projectors. They require more physical area for their mounting and are therefore a bit more cumbersome than the more compact disc or wire types.

We have touched but briefly on various methods for recording sound on disc, tape, wire, film, etc. Later articles will include the complete recording-playback systems for all of the above methods. Complete analysis will be given to each. There are so many means for recording and reproducing sound that we must first understand the functions of various component parts if we are to get maximum results from the systems.

Our next article will cover driving systems (cutters, embossers, etc.), their construction and characteristics.

(To be continued)

Mobile Radiotelephone

(Continued from page 47)

there is high local noise. Because of the large ratio of mobile units to fixed units, the over-all cost of service to the public is reduced by having the mobile units as small and simple as possible.

In determining the locations of the fixed land stations, field surveys are undertaken to determine propagation characteristics of the area. This is usually done by a combination of computation of field intensity over various paths and the making of actual field surveys.

Usually the land transmitter should be located at the highest available site in the vicinity of the area to be covered because of the line-of-sight propagation characteristics of very high frequencies. In general, the most suitable location for the land transmitting antenna will be on or above the roof of a centrally located building commanding a relatively unobstructed view in all directions of desired coverage. In some cities, hills may afford favorable sites; in others, a telephone central office or a midtown office building may be desirable to afford a high signal intensity where radio frequency noise is the highest. Here multiple-path transmission results from reflection and diffraction effects, causing signal field intensity to vary over a wide range within short distances. If the general level of signal intensity is relatively high, these variations are not very disturbing.

"Shadows," within which the signal intensity is considerably attenuated, may be cast by high buildings in the service area, and this effect is particularly marked on the far side of buildings near the transmitting antenna. In nearby "shadows," the high signal fields near the transmitter serve to offset the high attenuation enough to make the signal satisfactory, and the "shadow" area of high buildings a mile or more away from the transmitting antenna will be smaller and tend to fill in as distance beyond the interfering building increases. Increasing the height of the transmitting antenna often reduces this "shadow" effect.

In the case of land station receiving sites, the foregoing also applies. Another important problem is local radio frequency noise. The principal sources of noise at frequencies used in this service are man-made, such as electrical machinery, diathermy apparatus, etc. Thus locations should be selected where such interference is at a minimum.

The control terminal is usually located in a telephone building where a toll switchboard and toll power supplies are available.

The coverage of an area in a given direction is considered sufficient if the average signal-to-noise ratio is approximately 17 db. This ratio is determined from two measurements. The measurement of the magnitude of the signal is made with the transmitter fully modulated with a 1000-c.p.s. tone; the noise measurement is made with the transmitter on, but not modulated. The difference in signal and noise measurements in db. is the signal-to-noise ratio. These measurements may be made with the *Western Electric* 2B Noise Measuring Set.

Coverage measurements must take into account radiated power, distance from transmitting antenna, effective height of both transmitting antenna and receiving antenna, local noise, type of intervening terrain, and objects in the optical line of sight between the transmitting antenna and receiving antenna. Profiles of the terrain, drawn to take into account the curvature of the earth, are used in computations of coverage.

In the selection of land receiver sites, all of the above mentioned problems apply. The receivers, and particularly their antennas, should be located well away from noise-generating devices. In some cases it may even be desirable to locate one of the land receivers at or near the land transmitter. In the absence of actual measurements, the noise conditions may be estimated by grouping into four classes:

A. Very low noise — outlying residential area, light traffic; *B. Moderate noise*—residential area, moderate traffic; *C. High noise*—residential area or business district, heavy traffic; and *D. Very high noise* — business or industrial area, heavy traffic.

Measurements have indicated the radiated power necessary for sufficient signal-to-noise ratio at various distances under varying noise conditions and with various effective antenna heights. For example; with an antenna height above the effective ground plane of approximately 200 feet, range to be expected with 100 watts of radiated power at a frequency of 160 mc. over smooth earth under varying noise conditions is: *A.* Very low noise, approximately 30 miles; *B.* Moderate noise, approximately 25 miles; *C.* High noise, approximately 17

(Continued on page 113)

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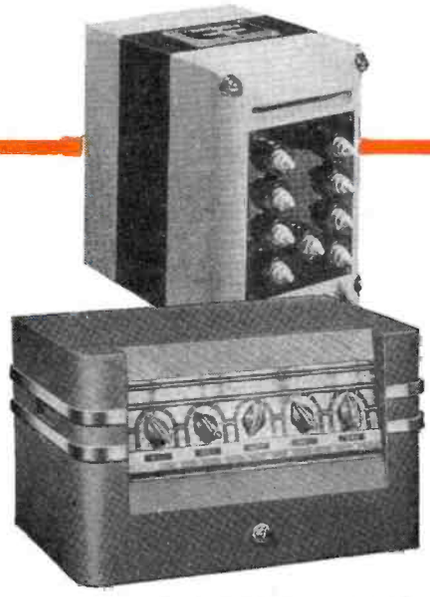

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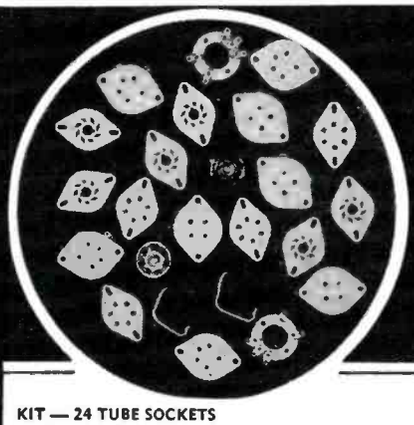

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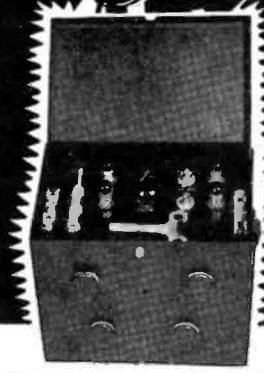
Price, complete kit.....$1.95



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A proud addition to any Ham Shack. Use it to ink paper tape for high speed sending or receiving, or convert to other uses. Original price several times this low price. Shipped as shown in individual wood carrying case. Tubes used: 1-1117Z6; 2-117P7—not included.

Price for both.....New.....$50.00
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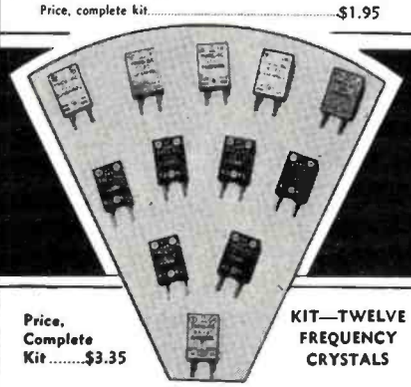
SIGNAL CORPS TIME INTERVAL UNIT ML-138

This unit is housed in a sturdy metal case, 7½"x6"x5¼" with hinged top. Includes necessary adjustment tools. Powerful clock mechanism runs several days. Audio Tone, controlled by relay, is emitted for several seconds once every few minutes. Two flashlight cells needed. Has many possibilities for Radiomen or Model Makers. Parts alone are worth more than our price.

Price.....$4.95 ea.



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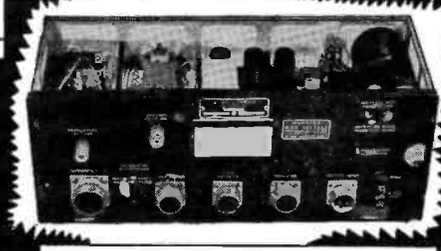

BC-348 POWER SUPPLY

To convert the BC-348 receiver for 110 V. AC operation. Constructed especially for the Esse Radio Company by a leading transformer company.

These power supplies have gained great popularity due to quality, price and simplicity in conversion. Filament supply 24V. Rectifier tube used: 6x5 (not included).

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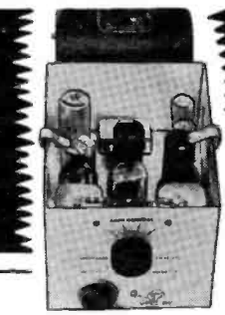

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Convert to high fidelity phone amp. or speech amp. Case size 9¾"x4¾"x5½". Tubes used and included: 2—12SJ5GT, 2—12A6. Complete with dynamotor as shown, for 24 V. DC operation.

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Metallic Objects Only

Used by the Army to detect buried metallic mines. Its private use suggests the location of underground or underwater pipes, cables and ore bearing rock, the location of metallic fragments in scrap materials, logs, etc. and the screening of personnel in plants for carrying of metallic objects.

The unit consists of a balanced inductance bridge, a two-tube amp. and a 1,000 cycle oscillator. The presence of metal disturbs the bridge balance, resulting in a volume change of the 1,000 cycle tone. The tubes used are low battery drain types such as 1G6 and 1N5. The circuit may be modified for control of warning signals, stopping of machinery etc. when metal is detected. Operates from two flash light batteries and 103 V. "B". However, a power supply operating from 110 V. may be used. Comes complete with spare tubes, spare resonator and instruction manual — in wooden chest 8¼"x28¼"x16". Weight in operation is 15 lbs. New, complete in original overseas packing container. Originally sold by War Assets for $166.00.

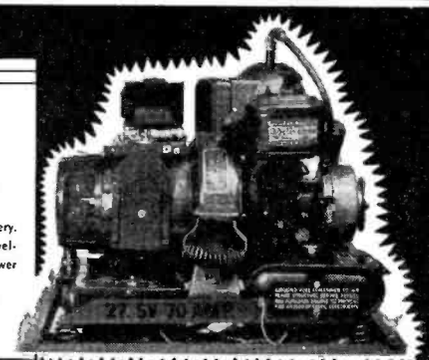
The U. S. Forestry Service has recommended procedure for using the SCR-625 Mine Detector to find concealed metal in tree logs and other timber products.

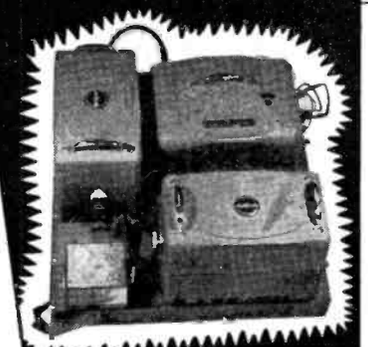
Price.....**$79.50 ea.**

GASOLINE GENERATOR—
27.5 V. DC — 70 AMP.

Electrical starting when connected to 24 V. battery. Ideal for power for emergency, cabins, aircraft, welding etc. These units were used for auxiliary power on bombers.

Price, used.....**$72.50**





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LINK FM POLICE TRANSMITTER AND RECEIVER (Not Shown)

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MINE DETECTOR AN/PRS-1
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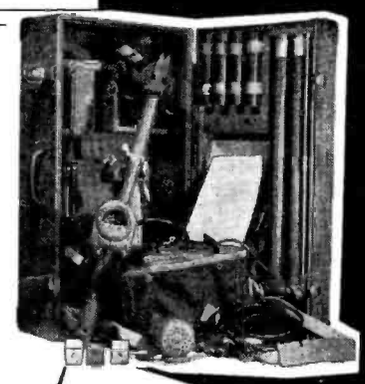

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miles; and *D*. Very high noise, approximately 10 miles.

The range increases, of course, with greater radiated power and with greater effective antenna height.

Highway service presents many similar problems. Since there is a marked difference in transmission at 40 mc. over good soil and poor soil, soil conditions must be carefully considered. Poor soil for radio transmission purposes is soil of relatively low conductivity and dielectric constant such as that consisting largely of rocks, gravel, or sand. Good soil from an engineering standpoint is soil of high conductivity and dielectric constant such as clay, loam, marsh or swamp land.

Heavy duty generating equipment is necessary for a vehicle equipped for highway mobile radiotelephone service. A storage battery of greater capacity will also be required. The choice of proper generating equipment depends upon the number of hours the vehicle is driven per day, the average speed at which it is driven, the number and duration of telephone calls per day.

There are also problems associated with the choice of closely coupled antennas or with use of a common antenna for transmission and reception.

In the case of closely coupled antennas involving a land transmitter and a land receiver, three primary conditions should be met:

1. The output of the transmitter should not overload the r.f. stages of the receiver.

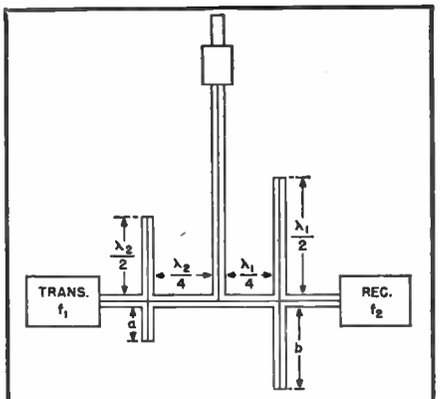
2. No spurious radiation from the transmitter should fall in the same channel as the fundamental response of the receiver.

3. The fundamental radiation from the transmitter should not occur at the same frequency as any spurious response of the receiver.

To meet condition 1, it must be remembered that the first r.f. stage is not very selective compared to the performance of the entire receiver. The tube may draw grid current when the input level is about 10 dbm., causing limiting in the stage with resulting noise and distortion. Since the output of a 250 watt transmitter is 54 dbm., a minimum loss of $54 - 10 = 44$ db. must be provided and to give considerable margin, this loss requirement is increased to 60 db. The loss may be provided by antenna separation, filters, or a combination of both.

If L is the transmission loss introduced, $L = L_1 - L_2$, where L_1 is loss introduced at the interfering frequency and L_2 is the accompanying loss at the operating frequency. Wave traps built of ⅞-inch coaxial transmission line and installed in the receiver lead would introduce approximate losses of $L_1 = 46$ db. and $L_2 = .04$ db. in the highway service, and $L_1 = 52$ db. $L_2 = .02$ db. in the urban service.

The diagram, Fig. 1, shows a method of installing wave traps in the transmission lines connecting a transmitter and a receiver to the same antenna. The wave trap in the transmitter lead is required only at very quiet locations. It prevents any portion of the incoming signal from being diverted from the receiver to the transmitter.



CONDITION	a	b
$\frac{\lambda_2}{\lambda_1} < 1$	$\frac{\lambda_1 - \lambda_2}{2}$	——
$1 < \frac{\lambda_2}{\lambda_1} < 2$	$\frac{2\lambda_1 - \lambda_2}{2}$	——
$\frac{\lambda_1}{\lambda_2} < 1$	——	$\frac{\lambda_2 - \lambda_1}{2}$
$1 < \frac{\lambda_1}{\lambda_2} < 2$	——	$\frac{2\lambda_2 - \lambda_1}{2}$

Courtesy of Bell Telephone Labs., Inc.

Fig. 1. Stub arrangement for reducing interference when one antenna is used for continuous operation of transmitter at frequency, f_1 and receiver at frequency f_2.

HIGHWAY SERVICE	
Land Station Transmitters	
12 channels, .04 mc. apart and lying between 35.22 and 35.66 mc.	
Mobile Transmitters	
12 channels, .04 mc. apart and lying between 43.22 and 43.66 mc.	
URBAN SERVICE	
Land Station Transmitters	
12 channels, .06 mc. apart and lying between 152.03 and 152.69 mc.	
Mobile Transmitters	
12 channels, .06 mc. apart and lying between 157.29 and 157.95 mc.	

Table 2. Frequency allocations for mobile radiotelephone service.

This is not a serious consideration at locations where set noise is not controlling. The wave trap in the receiver lead is always important, for it allows most of the transmitted signals to be radiated. Two or more wave traps may be installed in the receiver lead at half wavelength (at transmitter frequency) spacing, providing approximately the same suppression from each additional wave trap as obtained with the first. Sufficient loss may be provided with one filter and two should be more than sufficient.

If conditions 2 and 3 are met, the equipment design characteristics provide that an interfering transmitter signal will be at least 70 db. below the desired signal at the first limiter grid. Additional suppression of an interfering signal can be obtained by antenna decoupling or by the use of filters. For interference-free operation, the magnitude of the interfering signal should always be at least 70 db. $+ L$ below the desired signal at the first limiter grid of the receiver, and L should be approximately 100 db.

A subsidiary problem is to choose transmitter and receiver frequencies so that no spurious radiation from the transmitter occurs at the same frequency as any spurious radiation of the receiver or in the channels immediately adjacent to the fundamental response of the receiver.

For highway service, the receiving antenna will discriminate somewhat against the transmitter frequency since it will be adjusted in length to be more receptive at the receiver frequency. In the urban service, however, frequency separation relative to the operating frequency is so small for the two directions of transmission that the same antenna dimensions are used at the receiving site as at the transmitting site.

Another problem is to keep the radiation of spurious cross-modulation within tolerable limits during simultaneous operation of two transmitters operating into nearby antennas.

When appreciable r.f. voltages from one transmitter are impressed across the output tank circuit of another, spurious signals are generated because of the non-linear characteristics of the class "C" final amplifier circuits used in the transmitters. The problem of reducing materially the strength of the signal of one transmitter reach-

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at virtually cost of component parts, drawings, instructions, packing and mailing costs —complete except for cabinet, wire and solder.

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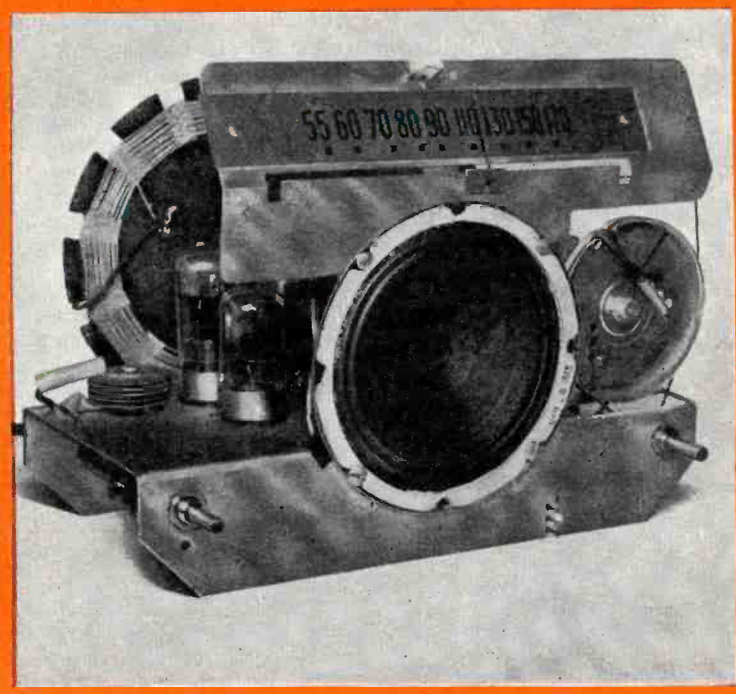

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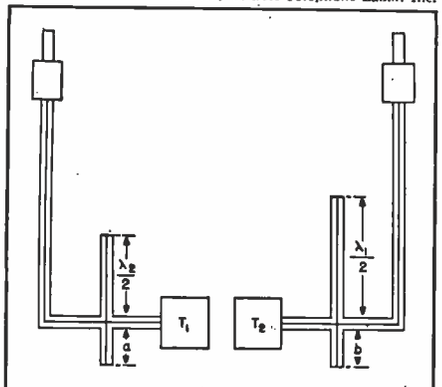
ing the tank circuit of the other transmitter by way of the antenna coupling becomes of great importance. The use of a filter between each transmitter output and its associated antenna feed line with the series elements of each filter resonant at the operating frequency of the transmitter with which it is associated and the shunt elements of each filter resonant at the operating frequency of the interfering transmitter is the obvious solution. However, because of the small ratio of frequency separation over the operating frequency as it is possible to obtain in the urban band, it is extremely difficult to build a filter which will discriminate against the interfering frequency without prejudicing the operating frequency. In the highway band, physical size of these coaxial filters is somewhat unwieldy, a quarter wavelength section being about six feet. If it is necessary to locate two transmitters in close proximity, it may be desirable to place the transmitter frequencies either as close together as possible or as far apart as possible. If the two frequencies are close together, the difference frequency is small, and all cross-modulation products will be grouped closely around the assigned frequencies. If the frequency difference is large, it is unlikely that the antennas will radiate any of the spurious frequencies developed. Fig. 2 shows filters designed to reduce interference between nearby transmitting antennas.

With the superheterodyne type of receiver, the harmonics of the local oscillator in one receiver may reach a nearby receiver through the coupling of the antenna connected to the two receivers. Measurements on receivers to be used in the mobile service show that the order of magnitude of the spurious output is low enough so that it is not expected to cause interference

Fig. 2. Stub arrangement for reducing interference between transmitting antennas operating in nearby and adjacent areas.
Courtesy of Bell Telephone Labs., Inc.



CONDITION	a	b
$\frac{\lambda_2}{\lambda_1} < 1$	$\frac{\lambda_1 - \lambda_2}{2}$	—
$1 < \frac{\lambda_2}{\lambda_1} < 2$	$\frac{2\lambda_1 - \lambda_2}{2}$	—
$\frac{\lambda_1}{\lambda_2} < 1$	—	$\frac{\lambda_2 - \lambda_1}{2}$
$1 < \frac{\lambda_1}{\lambda_2} < 2$	—	$\frac{2\lambda_2 - \lambda_1}{2}$

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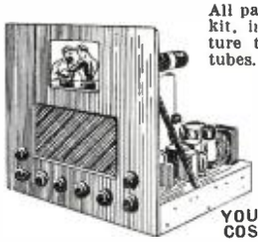


All parts included in the kit, including a 7" picture tube and 20 other tubes. Set pre-tuned for any of three Channels. Special antenna with 5 ft. upright aluminum mast and low loss lead in cable.

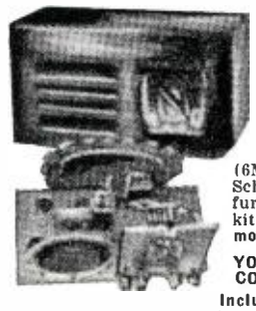
YOUR COST **$158.50**

6 TUBE AC-DC SUPER HET

Complete including attractive Walnut cabinet with slide rule dial. Built in antenna. **All major parts mounted.** Uses 2—12SK7's, 1—12SQ7, 1—12SA7, 1—35Z5, 1—35L6. Schematic diagram furnished with each kit.

YOUR COST **$19.95** Including Tubes Less Wire and Solder

5 TUBE AC 2-BAND



Complete with attractive Walnut cabinet and Airplane dial. Uses 1 — 6SA7, 1 — 6SK7, 1—6SQ7, 1—5Y3. Covers standard Broadcast (540 K to 1700 KC and Short Wave band (6MC to 18 MC). Schematic diagram furnished with each kit. **Major parts mounted.**

YOUR COST **$25.50** Including Tubes Less Wire and Solder

9 TUBE FM KIT

Complete with 29" single dipole antenna, less transmission line. Covers New FM band. Includes amplifier and 9 tubes. Easy to build—all you need is soldering iron, wire and solder. Pictorial and Schematic diagram furnished with each kit. All standard parts.

YOUR COST **$48.95** Including Tubes Less Wire and Solder

5 TUBE Super Het RADIO KIT

Complete including attractive Bakelite cabinet. **All major parts mounted.** Uses 1—50L6, 1—35Z5, 1—12SA7, 1—12SK7. Pictorial diagram furnished with each kit.

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The New Model 450 TUBE TESTER

Speedy operation—assured by newly designed rotary selector switch which replaces the usual snap, toggle, or lever action switches.

SPECIFICATIONS:

- **Tests all tubes up to 117 volts.**
- **Tests shorts and leakages up to 3 Meghoms in all tubes.**
- **Tests both plates in rectifiers.**
- **New type line voltage adjuster.**
- **Tests individual sections such as diodes, triodes, pentodes, etc., in multi-purpose tubes.**
- **Noise-Test—detects microphonic tubes or noise due to faulty elements and loose internal connections.**
- **Uses a 4½" square rugged meter.**
- **Works on 90 to 125 volts 60 cycles A.C.**

EXTRA SERVICE—May be used as an extremely sensitive condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute. **$39.50**

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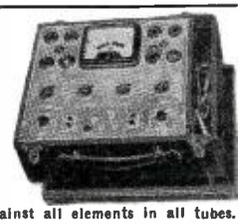
A Combination VOLT-OHM MILLIAMMETER plus CAPACITY REACTANCE, INDUCTANCE and DECIBEL MEASUREMENTS

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

The Model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½"x7½"x3" NET **$28.40**

The New Model 600 SET TESTER



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- **Tests all tubes up to 117 Volts.**
- **Tests shorts and leakages up to 3 Megohms in all tubes.**
- **Tests leakages and shorts of any one element against all elements in all tubes.**
- **Tests both plates in rectifiers.**
- **Tests individual sections such as diodes, triodes, pentodes, etc., in multi-purpose tubes.**
- **New type line voltage adjuster.**

MULTI-METER SPECIFICATIONS:

- **D.C. VOLTS: (At 1,000 Ohms Per Volt) 0 to 7.5/15/75/150/750/1,500 Volts.**
- **A.C. 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 2.000/20.000/200,000 Ohms 0 to 20 Megohms.**
- **DECIBELS: (Based on zero decibels equals .006 Watts into a 500-Ohm line.) —10 to +18 D.B., +10 to +38 D.B., +30 to +58 D.B.** **$62.50**

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PREMIER SIGNAL GENERATOR

Model 570 YOUR COST **$54.75**

Micro-Master tuning dial. Eliminates back lash and provides smooth split-cycle tuning. Calibration accuracy better than 0.5% up to 1.6 MC, and 1% on higher frequencies. Air trimmers on all bands. Buffer stage modulated by 400 cycle generator. Pure sign wave—less than 5% distortion. 9" Three color dial face. Frequency range 75 KC to 50 MC on the fundamental frequency and up to 150 MC on the third harmonic.

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D.C. VOLTS: (At 1,000 Ohms Per Volt) 0 to 3/15/30/75/150/300/750/1500/3000 Volts.
A.C. VOLTS: (At 1,000 Ohms Per Volt) 0 to 3/15/30/75/150/300/750/1500/3000 Volts.
D.C. CURRENT:
0 to 3/15/30/75/150/300/750 Ma. 0 to 3/15 Amperes.
RESISTANCE:
0 to 1,000/10.000/100,000 Ohms; 0 to 1/10/1,000 Megohms.
CAPACITY: (In MFD)
.0005—.2, .05—20, .5—200.
REACTANCE:
10 to 5M (Ohms, 100—50M (Ohms), .01—5 (Megohms).
INDUCTANCE: (In Henries)
.035—14, .35—140, 35—14,000.
DECIBELS:
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unless it actually falls within the pass band of the disturbed receiver. Even in this case it will cause interference only when the antennas of the disturbing and the disturbed receiver are rather closely coupled.

-30-

RPEE Conference

(*Continued from page* 54)

diocre beginning to one of the largest of all annual conventions.

Whether you are an Old Timer or a newcomer in the radio industry, the Radio Parts and Electronic Equipment Conference and Show will give you a complete picture of the industry today, the progress made in past years and the bright promise of an even greater future in radio and electronics.

Friday, May 16th has been set aside as "Open House Day" in order to accommodate the thousands of visitors keenly interested in the radio industry and its displays. This is a golden opportunity for you servicemen and amateurs living within driving distance of Chicago to come in and meet your favorite manufacturers, publishers, service authorities and distributors and to talk to them personally.

There is little chance that you will be able to find sleeping quarters for an overnight stay so don't count on a bed unless you already have hotel accommodations or can stay with a friend.

Copies of the RADIO NEWS DAILY will be available to acquaint you with the happenings at the Show. We'll be looking for you.

-30-

Phase Modulation Exciter

(*Continued from page* 69)

modulation is relatively small so that it is necessary to multiply the frequency in order to obtain sufficient deviation for satisfactory narrow band communication. By using an 80 meter crystal and multiplying the frequency eight times, a deviation of 2 to 3 kc. can be produced in the 10 meter band.

Construction

Most of the necessary construction details can be seen in the photographs.

The exciter unit is built on a standard 5½"x9"x3" chassis which can be obtained at any regular parts distributor.

The midget variable condensers are mounted directly to the chassis. There is no d.c. on the rotor which makes the mounting of these parts easy. In the r.f. section ceramic sockets and mica bypasses are employed.

In wiring, all grounds are made direct to the chassis and tie lugs are used freely for the mounting of resistors and condensers.

Operation

Tuning of the exciter is conventional and the procedure is as follows: With a 0-1 milliammeter plugged into jack, J_1, at the rear of the chassis, C_6 of the phase modulator tank circuit is tuned for maximum grid current reading. The meter should read from .1 ma. to .5 ma. depending on the activity of the crystal.

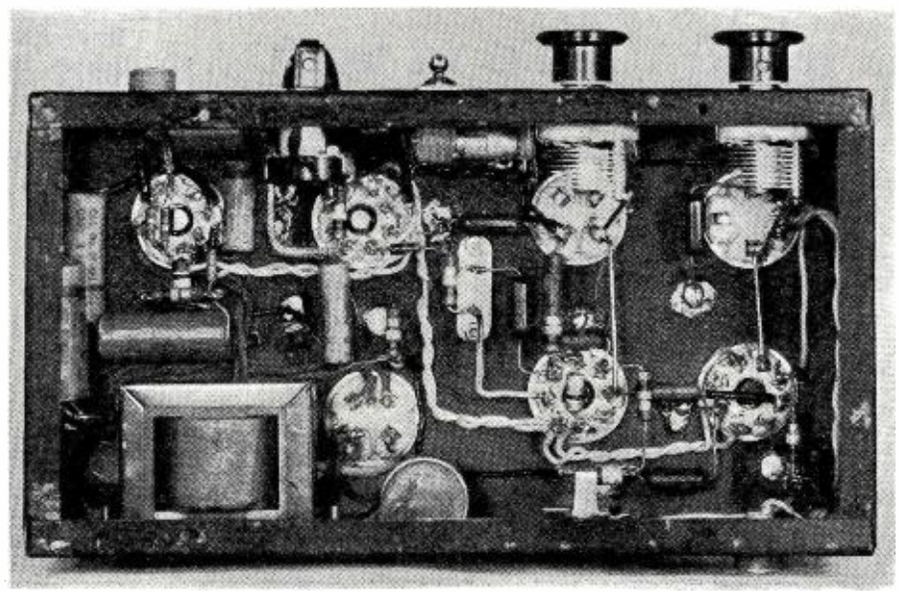
The tank circuit of the doubler stage is tuned to resonance with the help of a neon bulb. The output of the doubler stage is link-coupled through a microphone cable or twisted pair to a tuned circuit which plugs into the crystal stage of the transmitter that the exciter is feeding.

If the crystal stage is a tritet oscillator, the cathode coil should be shorted out. No attempt was made to feed the exciter into a Pierce oscillator.

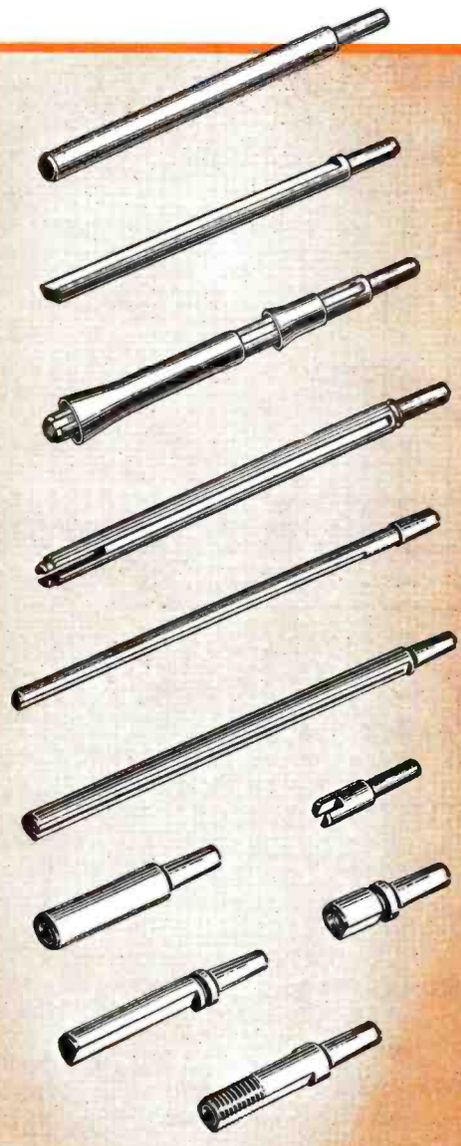
The gain of the two speech stages is sufficient to accommodate a crystal or dynamic mike. The gain control is used in the conventional manner.

-30-

Under chassis view of narrow-band phase modulation exciter unit.



11 SHORT CUTS TO SERVICING



"Quick, easy and efficient" . . . that's how servicemen describe IRC's 11 Tap-In Shafts. No fiddling or fussing with shaft inserts or "build-ups" . . . no money tied up in stocks of exact replacements. A smart tap of the hammer and the tapered surfaces of control and shaft lock together, forming a permanently tight attachment.

In combination with the IRC Century Line of Volume Controls, these 11 Tap-In Shafts are the logical answer for over 90% of your replacement problems. Save you time and money. Time saved means extra time for other money-making jobs . . . money saved means greater profits. The latest edition of the popular IRC Volume Control Replacement Manual is now available. Contains information on nearly all models up to 1946, complete listings for the 1941-42 sets coming in now for repair. 156 pages. 25c at your IRC Distributor. International Resistance Company, 401 N. Broad St., Philadelphia 8, Pa. *In Canada:* International Resistance Co., Ltd., Toronto, Licensee.

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INTERNATIONAL RESISTANCE COMPANY

IRC

Wherever the Circuit says Ω

FM Tuner Conversion

(*Continued from page* 53)

Now, remove the wire connection from the oscillator tuning capacitor, (see photo Fig. 6 inset). A 40 $\mu\mu$fd. ceramicon is connected in series with this capacitor and the wire just removed.

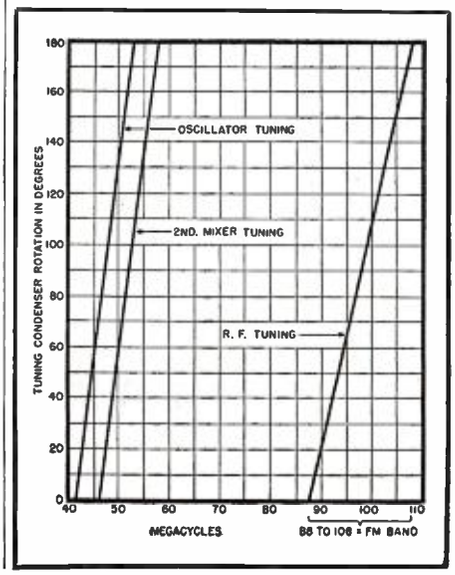
Wire in the oscillator coil connections as in the original set. (See Fig. 7) The grid (1st converter) coil is connected to the 1st 6AB7 grid as was the original coil. The bottom end is grounded. The antenna primary is connected through the twisted insulated leads to the antenna posts. There is no center tap on the antenna primary. A 25 $\mu\mu$fd. capacitor is inserted in series with the first 6AB7 grid tuning capacitor (see photo Fig. 6 inset) as was done in the capacitor for the 7A4 oscillator tuning.

The next step is to remove turns from the existing second converter grid coil (L_2) until there are four turns left. With these turns spaced about 3/16" apart leave enough slack on the end of the coil to provide for some trimming as described later.

To align the set, another receiver which has previously been calibrated was used by the author. All the necessary adjustments were made on a cut and try basis until the individual variable sections of the tuning capacitor followed the tracking requirements mentioned earlier. If a wavemeter of the absorption type is available, the oscillator tracking can be checked as described previously for the *Meissner* unit. If a v.t.v.m. and signal generator are available, alignment can proceed by feeding signals for the i.f. frequency 46.15-56.15 mc. into the antenna with the oscillator inoperative (remove 7A4 tube).

With the v.t.v.m. measure the voltage appearing across the plate of the second mixer (6AB7) tube as the tuning capacitor tunes in the generator

Fig. 8. The ideal tracking conditions for the three tuned circuits for the JFM-90.



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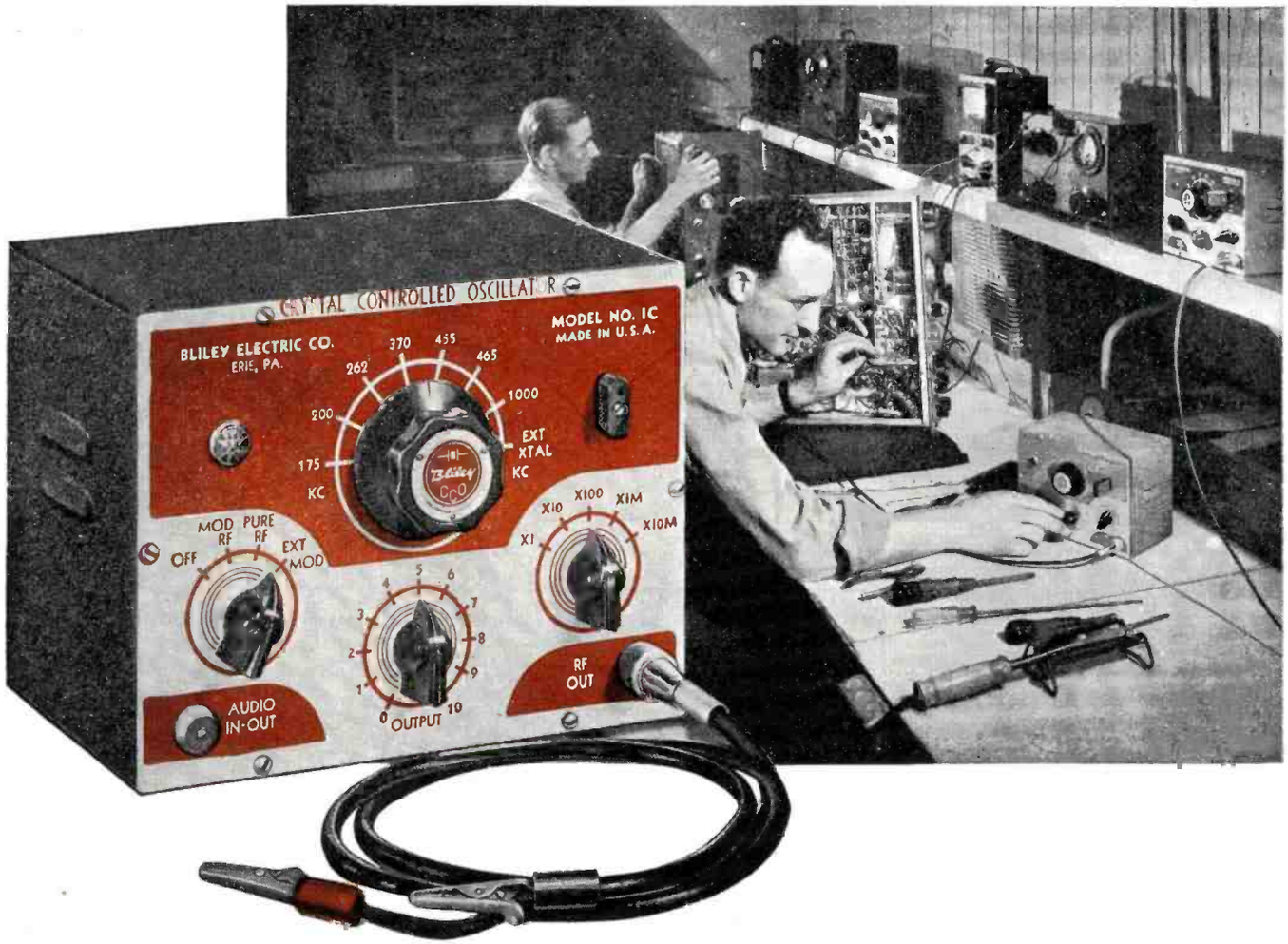

Yes, as John Derby says, the CCO eliminates any question or interpolation because each signal is directly controlled by an individual crystal oscillating at the required frequency. No need to identify confusing beat frequencies when you have *direct crystal control* in the CCO.

Precision is assured by seven Bliley crystals which are "on frequency" as soon as the oscillator is energized. No warm up time needed and no aging effects to compensate. All frequencies are accurate, dependable and permanent with *direct crystal control* in the CCO.

This small compact instrument provides instant selection of crystals oscillating at 175 kc, 200 kc, 262 kc, 370 kc, 455 kc, 465 kc and 1000 kc. An external socket is provided to accommodate extra crystals that may be needed for special frequencies.

The CCO is a "techniquality" product of Bliley engineers and craftsmen who have pioneered in frequency control for over fifteen years. Ask your Bliley distributor, or write direct, for Bulletin 32 which gives complete details.

Bliley

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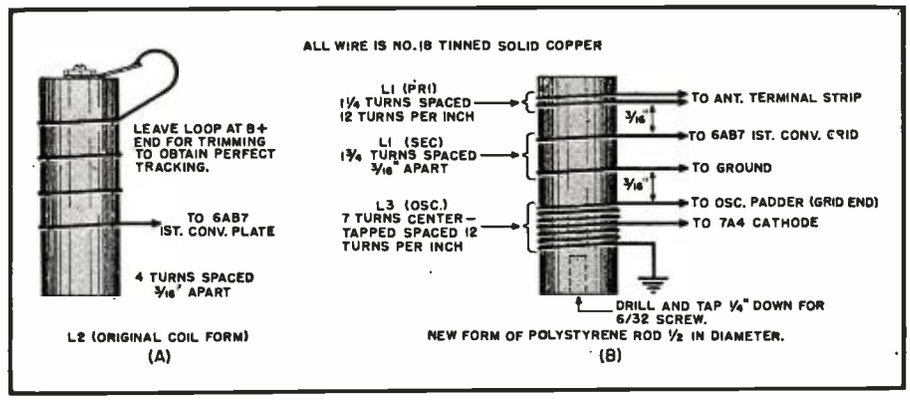
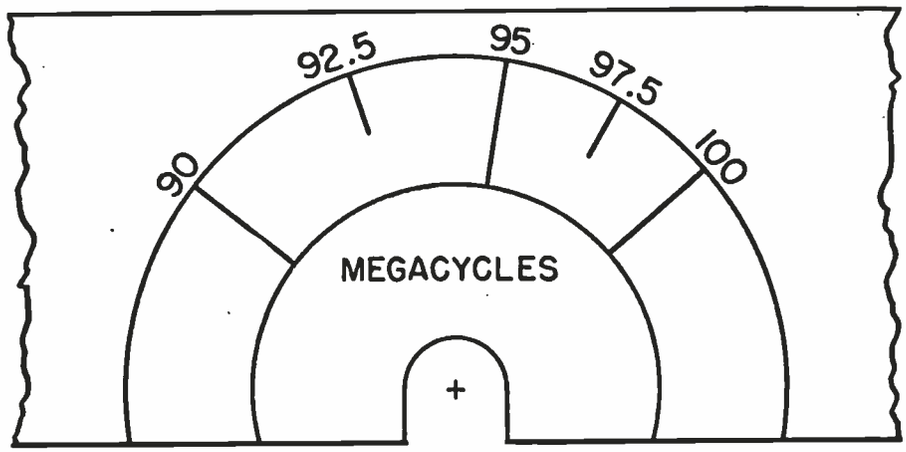


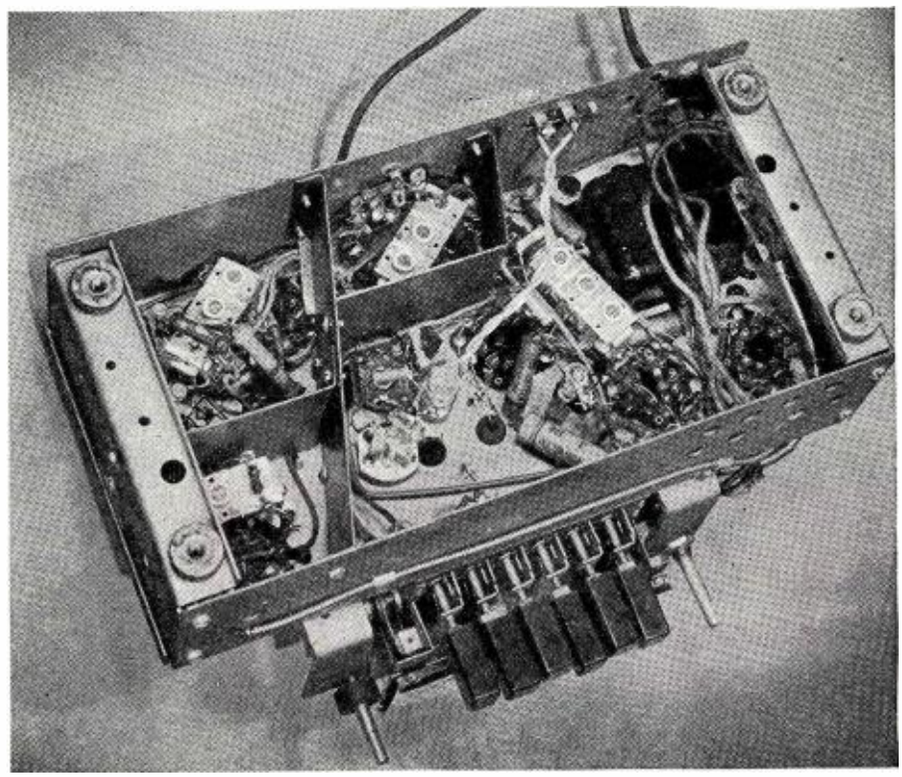
Fig. 9. Mechanical details of coil assembly for the General Electric JFM-90 tuner.



Full scale drawing of recalibrated dial scale for GE tuner.

at several points. Adjustment may be made by trimming the loop which had been left on coil L_2. If the desired frequency is tuned in, the v.t.v.m. will peak. Next with the oscillator operating adjust the oscillator padder until 4.3 mc. is obtained at the three arbitrarily chosen points on the dial as tuning progresses through the range. (See tracking chart Fig. 8) The next

Under chassis view of the converted JFM-90 tuner.



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SCR-522 VHF XMTR-RCVR.

$34.95

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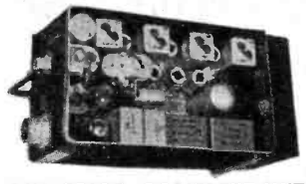

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● This "Glide Path" Receiver sold for $150.00 as SURPLUS a month ago. Today you can buy this superhet for $13.95, complete with 11 tubes. 7-6AJ5, 1-12SR7, 2-12SN7, 1-28D7. Frequencies: 332.6, 333.8, 335.0mc. 6 Relays are included. Requires only 28v. Total "A" & "B" drain only 1.7 amps at 28 volts. Tubes alone worth more than price of complete receiver.

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● 110 AC operation. Brand New. Sealed Cartons. A GREAT BUY! 120 pounds of new transformers, chokes, oil condensers, three 5U4G tubes, magnetic circuit breakers for both HV and Fil ckts. Heavy black crackled steel case. READY FOR OPERATION!

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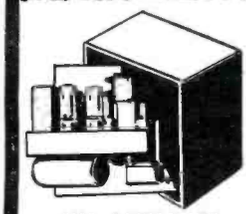

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● Three 6V6GT tubes (1 spare). 24v dynamotor, shielded 6V6 output trans., shielded choke and input trans. Oil condensers. Steel cabinet. Parts alone worth $12.75 NET. Brand new. Sealed Cartons. Our price, $4.75 with 3 tubes. (Easily converted for audio.)

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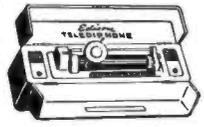

● Edison Telediphone Portable Recorder with crystal recording head. Universal 110 AC/DC Motor & Governor. Two can be connected together for continuous recording. Heavy airplane luggage case. Used. War Surplus. Motor alone worth more than our price of complete unit. ONLY .....$29.50 Net

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● Pocket Model 543-S. 300v AC-DC. Also ohms and MA. scales. ONLY $12.85 NET

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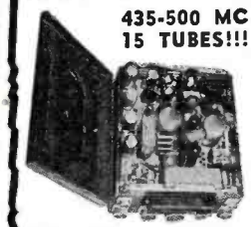
12" DeLuxe Alnico-5 PM SPEAKER Fine for PA use, etc. ONLY $10.35

I.F.F. XMTR-RCVR.

435-500 MC 15 TUBES!!!



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step is to feed the 88-108 mc. signals into the set and adjust the trimmer on the r.f. tuning section until the tracking follows successfully. It will be a case of adjust and try, using a little patience in changing the adjustments and trimmers and a little lead dressing back and forth.

-30-

Practical Radio Course

(*Continued from page* 67)

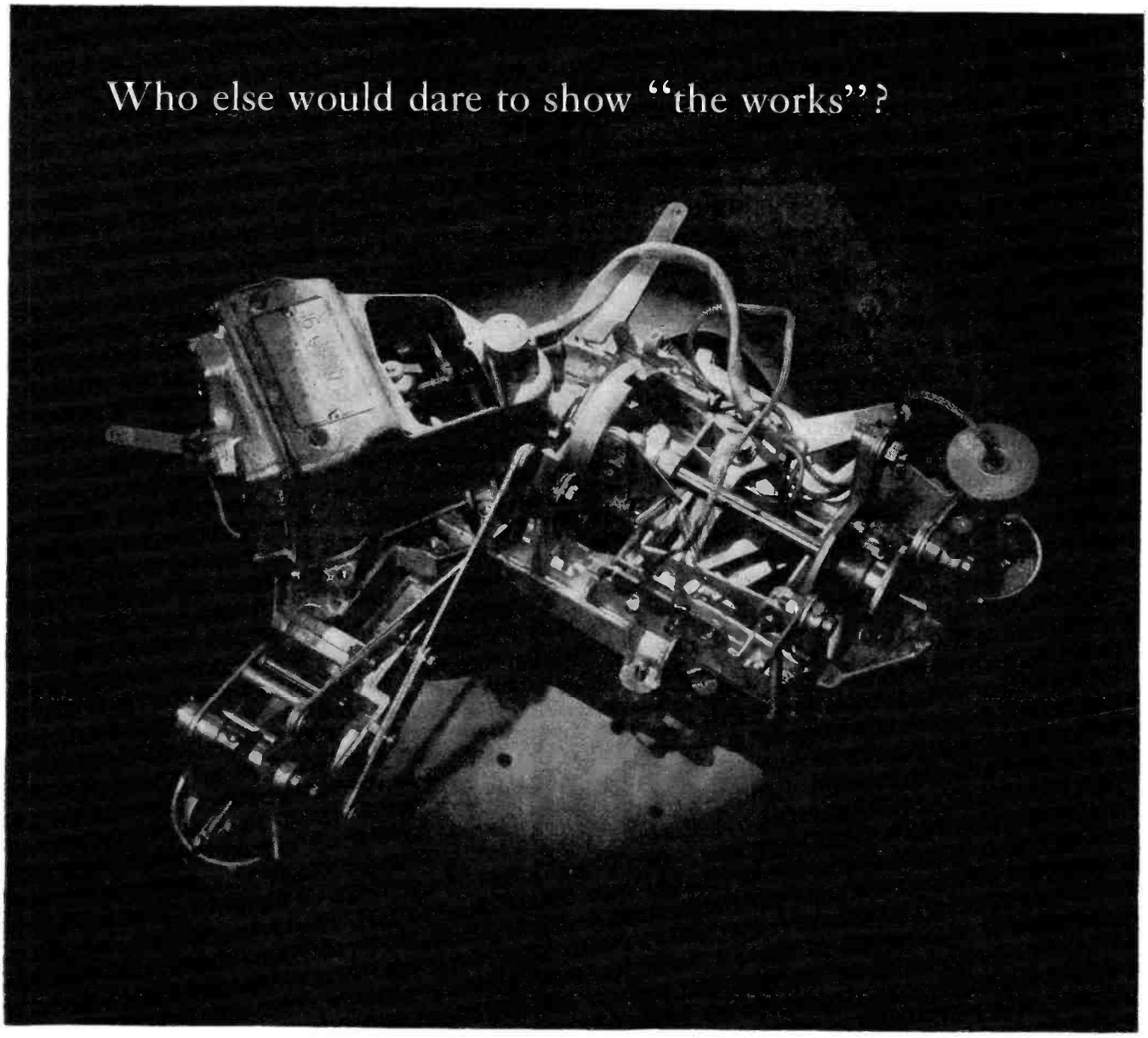
but unusually strong interfering image-frequency signals. This was the image-interference prevention method resorted to in most of our early AM broadcast band receivers—especially those which employed low i.f.'s in the neighborhood of 175 kc., 264 kc., etc., since such low i.f's resulted in increased image interference troubles. Such tuned r.f. stages are comparatively costly and bulky, for each requires the use of a tuning coil, a variable capacitor section on the signal-tuning capacitor gang, an amplifier tube and socket, associated resistors and bypass capacitors, etc. Consequently, present-day preselectors for AM broadcast band receivers usually consist of a single tuned r.f. stage only.

Choosing I.F. for Prevention of Image Interference

When the receiver designer is unable, because of high signal frequencies to be received, cost, physical size of receiver, or other such limitations, to provide adequate image suppression circuits ahead of the frequency converter by the use of r.f. preselection, it is often possible for him to eliminate the possibility of image interference by properly choosing the i.f. to be employed in the receiver—unless this dictates the use of an i.f. that is undesirable from other viewpoints such as inability to secure sufficient gain per i.f. stage within the allowable limits of cost, stability of the i.f. amplifier, physical size of the receiver, etc. Even if an r.f. preselector is employed in the receiver, proper choice of the i.f. used will help by decreasing the possibility of image ininterference.

Study of Fig. 2A and Table 1 will show that the i.f. value chosen for use in a receiver has a direct and important bearing on the frequency that a signal must have in order to qualify as an image-frequency signal and thus be able to cause interference, when a desired signal of a particular frequency is being received. Referring specifically to the image-frequency interference example illustrated in Fig. 2A it is evident that if the receiver considered there employed an i.f. value appreciably higher or lower than 455 kc., the 1480 kc. signal labeled as "interfering signal" would no longer qualify as an image-frequency signal for the 570 kc. desired signal. For example, suppose that instead of using an i.f. of 455 kc. in this

Who else would dare to show "the works"?



THIS is a Garrard automatic record changer standing on its ear. If we showed it to you right-side-up, you would see a fine record changer, but there would be no convincing proof that Garrard is the world's finest.

For your own satisfaction, turn any other record changer you use in your combinations, "bottoms up" and compare it to the Garrard. Immediately you will see the difference. Where others have little tension springs and stamped out bits and parts, Garrard is completely controlled by fine precision-machined gears and cams.

Obviously, the many exclusive features that make the Garrard changer more precise...more human ...than human hands, don't show in a photograph —right-side-up or upside down. Read about them here. Better still, send for a sample changer and put it through your own tests.

Such a record changer as the Garrard cannot be built for so many dollars and cents. It is intended for your finest combinations, where *quality* not *price* is your talking point.

governor-controlled, speed-regulated motor • completely automatic mixing • range of pickups available • true-tangent, jewelled-pivot pickup • exclusive non-slip spindle

...the record changer they ask for by name...

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receiver its i.f. amplifier was designed to employ an i.f. of 480 kc. The new conditions are illustrated in Fig. 4A. For a desired-signal having a frequency of 570 kc. the oscillator frequency is now $570 + 480 = 1050$ kc. With the oscillator operating at 1050 kc., after passing through the frequency converter the 1480 kc. signal would appear as a signal having a carrier frequency of $1480—1050 = 430$ kc. Notice that this frequency is 50 kc. removed from the 480 kc. i.f. employed in the receiver, consequently the 1480 kc. incoming signal no longer qualifies as an image-frequency of the 570 kc. desired signal. Since the selective grid and plate circuits of the i.f. amplifier would now be fixed-tuned to the 480 kc. i.f., they would attenuate this 430 kc. signal (which is $480 - 430 = 50$ kc. off resonance) sufficiently so that it would not reach the detector or demodulator tube. This action is illustrated pictorially in Fig. 4B. Observe that we are now depending solely upon the proper choice of i.f. and the selectivity of the tuned circuits in the i.f. amplifier to attenuate the undesired signal.

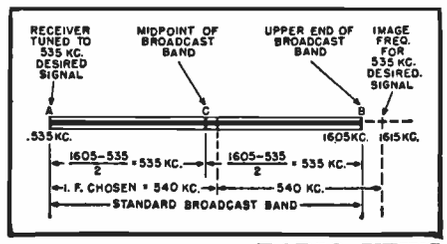
Radio servicemen often bring about this condition in order to eliminate image-frequency interference that is being caused in an existing receiver by a particular undesired signal. They readjust the i.f. and oscillator tuning circuits so that a slightly different i.f. is employed in the receiver. Consequently the undesired signal no longer qualifies as an image-frequency signal and therefore does not get through the i.f. amplifier. This shifting of the i.f. results in the action illustrated in Figs. 4A and 4B.

Shifting the Image Frequency Outside of Transmitting Band

A study of the foregoing discussion and of Fig. 5 will make clear the fact that if we choose an intermediate frequency value greater (even if only slightly) than half the width of the frequency band in which signals of interfering transmitters are likely to occur, image interference from signals of transmitters within that band is no longer possible. This is so because all possible image frequencies now fall outside of that signal-frequency band. This is a direct consequence of the "twice i.f." relationship between "desired" and corresponding "image-frequency" signals.

To illustrate, let us see how this ap-

Fig. 5. Diagram illustrates how the image frequency for any signal tuned in over tuning range of receiver may be thrown outside of the broadcast band by proper selection of the i.f. frequency.



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Transmitter output 12 watts, voice amplitude modulated on any one of four xtal controlled frequencies. Receiver is readily switched to either one of the 4 present xtal controlled channels. Tubes used: 2—832's; 3—12A6's; 1—6G6; 2—6SS7's; 1—12J5GT; 1—12C8; 1—9002; 3—9003's; 1—12AH7GT; 3—12SG7's. Super Special. **Complete with tubes** **$39.95**

SCR-274-N COMMAND SET

This unit consists of 3 receivers, 2 transmitters, 4 dynamotors, 1 modulator, 2 tuning control boxes, 1 antenna coupling box with RF ammeter, antenna relay and 5000 v., 50 mmfd. W.E. vacuum condenser. Also complete set of 29 tubes with each unit. The receivers cover frequencies of 190-550 kc; 3-6 mc; 6-9.1 mc. Tubes included are: 12SK7—RF amp.; 12K8—mixer; 12SK7—1st IF; 12SK7—2nd IF; 12SR7—diode det. and CW osc.; 12A6 output or AF; Xmtrs cover freq. of 3-4 mc. and 4-5.3 mc.; tubes included are 1626 master oscillator driving 2 parallel 1625's; a 1629 and a calibrating crystal also included. Each receiver has its own dynamotor and another dynamotor powers the transmitter and modulator. Terrific Value. **Complete ready to operate** .. **$39.00**

BC 348 RECEIVER

Built for continuous duty, this band switching, six band receiver with a freq. range of 1,500 kc. to 18,000 kc. Has automatic noise compensator—constant sensitivity on all bands—output at 300 or 4000 ohms—xtal filter AVC-MVC-BFO; Smooth vernier tuning; 90 turns of tuning for ea. band. Tubes include: 1st RF—6K7; 2nd RF—6K7; RF Osc.—6C5; 1st Det.—6J7; 1st IF—6K7; 2nd F and CW Osc.—6F7; 3rd IF and 2nd Det.—6B8; Aud. Out.—41. Complete with built-in dynamotor for 28 v. DC. (Conversion kit available for 110 v. operation 60 cy.—price on request.) Conversion instructions and schematics furnished with each unit **$49.50**

TELEVISION FOUNDATION KIT

The television foundation kit consists of the most essential (and expensive) parts needed in the construction of a television receiver starting with the high voltage power supply, for the picture tube right through to the antenna. The kit contains the high voltage picture tube transformer (for five or seven inch tube), 2X2 filament transformer, low voltage transformer for the receiver, cathode ray filament transformer, filter choke, 6.3 filament transformer for the 16 six volt tubes along with the five volt transformer for the 5U4. The two high voltage filter condensers, blocking oscillator, transformer all R.F.'s sound and video I.F.'s, peaking coils, discriminator transformer. Rectifier tubes 2X2 and 5U4, the picture tube 5BP4, an all aluminum Elincor dipole antenna are also included. Of course there is the easy-to-follow 26-page instruction book, with a large 12 by 18 schematic diagram. The instructions include television theory, circuit functions, explain scanning, give preliminary voltage measurements, parts layout and final adjustment of the television receiver which facilitates easy alignment without the use of elaborate test equipment. The only knowledge necessary to build this set is the ability to ready a simple schematic diagram. Most radio men will have many or all of the minor parts not included in the foundation kit **$34.75**

Remaining set of necessary tubes **$14.95**

TRANSVISION TELEVISION KIT

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6AG5	.99	45	.64	826	2.25
6AG7	.99	46	.65	828	7.50
6AK5	.99	50L6	.99	829B	3.95
6AL5	.99	70L7	1.59	830B	5.25
6B4	1.29	71A	.69	832	2.25
6B6G	.89	713A	1.65	832A	3.95
6C4	.64	954	.75	834	2.95
6C5	.51	955	.75	835	3.00
6C21	12.95	956	.75	837	2.50
6F5	.51	957	.75	838	3.75
6F6	.79	958A	.75	967	6.00
6F7	1.25	959	.75	7193	.49
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6H6	.59	9003	.98	2X2	.84
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6K8	1.25	HY615	.89	5Y4G	.59
6L6	1.25	V70D	6.90	5Z3	.89
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6SA7	.90	2C34	1.15	35Z5	.99
6SC7	.85	2C40	2.60	80	.75
6SG7	.98	2J32	20.00	83V	.98
6SH7	.65	2J33	20.00	84	.90
6SJ7GT	.69	2JB51	2.49	117Z3	1.19
6SK7	.79	2J56	20.00	250R	3.95
6SL7	.89	211	1.25	836	1.50
6SN7GT	.69	217C	7.50	866A	.75
6SQ7	.89	3E29A/		872A	2.25
6SR7	.89	829B	2.95	884	.75
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6U5	.98	307A	6.25	2051	.90
6U6	.98	4E27/257B	6.49	RK60	1.25
6Y6GT	.99	446A	2.60	RK72	3.50
6Y6G	.89	6C4	.64	VR90	.75
7F7	1.25	703A	1.49	VR105	.75
12SA7GT	.99	705A	4.95	VR150	.75
12SK7	.89	715B	4.95	Z225	1.95
12SN7GT	.79	800	2.25	2AP1	2.25
12SQ7GT	.99	801A	1.75	3AP1	3.45
12K8	1.25	803	8.95	3BP1	2.95
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FOR BC-348 OWNERS

Converter for Broadcast Band

Convert that BC-348 or other Receivers that tune to long wave bands 200-500 KC without any alteration in your circuit. Our special converter takes power from receiver. Just tune your set to 450 KC and forget it. All tuning is done on converter panel covering 550 to 1600 KC—double conversion means High Sensitivity, Excellent Fidelity, and Higher Selectivity—complete basic kit with schematic and full instructions—less chassis dial and tuning knobs. **Terrific Buy at** **$6.50**

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Cat. No.	Defl. Angle	Horiz. Ind.	Vert. Ind.	Price
DY 18	55°	5 mh	19 mh	$14.75
DY 2 L	40°	5 mh	22 mh	15.75

BC 375 TRANSMITTER

A complete transmitter giving 150 Watts with a freq. coverage of 200 to 12,000 KC (except for Broadcast Band) in seven tuning units. For alterations refer to Dec. QST for other amateur freq. and AC operations. Also included is the BC 306A antenna tuning unit with variometer and switch, plus PE 73-C dynamotor including relay switches and fuses, etc. Unit comes complete with 5 tubes, 211 oscillator, 211 RF amplifier, 10 speech amplifiers, and 2—211 push-pull modulators. **A Bargain at** **$45.00**

BC-221 FREQUENCY METER

A superb frequency standard, this stable, heterodyne freq. meter checks up to the 125th harmonic. Fundamental ranges 125-250 and 2000 to 4000 KC. Makes a wonderful VFO accuracy that cannot be beat. . . . Stability better than .005%. Comes complete with tubes, crystal and calibration chart from 125 kc. to 20,000 kc. A simple matter to meet FCC regulations on freq. measurements with this unit. **Going Fast at** **$39.50**

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Attention Hams—12 V. Dynamotor—just the thing for your portable 2 meter rig—low battery drain—235 V. output at 90 mils. No need to worry about hash—filter built in. Can be run at 50% overload and gives up to 150 mils at 215 V. without damage for continuous duty. 6¼" x 5¾" x 3½" with cover. **Special** **$2.95**

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SELSYN MOTORS

Selsyn II—5 brass housing motors—have a variety of swell uses—ruggedly built—heavy torque and made to rigid Army specif. Made for use on 115 v 60 cy AC. Ideal for remotely controlling your beam ant. and to tell just where it's pointed. Minimize guess work when pinpointing that beam—these motors will not only indicate but will also drive. A steal at $12.95 pr. Shipping weight Approx. 24 lbs.

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Hams, Experimenters! Just the thing for your antenna tuner—heavy duty hi-volt. insul. coil—ruggedly built—handles up to 750 watts R.F. Turns can be removed to resonate at any of the antenna bands now in use—heavy mycalex insulation, air wound coil made to give lower surface resistance to R.F. by flat winding—complete with 4 mounting lugs. **Excellent Buy at** **$1.49**

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Carrying case for BC 221 or SCR 211 Freq. Meter complete with canvas cover. Special	6.95

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OT-101H	Horiz. Osc.—15,750 Cy	$3.25
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plies to the case of a receiver designed for reception of signals over the AM broadcast band (535 to 1605 kc.). This band is illustrated between points *A* and *B* of Fig. 5. Let us assume that in a certain locality there is danger of image-frequency interference from other AM broadcast stations assigned to frequencies within this band. Half the width of this frequency band is equal to $(1605-535)/2 = 535$ kc. (point *C* in Fig. 5 indicates the center of the band). Consequently, if an i.f. higher than this (say 540 kc.) is employed in the receiver, the "image" frequency corresponding to a signal from the lowest-frequency (535 kc.) station in the band will be $535+(2\times540)=1615$ kc. Since this frequency lies outside of the AM broadcast band, there can be no AM broadcasting station operating on it—hence there is no possibility of image-frequency interference occurring from such a station. The same will be true for any other desired signal of higher frequency tuned in over the AM broadcast band, for its image frequency will lie farther and farther outside of this band. (Of course, this ignores the possibility of image-frequency interference occurring from other types of transmitters of suitable frequency lying outside this band, such as those in the 1700 kc. police band, 2000 kc. amateur band, etc.). Furthermore, the higher the intermediate frequency is made, the further outside the regular broadcasting band will the possible image frequencies be located.

RMA Recommended Standard I.F. for AM Broadcast Band Receivers

It would appear from the foregoing discussion that the problem of image-frequency interference could be easily solved in any receiver design simply by chosing an i.f. high enough so that the frequencies of all possible receivable signals that could qualify as image-frequency signals and thereby cause such interference would lie outside the regular transmitting bands so there would be no transmitters operating on them. Unfortunately, the choice is not a wide-open one for other conflicting considerations in the receiver design may make it impracticable to choose just such an i.f. Some of the more important of these include:

1. The problem of adjacent-channel selectivity. We found that the higher the i.f. employed in the receiver (in order to reduce the possibility of image-frequency interference), the lower will be the adjacent-channel selectivity existing for separation of the wanted signal and any of the possible interfering adjacent-channel signals.

2. The possible danger that other spurious responses, such as harmonic of i.f. direct i.f. response, etc., may occur if too high an i.f. value is employed.

3. The consideration that the higher the i.f. employed in the i.f. amplifier the less the gain per stage realized,

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The model KT 20 kit provides **all** components, including meter, panel, cabinet, resistors, condensers, tip jacks, control, selector switch, copper oxide rectifier, pre-cut wires—in fact every component and part needed to complete the unit.

THE KIT COMES COMPLETELY ASSEMBLED. Can be wired in 15 minutes. Components and circuit guaranteed to meet the following specifications:

4 A.C. VOLTAGE RANGES: O-15/75/300/1500 volts.
4 D.C. VOLTAGE RANGES: O-15/75/300/1500 volts.
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2 RESISTANCE RANGES: O-10,000 ohms; O-1 Megohm.

Complete kit including **all parts** assembled and ready for wiring, circuit diagram, easy-to-follow instructions and detailed operating data for the completed instrument.

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The New Model B-45
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A.C. VOLTS: 0 to 15/30/150/300/1500/3000 Volts.
D.C.Current: 0 to 1.5/15/150 Ma. 0 to 1.5 Amp.
Resistance: 0 to 500/100,000 ohms; 0 to 10 Megs.
OUTPUT VOLTS: 0 to 15/30/150/300/1500/3000
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.
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The Model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½"x7½"x3". **$28.40**

The New Model CA-11
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Simple to operate . . . because signal intensity readings are indicated directly on the meter!

- SIMPLE TO OPERATE—only 1 connecting cable—NO TUNING CONTROLS.
- HIGHLY SENSITIVE—uses an improved Vacuum Tube Voltmeter circuit.
- Tube and resistor-capacity network are built into the Detector Probe.
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although this is not as important as it formerly was since high-gain r.f. pentode amplifier tubes are now available for use in i.f. amplifiers and modern i.f. coupling transformer design has advanced to such a degree that quite acceptable gains may now be realized even at what were formerly considered exceedingly high intermediate frequencies.

Because the many conflicting factors mentioned above make the selection of the i.f. to be used in a receiver under design a more or less arbitrary matter dependent somewhat on the individual preferences of the designer himself, many different i.f. values have been employed in AM broadcast band receivers. Mainly because with the then-existing amplifier tubes and i.f. coupling transformers high-gain could be realized only in i.f. amplifiers employing comparatively low values of i.f., early superheterodynes designed for the AM broadcast band employed comparatively low values of intermediate frequencies, such as 30, 50, 110, 175 and 260 kc. Since there is ample possibility for image interference to occur when such low i.f.'s are used, rather elaborate preselector systems had to be employed to suppress strong and numerous interfering image signals before they could reach the frequency converter (see Fig. 3). Later, (especially with the introduction and popularization of all-wave receivers,) the trend shifted to higher i.f's in the neighborhood of 450 kc. and frequencies of 450, 455, 456, 465, 470, etc., became very popular, although 260 kc. still continued to be employed in many auto-radio receivers. It was found that it is possible to use a high intermediate frequency so as to avoid image interference and still retain sufficient adjacent-channel selectivity by employing highly efficient i. f. amplifiers and, at the same time highly effective tuning circuits in the r.f. system. Moreover, by using high-gain r.f. pentode tubes and i.f. coupling transformers of advanced design in the i. f. amplifier, sufficient gain can be obtained.

Finally the RMA made an extensive study of the subject in an attempt to standardize the i.f. value to employ in receivers designed for the AM standard broadcast band. As a result of this work a standard i.f. value of 455 kc. is recommended and has now been adopted by most manufacturers of these particular receivers.

Observe that when the 455 kc. standard i.f. is employed, the image frequencies (except for a few channels at the upper end of the band) fall *above* the 535-1605 kc. AM standard broadcast band—on frequencies to which few existing services are assigned for the FCC has pretty well cleared this part of the spectrum to prevent interference. However, in some localities there is still the possibility of image interference from a few stations that happen to be assigned to frequencies at the upper end of the AM broadcast band (see Table 1) if the r.f. signal-tuning circuits of the receiver do not provide a sufficiently high image-rejection ratio to attenuate these signals adequately. Also, the 455 kc. i.f. lies within the 415-510 kc. band used for coastal, marine relay and ship communications, so direct-i.f. interference from them is possible in some localities. However, the use of a suitable wave trap in the antenna circuit, tuned to the intermediate frequency, is effective in minimizing interference from these latter sources. The large majority of AM broadcast band receivers manufactured within the past few years employ the standard 455 kc. i.f. —or some value close to it.

RMA Recommended Standard I.F. for FM and other V.H.F. Receivers

FM broadcasting is now assigned to the very high frequency (v.h.f.) band extending from 88 to 108 mc. Since the image-suppression improvement resulting from the use of each r.f. preselector stage is much less at high frequencies above the standard 535-1605 kc. AM broadcast band (because the selectivity of tuned r.f. circuits decreases as the frequency is increased), a high degree of r.f. preselection at these frequencies becomes rather difficult and expensive to attain. Therefore, most receivers designed for use on the higher-frequency signal bands

ADDITIONAL SUGGESTIONS FOR CONSTRUCTING THE 5" OSCILLOSCOPE

SOME of our readers have experienced difficulty in constructing the unit described in the article "Build this 5" Cathode-Ray Oscilloscope" by Lyman E. Greenlee which appeared in the October, 1946 issue of RADIO NEWS.

Mr. Greenlee has made several suggestions which will simplify the construction process and improve performance. With some tubes, such as the 5CP1, R_{23} should be 50,000 ohms and R_{21} should be 300,000 ohms to make the focusing easier. In case ripple from the power transformers is bothersome, try reversing one transformer in its mounting, i.e. turn it around on the chassis. Use large size potentiometers, not midgets. Be sure the cathode-ray tube socket is wired correctly. Keep grid and plate leads to 6SJ7's as short as possible and shield if necessary. Mount C_8, C_{14}, C_{17} and C_{18} as close to the CR tube socket as possible.

The following corrections should be made in the circuit diagram. R_{13} should be a 10 watt, wire-wound resistor instead of ½ watt. There should be a .1 μfd. condenser between R_3 and R_5 (6SJ7 grid and 884 plate). It is desirable to include a .1 μfd. condenser between the horizontal input and R_3. The line switch, S_4, may be more conveniently incorporated as a part of either R_1 or R_3 and, finally, R_{11} should be 2 watts in place of a 1 watt resistor.

—30—

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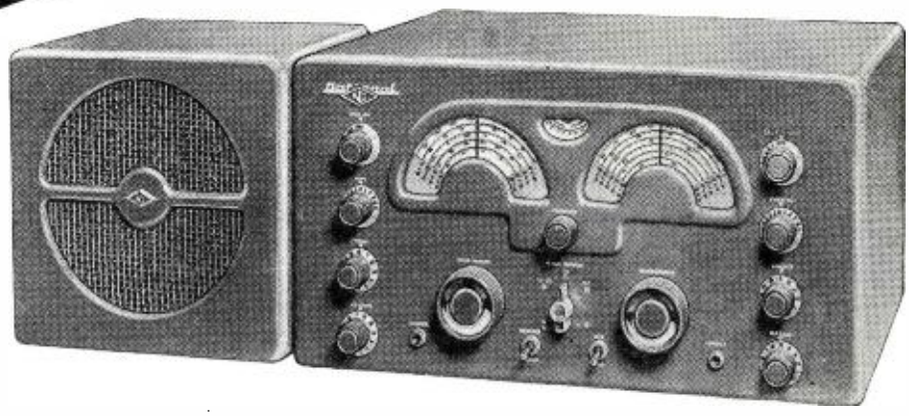

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such as those used for FM and television broadcasting, depend more upon the use of a high i.f. *especially selected* to throw the image frequencies outside of the frequency band in which there is likelihood of interfering transmitters being assigned, than they do upon the use of r.f. preselectors to attenuate image-frequency signals before they reach the frequency converter.

Receivers for service above 20 mc. should employ higher intermediate frequencies than do those for use on the 535-1605 kc. AM broadcast band, not only for adequate image suppression but also for ease of tuning and alignment. Attempting to tune in signals of this order when a 455 kc. i.f. is employed becomes extremely difficult, even with high-ratio vernier dials and very stable oscillators. Under such conditions, the percentage difference between the signal and oscillator frequencies becomes very small, and even normally stable oscillators have a tendency to "lock in" and to be otherwise influenced by the signal circuit during the tuning process. Even small amounts of coupling between the oscillator and signal circuits (through space-charge coupling within the tube, or from other causes) will sometimes cause appreciable amounts of current at oscillator frequency to flow in the latter and introduce harmful effects. Use of a high i.f. will tend to prevent these difficulties.

With the increasing popularity of FM which results in more and more transmitters in close proximity laying down strong local fields, the use of high values of intermediate frequency in FM receivers has become mandatory in order to reduce the spurious responses even though these higher values of i.f. make the realization of satisfactory gain and stability more difficult and expensive to attain. Hence design engineers have been forced to compromise on values of i.f. which result in acceptable gain and stability with the minimum of spurious responses. This compromise has been aided considerably by the development of better components for the amplifiers.

A few years ago when the assigned standard FM broadcast band extended from only 42 mc. to 45 mc., an i.f. of 2.1 mc. was used in some of the early FM receivers. Later, an i.f. of 3.2 or 3.3 mc. was employed. The FM band was later extended to cover from 42 to 50 mc. To eliminate image response due to FM stations in this band an i.f. greater than 4 mc. had to be used. A value of 4.3 mc. was chosen and became standard. This was satisfactory because, since the oscillator frequency in these receivers was made *lower*[5] than the signal frequency, and the i.f. had to be made more than one-half of the total band, using an i.f. of 4.3 mc. made the first image

[5] This is contrary to the practice commonly employed in AM broadcast band receivers because it is desirable to reduce the frequencies at which the oscillator must operate.

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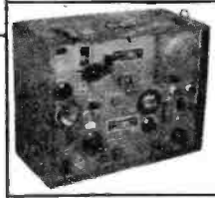

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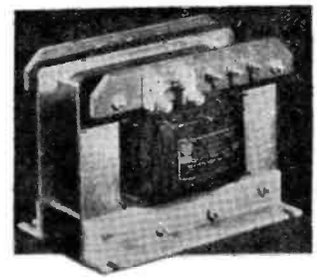

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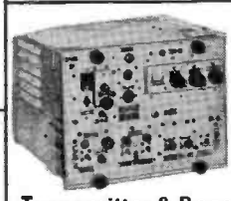

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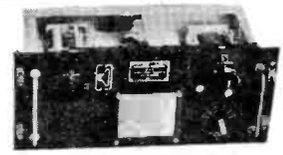

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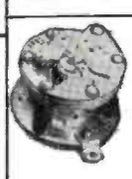

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response occur at 33.4 mc. ($4.3 \times 2 = 8.6$ mc. below the signal frequency)—which was out of (below) the prescribed FM broadcast band of 42-50 mc.

The introduction of the 6SH7 high frequency pentode amplifier tube provided considerable improvement in over-all stability since its plate-to-grid capacitance is very low and separate cathode prongs are provided for the grid and plate return circuits, thus reducing the coupling between these two circuits to a minimum. It aided in improving these 4.3 mc. i.f. amplifiers.

The postwar expansion of the standard FM band to 88-108 mc. has made necessary another upward revision in the i.f. employed in FM receivers. The RMA recommended i.f. value is now 10.7 mc. This frequency has been chosen so that no image-frequency interference from other FM broadcasting stations in the FM band occurs in these receivers. Here again, the same reasoning has been applied for the selection of the standard i.f. to be employed. One-half of the total FM band is $(108-88)/2 = 10$ mc. Therefore in order to throw the first image response outside of this prescribed band, the i.f. had to be made something more than this 10 mc. value. The RMA has settled on a value of 10.7 mc. as the best all-round compromise for the i.f. value to be used in postwar 88-108 mc. FM broadcast and other v.h.f. receivers. (The former prewar 4.3 mc. standard i.f. is now obsolete.)

RMA Recommended Standard I.F. for Television Broadcast Receivers

Three v.h.f. bands, 44-50 mc., 54-72 mc., and 76-88 mc., have been assigned for television broadcasting. Since the total band covers $88 - 44 = 44$ mc., this requires an i.f. in excess of $44/2 = 22$ mc. in order to eliminate the possibility of image-frequency interference from other television broadcasting stations. Television receivers employ two separate i.f. amplifier channels, one for the sound channel and one for the picture (video) channel. The following standard i.f. values have now been recommended by the RMA for use in these receivers:

1. The sound-channel i.f. shall be located in the region 21.25 to 21.9 mc. and oscillator frequency shall be *higher* than the incoming signal frequency.

2. The video channel i.f. shall be 26.4 mc. (pre-1941 television receivers generally used a sound channel i.f. of 8.25 mc. and video i.f. of 12.75 mc.).

The Final Choice of I.F.

From what has been presented in this discussion it is apparent that choice of the intermediate frequency to be employed in a superheterodyne will depend, in the final analysis, upon the signal frequency band over which the receiver is to operate and the class

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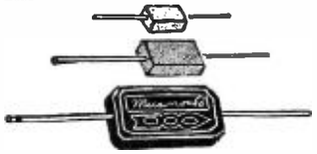

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6—Dial Scales; 25 asstd. airplane & slide-rule (acetate & glass included) 2.98
7—Escutcheon Plates; 25 asstd. airplane, slide-rule & full-vision types 2.95
8—Knobs; 25 asstd. wood & bakelite incl. push-on, setscrew & push-button types. 1.00
9—Wafer Sockets; 12 asstd. 4 to 7 prong .25
#10—Voltage Dividers; 10 asstd. standard, multi-tapped. Hi-wattages included ... 1.98
#11—Shield Cans; 15 asstd. for coils, tubes, transformers, etc. 1.00
#12—Mica Padders & Trimmers; 15 asstd. incl. multiple & ceramic base types ... .69
#14—Volume & Tone Controls; 10 asstd. wire-wound & carbon. Less switches. 1.49
#15—Wire-wound Resistors; 15 asstd. ohmages, 5 to 20 watts; incl. enameled & candohms ..... .98
#16—I F Coils; 6 asstd. including shielded & slug-tuned. Peaks unmarked 1.95
#17—Dial Windows; 12 asstd. sizes incl. flat & moulded acetate and convex glass 1.29
#18—Bakelite Coil Forms; 18 asstd. popular sizes up to 3" diam. ..... .98
#19—High Resistance Units; 25 asstd. carbon, ferrule-ended. 25000 to 5 megohms ..... .49
#20—SPEAKER REPAIR KIT. A real money & time saver. Contains: 20 asstd. paper rings, 10 spiders, 25 asstd. voice coil forms, 3 yds. felt strips, 20 chamois leather segments, kit of 16 shims & tube of spkr. cement. All for 2.49
#21—Metal Cased By-Pass Condensers; 20 asstd. paper-wound, multi-section; 200-400WV ..... .98
#22—Resistor Assortments; 20 carton & wire-wound, ⅓ to 3 watts ..... .49

Filter Choke, 15 henry, 1200 ohms DC, 50 ma. 2"x1⅝"x1⅜" ..... $.49
4 TUBE AMPLIFIER (2-7C5, 7F7, 7Y4) Used as electronic supercharger control. 110V. 400 cycle. Black crackle finish case & slide-in chassis. Contains: power trans., 7 mica & oil cond., 7 resistors, 4 loctal sockets plus other components worth several times the price. 8¾"x4½"x3¾". Less tubes 1.49

"Ouncer" Input Transformer (⅞"x1 3/16") #56: Carbon mike to grid; #58—Dynamic mike or low impedance pick-up to grid; either 12 for $0.49 5.00

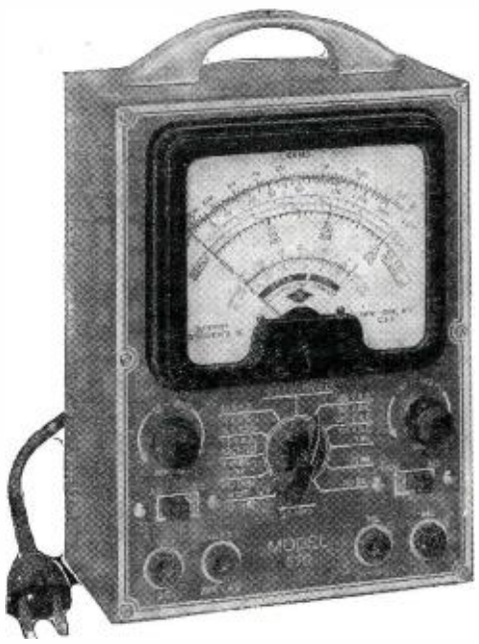
ALUMINUM PANELS (.072"): 8"x6" $0.39
8"x8" ... .49; 8"x10" ... .59; 8"x15" ..... .79
BAKELITE PANELS: ⅛" glossy brown. 7"x10" .. .59
7"x14" ... .69; 7"x18" ... .79; 9"x14" ..... .85
⅛" Linen Bakelite Strips. 11"x1½"—3 for ..... .25
PRECISION RESISTORS. ± 1% wire-wound. Ohmages: 2.35, 11, 24.5, 100, 840, 7800, 30K, 50K or 400K ..... .35
Frequency Meter tech. manual (Navy) Theory & operation. 39 illust. & diagrams, 58 pp ..... .15
Victor Power Transformer for models R-32, 45, 52 or 75. Unshielded 5.95

HEADBANDS (HS-33) with PL-54 plug & cord ... $.39
PL-54 Plug & 13" tipped double phone cord ... .19
JK-26 ext. jack for PL-54, Bakelite shell ..... .23
HEADPHONES—Army HS-33, 2000 ohms. Leather covered, adj. forks. With PL-54 plug 1.25
Rubber phone cushions for above, per pair ..... .20

LEOTONE RADIO CO.
MAKERS OF CONES AND FIELD COILS
65-67 DEY STREET, NEW YORK 7, N.Y.
WORTH 2-0284-5
12,000 SQ FT OF RADIO PARTS

NOW AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK!

The New Model 670
SUPER-METER



A Combination VOLT-OHM-MILLIAMMETER plus CAPACITY REACTANCE INDUCTANCE and DECIBEL MEASUREMENTS.

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

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.

Housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½"x7½"x3" **$28.40**

Please place your order with your regular radio parts jobber. If your local jobber cannot supply you, kindly write for a list of jobbers in your state who do distribute our instruments or send your order directly to us.

SUPERIOR INSTRUMENT CO., 227 Fulton St., Dept. RN-5, New York 7, N. Y.

of service for which it is to be used. The RMA has recommended standard values for the i.f.'s to be employed in AM, FM and television broadcast receivers, and most of the manufacturers of these receivers are now employing these values. Receivers designed for services other than these can be expected to employ other i.f. values, depending upon the designer's preference arrived at after careful study of the existing conditions and all the conflicting factors involved.

(To be continued)

What's New in Radio

(Continued from page 88)

and connections, or for looping wire if it is to be used.

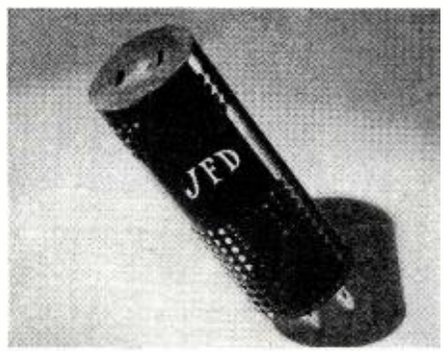
The insulator ends are machined to fit the inside diameter of standard aluminum or dural tubing having 1" o.d. For smaller tubing, the insulator ends can be turned down to fit the required size.

James Knights Company of Sandwich, Illinois will supply additional information upon request.

RESISTOR BALLAST

A new plug-in type resistor ballast is currently in production at the *JFD Manufacturing Company's* plant.

This ballast is designed to convert 110 volt radios and electrical appliances for use on 220 volt circuits. The ballasts are available with American, British, and Continental male plugs;



the female sockets are American. This *JFD* Step-Down Ballast may be used with radios, electric razors, fluorescent fixtures, phono-radio combinations, electric clocks, electric blankets and other electric appliances.

Descriptive literature covering this new ballast will be forwarded upon request to Department RN, *JFD Manufacturing Co.*, 4117 Fort Hamilton Parkway, Brooklyn 19, New York.

BUILT-IN RADIO

Reeves Sound Studios, of New York, has recently announced a new built-in radio and sound system which is engineered to be a functional part of a home.

Known as the *Reeves* "Soundcraft Radio," the unit consists of four major parts; a portable tuner, an amplifier, a record player, and one or more speakers, plus an antenna and necessary wiring.

The portable tuner, which is about the size of a cradle telephone, is the only part of the system which is exposed. All other units are concealed in the walls or other suitable space. The amplifier unit can be placed in a closet, cellar or attic.

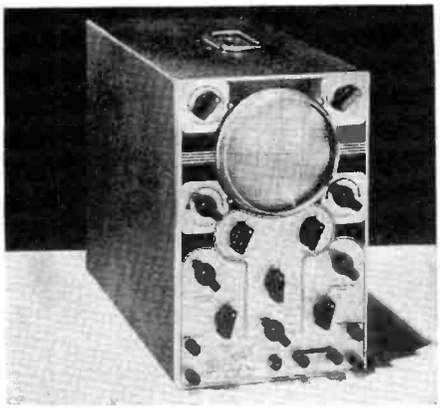
Present production calls for standard AM reception units only, but an FM tuner will be provided at a later date. No elaborate conversion process will be required.

Reeves Sound Studios, 10 East 52nd Street, New York, New York, will supply additional information on the "Soundcraft Radio" to those requesting it.

5" OSCILLOGRAPH

The recently developed *Hickok* Model 195, general-purpose 5" oscillograph has several unique features of interest to servicemen.

This new unit provides sinusoidal



sweep with phasing control and is designed for accurate visual analysis of the wave shapes of television, FM and AM signals. The 5" screen, using the new 5 UP-1 cathode-ray tube, provides easy visibility of all types of radio servicing.

The Hickok Electrical Instrument Co., 10524 Dupont Avenue, Cleveland 8, Ohio, will provide full details regarding this unit upon request.

FLEET CONTROL UNIT

Because of the increasing number of radiotelephone installations, the appearance of *The Hammarlund Manufacturing Company's* new "Fleet Control" selective calling system for two-way service is particularly timely.

Designed with all of the features of previous "Fleet Control" models, the new SCM-26-T includes a bell ringing circuit which provides an audio as well as a visual signal in the mobile unit being called.

In this new unit, the signal light remains lighted until the operator of the mobile unit calls the central office. This feature is advantageous in cases where the operator is absent from the vehicle for varying periods of time.

The Hammarlund Manufacturing Company will provide complete details on the Model SCM-26-T to those who write the company at 460 West 34th Street, New York 1, New York.

—30—

LETTERS *from our readers*

SERVICE CONVENTIONS?

"AT THE February meeting of the Federation of Radio Servicemen's Associations of Pennsylvania held in Harrisburg, the feasibility of holding a State Convention of Radio Servicemen was discussed. I do not believe such a gathering, sponsored by servicemen themselves, has ever been held. We are interested in getting the reaction of individuals and groups to such a suggestion.

"Accordingly, we would appreciate it if you would publish this letter, along with any comments you would care to make. We will welcome any suggestions or ideas from individual servicemen or groups. Please address correspondence to the writer."

A. R. Guild, Secretary
Radio Servicemen's
Association of Pa.
410 Campbell Street
Williamsport 11, Pa.

This would be a good idea if it can be worked out. At least it would give you fellows a chance to thrash out your problems.

* * *

SERVICING AUTO RADIOS

"YOUR RADIO NEWS is one of my sources for radio information and I would be very pleased if you would give us an early article on auto radio servicing and installation.

"There is no doubt that the radio serviceman in the near future will have to specialize in a certain type of repair service.

"There is no branch of radio that is expanding like auto radio and there are very few technical articles on this subject.

"An article on how to build a vibrator tester using commercial parts that are readily obtainable would be very helpful."

Preston L. Williams
South Norfolk, Va.

A construction article on the vibrator tester has already been planned and will be run as soon as we can get the material completed.

* * *

SUGGESTIONS

"YOU have a swell magazine. However, I believe you should have some articles on television, facsimile and pulse time modulation. A number of your readers are operators and someday they will have use for such information.

"Another item of interest would be a discussion of what makes a good radio trade school. This would be of great value to veterans who are planning to attend a radio school. I have come in contact with some good schools and some not so good.

"I wish to speak in support of a television operator's license, to be issued by the FCC. Television involves principles not encountered in radiotelephony, namely optics and anyone who has a radiotelephone first class license is not necessarily qualified to be a video or FM engineer. Instead of easing the license requirements they should be stiffened to keep pace with the advancement of the art."

Alban Hatzell, WØFIV/6
Hollywood, California

RADIO NEWS *is planning to run more and more articles on television, facsimile and pulse time modulation. Watch for them.*

* * *

LOOK WHAT MR. DARR STARTED

"JACK DARR has covered the question of standardizing methods and procedures on the design of new radio receivers. He has done this so well that I can add little or nothing to his list of suggestions. I think he has something there.

"I believe that it would be well for each receiver manufacturing company executive to read Darr's letter and be inspired."

Walter Demski
Walter's Auto and Radio Supply
McKeesport, Pa.

* * *

"JACK DARR'S revealing letter concerning the poor construction of commercial receivers encouraged me to write this letter. Every time I think about repairing radios, I dream a nightmare of rotten rubber hook-up wire, rat's nest wiring, slipping dial cables, and row after row of unmarked trimmers.

"Here are a few suggestions: don't use rubber hook-up wire of poor quality because a serviceman can't make anything on the time spent in rewiring sets in which the wiring has decomposed; avoid the use of rubber mountings on tuning condensers, dials, etc. The rubber dries out and then the tuning mechanism is a loose-jointed mess; mark or color-code the values of the resistors *and* condensers so that replacement will be simpler. It seems as if the only condensers that go bad are the unmarked ones; eliminate push-button tuning on sets as the contacts get dirty, the coils drift with age, and the temperature coefficient is such that it drifts away from the station as the set warms up.

"Mount electrolytic condensers as far away from the hot tubes as possible. They will last three or four times as long; don't use OZ4 tubes for rectifiers in auto radios, they seldom last any length of time; calibrate dials accurately enough so that one will know

he has the correct station; incorporate two- or three-position selectivity control on the better sets; incorporate a t.r.f. stage on the better sets; if a set has an r.f. stage, provide sufficient trimmers and permeability tuned coils so that it may be tracked with the mixer and dial; and finally use a simple but good quality coaxial speaker system in larger radios.

"I could rave on and on—but I suppose what I haven't said will be just as effective in correcting conditions as what I have said."

William W. Schriever
Norman, Oklahoma

* * *

"THREE cheers for Mr. Darr and his letter. If any of these so-called engineers had to disassemble their product, where the speaker, loop aerial, phono motor, pickup, extension controls and chassis were all wired together without the use of plugs, or other convenient methods of disconnecting the units, perhaps they'd make some drastic changes. And why not some more substantial method of putting on tube locations than paper charts which become torn, lost or obliterated. Equally as bad are inaccessible chassis screws in portable radios which have to be painstakingly removed with an offset screwdriver by half turns, since wooden battery dividers keep you from making a complete revolution."

C. H. Hartwell
Armstrong Radio & Appliance Store
Chicago, Illinois

* * *

"I AM a newcomer to the radio service field so I have held my peace regarding many things I thought were wrong with the design of radios but I do agree 100% with Mr. Jack Darr. My particular gripes concern the lack of accurate dial calibration marks at the limit of pointer travel and at the 1400 kc. and 600 kc. in many sets and the lack of trimmer and padder identification."

William F. Oliver
Plymouth, Wisconsin

* * *

"LET'S give three cheers for Jack Darr for expressing his opinion on the new sets coming out now. He voiced the opinion that many of us have been thinking.

"In comment, several of the prewar models had started using his suggesting practice of calibrating the rear of blind dials. I, for one, utter a long low curse when I have to replace a chassis in the cabinet to recheck the dial.

"Another headache is the tiny, ineffective Allen-head set screws in some of the new knobs. Have they run completely out of springs, what was wrong with the split shaft?

"Mr. Darr, without a doubt, is a conscientious worker and like him I never cease to wonder about this deal of the soldering on the new radios. What is the matter with present-day workers?

"My radio experience has covered about the same number of years as Mr. Darr's and I have a shop that I am proud of and I am proud of my work. How about you manufacturers giving us a product to work on."

Charles C. Gohn
Radio Service Department
Bogle Hardware
Shenandoah, Iowa

* * *

RECTIFIER INSTALLATION

"I READ the article in the November issue of RADIO NEWS in regards to installing a selenium rectifier in a radio.

"Instead of going through all the work of pulling the set apart, I have a *Zenith* Portable, Model 7G605, I just took the base of an old tube and soldered the lugs to the plate and cathode terminals and plugged it in. It works perfectly. This was on a 117Z6GT.

"Why couldn't these rectifiers be put out this way?"

William P. Dowd
Officers' Quarters
State Farm, Mass.

Nothing is impossible . . . but this suggestion is not too practical as the manufacturers and parts jobbers would have to stock too many different items. It isn't too much trouble hooking up a socket to these rectifiers.

-30-

International Short-Wave
(*Continued from page 70*)

Smichov—the most distant quarter—took a substantial part in the battle for Broadcasting House and the battle for the transmitter in Strasnice, a different part of Prague. . . . After the building had been hit by a heavy torpedo on Sunday night, which had exploded a few yards from the studio and buried many defenders of Broadcasting House, announcing was taken over by the technicians themselves directly under the transmitting masts in the suburb of Strasnice. In the meantime, workers of the Broadcasting Company, chiefly technical workers, had moved the necessary technical fittings into one of the churches of the Church of Czechoslovakia, with a park, which was about 1 km. from the main building and connected with it by a cable. Here they quickly improvised a new studio and the necessary offices. The announcements were made from the choir and until the revolution was over not a single outsider knew where the studio was. On Tuesday, during the bombardment and shelling of Prague (at the very same time when peace was being solemnly declared in London) the Czechoslovak Broadcasting Company was moving into the shelter of Hus House.

"On the first day after the liberation of Prague—May 9th—at 7 p. m.—normal, though festive, transmissions were begun from the mother house in Prague XII, which although heavily damaged and half destroyed, had been

defended until the arrival of the Red Army. The Commanding Officer of the Soviet Troops said that Prague was the only city which had not ceased to transmit throughout her revolution and which had managed to keep all her transmitting stations. This is in the first place due to the efforts of the devoted staff of the Czechoslovak Broadcasting Company, of their comrades from among the broadcasting staff of the Postal Service and hundreds of unknown fighters who came to help the Broadcasting Company. . . .

"Now the Czechoslovak Broadcasting Company is quickly reviving from the heavy wounds which were inflicted on it by the Nazi occupation, the Gestapo terror, and by this war which had in its last phases passed through Czechoslovak towns with transmitters and stations, and had ended in Prague, and from many other wounds which it bore bravely and returned with interest during the Slovak Rising and the Prague revolution.

"Among the questions which are put by friends and kind guests from Allied countries who are interested in the Prague revolution, there are always these: Was it the right moment? Or was the order given before? By which group? Who gave the order to the announcers to call? Was it the Czech National Council? . . . And so on.

"We are sure that it was the entire *Czech nation,* who in the same moment in places distant from each other, organized and unorganized, simultaneously *felt* the fatal moment, and unasked, obedient to orders and without orders, armed and without arms, led and without leaders, threw itself against the Nazis, against the occupants! It was the most spontaneous rising of a people, historically related to the spirit of the Hussite revolution, because it originated from the very matter of the national spirit, from the roots of the ideals of liberty, of the national, state and political tradition of that period of humanity, in the midst of which beats the heart of Prague. After seven years once more uplifted heads, after seven years' humiliation, *we can again fight for and defend our liberated homeland!*"

Czech Schedules

The assertion that the Czech Radio is rapidly recovering is borne out by the expansion of its facilities, especially with regard to "foreign language" broadcasts.

Good to excellent signals are reported from various quarters of the United States during the daily North American beam (in *English,* Czech, and Slovak), 7-8* p.m., over OLR5A, 15.23; *English* news is read around 7:35 p.m. In addition, there are cultural reviews, economic talks, Trade Union Bulletins, on various days, and always beautiful music; while the major portion of the program usually originates in Prague, ofttimes relays

*Unless otherwise stated, all time herein is expressed in American Eastern Standard Time—EST—5 hours BEHIND GMT.

are taken from Bratislava and elsewhere. Reception reports are desired and verifications are being sent out promptly. Address, The Czechoslovak Broadcasting Corporation, Prague (Praha), Czechoslovakia.

Additional *English* periods are scheduled daily at 1:45-2 p.m. from OLR3A, 9.55; at 3:45 and 5:45 p.m. from OLR2A, 6.010. (These are usually heard fair to good in the United States.)

The Czech Radio also broadcasts to Austria in German between 2:30-2:45 p.m.; in French, 3-3:15 p.m. and 5:15-5:30 p.m.; in Spanish, 3:30-3:45 and 5:30-5:45 p.m.; to Scandinavia (Swedish, Norwegian, Danish), 4:15-4:30 p.m.; and to Switzerland (French, German, Italian), 4:30-5 p.m.; all these transmissions are from OLR2A, 6.010.

Czechoslovakia lies in the very heart of Europe, and like Switzerland, Austria, and Hungary, is a land-locked country without direct access to the sea. It is bounded on the north by Germany and Poland; on the south by Austria, Hungary, and Rumania; on the west by Germany; and on the east by Poland and Rumania. It lies athwart Europe from west to east, its extreme length being 600 miles and its width varying from 50 to 100 miles. Prague (Praha) is its capital.

The subterranean caverns of Czechoslovakia are among the curiosities of Europe. In the Moravian Kras not far from Brno there stretches an extensive system of caverns, lakes and abysses, all underground. Among the famous sights of Central Europe are the magnificent ice caves in Dobsina in a district known as the "Slovak Paradise." Czechoslovak spas and mineral springs are among the foremost in Europe.

Prague has a wealth of medieval architecture equalled by few other cities on the Continent. It is believed that more than 3500 years back there was a settlement within the territory which is now occupied by present-day Prague, on the site of the castle of Vysehrad.

Czechoslovakia possesses one of the richest territories in Europe—both in natural resources and industrial development.

About 75 per-cent of the population is Roman Catholic, the rest Protestant. Institutions of higher learning are the Czech University in Prague (founded in 1348); the Universities of Brno and of Bratislava; and the German University in Prague.

The Czechoslovak Republic was recreated as the result of World War I. The reestablishment of independence marked the culmination of the struggle of the Czechs and Slovaks for freedom, a struggle the beginning of which went to the Middle Ages, when the ancient independent kingdom of Bohemia was absorbed within the Hapsburg Monarchy.

The Czechs and Slovaks are two closely related branches of Slav ori-

gin; each has its own literary language, but a Czech understands Slovak without any effort and vice versa. In the ninth century they formed a single state, the Great Moravian Empire, which was destroyed during the Magyar invasion of Central Europe in the tenth century. Later the Slovaks lived in the Hungarian and the Czechs in the Austrian half of the Austro-Hungarian Empire. Religious and political persecutions in the sixteenth and seventeenth centuries led to an unsuccessful revolt of the Czechs which resulted in the loss of their freedom at the Battle of the White Mountain near Prague in 1620.

Dr. Eduard Benes has been named President (third time) to serve until a new Constitution has been drafted and another election held.

Looking toward the future, the Czech Parliament has adopted a two-year reconstruction program that sets production goals for most industries and contemplates shifting of workers to achieve the greatest efficiency, and to lay a secure foundation for further progress. In a comprehensive commentary on this plan, "Two Years of Work," Jan Roubal explains:

"The Czechoslovak people have responded to the announcement of the Government program with genuine enthusiasm. The miners were the first to make a solemn promise that they would fulfill the plan, and challenged other workers to compete. The results that have so far been achieved prove that they will really fulfill the plan. Even before the actual proclamation of the plan, output is already rising. Czechoslovak young people willingly assist the peasants. All sections of the nation irrespective of party allegiance are joining in the work for a better future of the Republic and her people. This concerted effort is a guarantee that the plan, whose material factors have been carefully weighed, will really be fulfilled."

* * *

Re Sunspots

"Don't worry too much about sunspots," is the advice of the well-known New York DXer, Roger Legge.

"Actually, they are of benefit to DXing," Mr. Legge tells me. "It is during *years* of high sunspot activity —such as at present—that high-frequency reception is the best. During winter evenings several years ago, when there was very low sunspot activity (bottom of the sunspot cycle), all Europeans of 6 megacycles and above were sometimes inaudible, due to the very low maximum usable frequencies, and the BBC on 2.880 would then be the only European audible; now we are getting good evening reception from Europe on all bands up to 15 megacycles.

"During the few days each month when there is an ionospheric storm, reception is of course poor, but we DXers should be willing to put up with some bad days occasionally in return for improved reception the remainder of the time. (Also DXers

should take a few days off once in a while!) Naturally, these ionospheric storms *are* serious to the communications companies, since they *do* disrupt their circuits."

* * *

Beira Data

We are indebted to Mervyn P. Laubscher, South Africa, for this late information received by him direct from CR7IB, Beira:

"Our station, CR7IB, consists of a HT4 Hallicrafters transmitter, with about .3 kw. power, working on a frequency of 7.255 megacycles. (*Note:* This is definitely a mistake and *should be* 7.155 megacycles—M.P.L.) Station CR7IC consists of a Utah transmitter of UAT-1 type, the power of which is approximately .1 kw., operating on a frequency of 3.498 megacycles.

"These stations, which are the sole property of the Aero Clube da Beira, broadcast in conjunction the same program at the following hours—Daily, except Sunday, 4:45-5:45 a.m. and 1-3 p.m.; Sundays, 4-7 a.m. News in Portuguese is read at 5:05 a.m. and 1:05 p.m.

"Our programs consist mainly of recorded music. Owing to the war, we were able to obtain necessary materials for the construction of only studios, one of which is already in use, and the other is now being given the final touches. We hope to be able soon to improve our programs, with variety shows, radio sketches, etc.

"A small number of amateurs enthusiastically maintain the stations in good working condition, hoping to see them grow up more and more as conditions permit."

The letter was signed "For Presidente da Comissao Administrativa das Emissoras do Aero Clube da Beira."

(*Continued on page* 154)

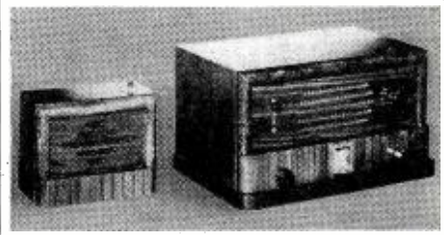
Bob Ham, manager of the music center at the Downtown Broadway store, Los Angeles, demonstrates the new General Electric television receiver to Mrs. Fay McCarthy, a Los Angeles housewife. Los Angeles recently celebrated Television Week during which time thousands of persons visited the exhibits of television receivers. Two-thirds of the receivers on display were table models while the balance were consoles. Public reaction to the special television programs broadcast during the show was reported to be good.

NEW RECEIVERS for Summer Market

COMBINATION RADIO-INTERCOM

Electronic Laboratories, Inc. is introducing a new radio-intercom which has been designed for the modern executive who wants both radio and intercom service without the use of multiple units.

The model is housed in a dark mahogany veneer cabinet which holds both master and slave units. The



radio-master unit blends with office furnishings and is fully finished on all sides to permit its use without regard to location.

Known as the Radio-Utiliphone, this unit will cover the standard broadcast band from 540 to 1520 kc. and measures 12 x 9 x 7 inches. The slave unit measures about 7 x 4 x 5 inches. As many as four slave units may be used with the master instrument.

Intercom controls are located on the top half of the front panel with the talk and listen switch on the left and slave station selector on the right. The radio switch and volume control is at the bottom left and the radio station selector at the bottom right of the front panel.

Operational details on this unit will be furnished by *Electronic Laboratories, Inc.*, Indianapolis, Indiana.

SONORA PORTABLE

The Model WDU-233, housed in a buff-colored luggage-type case with blending metal grille and contrasting brown plastic trim, has been added to

Sonora Radio & Television Corporation's line of portable receivers.

This three-way portable receiver tunes the full 535-1620 kc. broadcast band and features a built-in loop which eliminates the necessity for an aerial or ground wire.

The Model WDU-233 carries a tube complement consisting of a 1R5, 1U4, 1S5 and 3V4 plus a selenium rectifier. The unit is 12" wide, 9" high and 6" deep and weighs 7¼ pounds, less batteries.

Sonora Radio & Television Corporation, 325 North Hoyne Avenue, Chicago, Illinois, will supply further details upon request.

PHILCO TABLE MODEL

A new addition to the *Philco* low-priced table model receiver line has been introduced as the Model 204.

This postwar superheterodyne incorporates five tubes, including rectifier, a beam power pentode audio system, and an electrodynamic speaker for improved tonal quality on standard broadcasts.

The cabinet is all plastic and features a leather-grained pattern in

wood plastic with contrasting ivory plastic bezel, ivory knobs with bronze inserts, and a base finished in ivory.

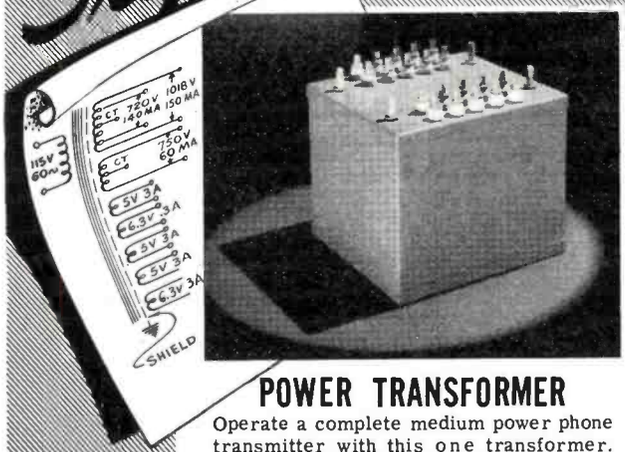
Full details and price on the Model 204 will be furnished upon request by *Philco Corporation,* Philadelphia, Pa.

ECHOPHONE CONSOLE

A new feature has been incorporated in the recently introduced console model home receivers by *Echophone.* These consoles feature a.f.c. on FM. This new development makes feasible push-button tuning on FM stations with electronic correction of any error in mechanical setting of the push buttons.

The EC-403, one of the new units, is a fifteen tube console with separate push button and manual tuning on the broadcast and manual tuning on the short-wave bands. The frequency range is 540 kc. to 18 mc. on AM. A special feature of the receiver is two spread bands, one operating from 9 to

Srepco BRINGS YOU THE Best Transformer Buy THIS YEAR



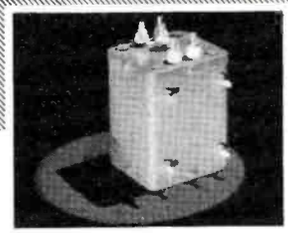
POWER TRANSFORMER

Operate a complete medium power phone transmitter with this one transformer.

- o 500 Volts at 150 ma.
- o 325 Volts at 140 ma.
- o 350 Volts at 60 ma.
- o 3 - 5 Volt filament windings.
- o 2— 6.3 Volt filament windings.
- o Static shield.
- o Army-Navy Ratings.
- o 5-3/4" x 6-1/2" x 5-3/8" high.

Net Wt. 22-1/2 lb. - Shipping Wt. 25 lb.

Only **$3.95** STOCK NO. B-117



Isolation Transformer

115 Volt - 115 Volt with static shield. Operates cool at 40 watts.

- AC-DC set line noise reduction.
- Eliminates hot grounds in AC-DC set service.
- Absolute necessity for Intercoms in noisy electrical locations.
- 2-3/4" x 3-1/4" x 4" high.

Net Wt. 3-3/4lb - Shpg. Wt. 6 lb.

STOCK NO. B-116 Only **$1.95**

150 MA. Choke

- 150 ma., 5 henry
- 105 ohm DC resistance.
- Upright or thru-chassis mounting.
- Army-Navy Rating.
- 3" x 3-1/2" x 3-1/2" high.

Net Wt. 4-1/2lb - Shpg. Wt. 6 lb.

Only **$1.95** STOCK NO. B-203

TEAR OUT AND MAIL NOW TO:

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STANDARD RADIO & ELECTRONIC PRODUCTS CO.
135 East Second Street, Dayton 2, Ohio

Please ship at once:
___ B-117 Power Transformer $3.95 ea.
___ B-116 Isolation Transformer $1.95 ea.
___ B-203 150 MA Choke $1.95 ea.

Name _____
Address _____ State _____
City _____

MAIL ORDERS SHIPPED WITHIN 24 HOURS
20% DEPOSIT REQUIRED

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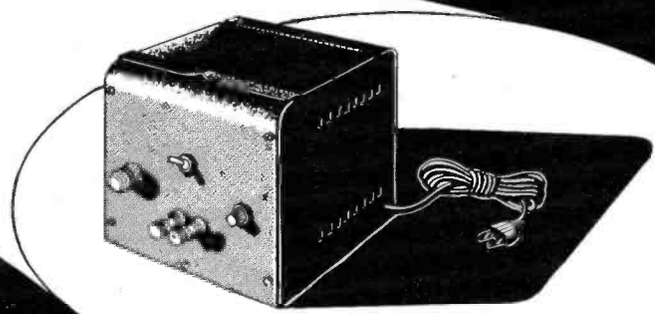
STANDARD RADIO & ELECTRONIC PRODUCTS CO.
135 E. SECOND ST. DAYTON 2, OHIO

Whether for Auto Radios or Dynamotors...



...Weber D. C. Power Supplies deliver the current

Indispensable for the dealer, to demonstrate auto radios, and for the serviceman, to repair them, *WEBER* D. C. power supplies are the efficient, practical answer to a pressing need. Utilizing selenium rectifiers as the heart of the unit, *WEBER* supplies are assured of long, trouble-free operation. All *WEBER* supplies operate off the standard 115 volt A.C. 50/60 cycle line, are equipped with internal thermal circuit breaker and are housed in attractive crackle painted steel cabinets.

Eliminate the messy bulk of storage batteries and be assured of the accuracy your demonstrations or service need. The *WEBER* Model No. 6DC4B, as illustrated, delivering 6 volts D.C. at 4 amperes is an excellent value at $15.75 net to servicemen and amateurs. Model No. 6DC8B, delivering 6 volts at 8 amperes, net $20.50.

Here are leaders in the *WEBER* line; look them over and order from your jobber or direct from us. Should you require different specifications, a letter to our engineering department will bring a prompt reply.

Model—12DC4C	12 volts D.C. at 4 amps	net $16.50
Model—12DC12B	12 volts D.C. at 12 amps	net 32.50
Model—28DC4B	24-28 volts at 4 amps	net 34.50
Model—28DC10B	24-28 volts at 10 amps	net 47.50
Model—28DC20B	24-28 volts D.C. at 20 amps	net 77.50

Literature on above models available to distributors upon request

WEBER RADIO LABORATORIES

1793 Nostrand Avenue Brooklyn 26, New York

12 mc. and the other from 15 to 18 mc. FM broadcast coverage from 88-110 mc. is provided. An automatic record changer and ample record storage space is also included.

This receiver is housed in a Gothic

Chippendale cabinet and contains a single 15" speaker with Alnico V permanent magnets.

The Hallicrafters Company, 4401 West Fifth Avenue, Chicago 24, Illinois, is manufacturing this console and will supply additional data upon request.

PERIOD CONSOLE

In keeping with the West Coast trend toward casual living, the *Magnavox Company* has brought out a new model console radio which is housed in a French Provincial cabinet.

Authentic styling, featuring panelled doors and antique brass exterior fittings, make this radio-phono-

graph suitable for early American or ranch-house decorative schemes.

Distribution has been confined to the West Coast, but *Magnavox Company,* Fort Wayne, Indiana, will supply additional data upon request.

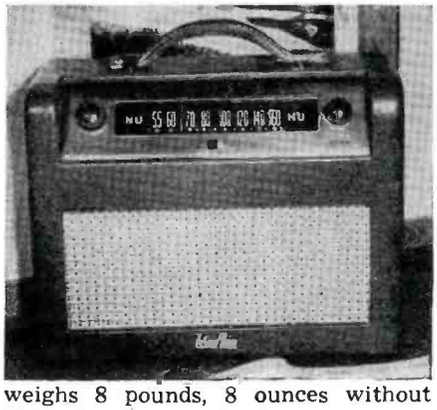
THE "COMMUTER"

A new 6-tube portable receiver which will operate on a.c.-d.c. or batteries has been added to the *National Union Radio Corporation* line of home radios.

Housed in a simulated leather-covered case with the genuine leather carrying handle, the "Commuter" incorporates low drain *National Union* tubes for added battery life. Full broadcast band coverage is provided with tuning by means of a slide rule

dial scale. All controls are recessed to minimize damage to the receiver.

The "Commuter" Model G-613



weighs 8 pounds, 8 ounces without batteries.

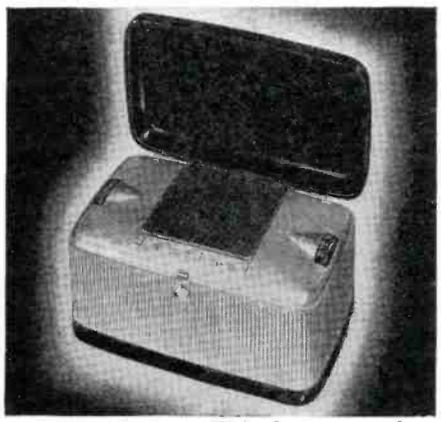
National Union Radio Corporation of Newark, New Jersey, will supply additional details on this receiver upon request.

A MIDGET MIDGET

Sentinel Radio Corporation has recently announced production on their "Treasure Chest" model, a tiny midget receiver measuring 4" high, 4" deep and 8" wide.

This model has five tubes and operates on either a.c., d.c., or batteries. It is available in two-tone plastic cabinets in a variety of colors.

The radio has been so designed that the listener may hear a program even when the cover is down by holding the



radio to his ear. This feature makes the set particularly suitable for travel, at ball games, office desks and at home.

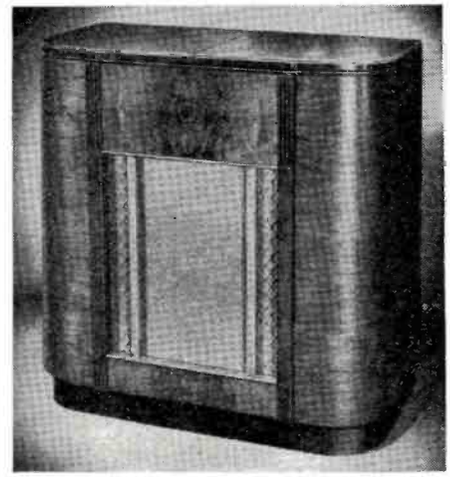
Sentinel Radio Corporation of Evanston, Illinois, will supply additional information upon request.

FM-AM COMBINATION

Production has begun on two new FM-AM phonograph-radio combinations which will be known as the *Farnsworth* Models GK-102 and GK-141.

The Model GK-102 is housed in a modern cabinet which comes in either walnut or blonde "Golden Harvest" finish. The automatic phonograph which will handle twelve 10" or ten 12" records has an automatic play control which stops the mechanism after the last record in a stack has been played. The circuit uses nine tubes and a rectifier and has drift-

corrected, push-button electric tuning, a.v.c., a shielded rotatable built-in antenna for AM reception and a built-in dipole antenna for FM reception, bandspread tuning, push-pull amplification, and a 12 inch reverberation-insulated PM Alnico speaker.



The companion model to this receiver is the GK-141 which is housed in a mahogany cabinet of traditional Sheraton styling. This 13 tube, (plus rectifier) set has short-wave as well as FM and AM bands, eight push-buttons to tune FM and AM stations, and travelite slide-rule dial.

Further information on either or both of these instruments can be obtained from *Farnsworth Television & Radio Corporation,* Ft. Wayne, Ind.

NEW PORTABLE

Garod Radio Corporation of Brooklyn has entered the low-priced luxury portable field with their new Silver Anniversary Model 5D3.

This radio has a built-in loop antenna hidden in the front-raising plastic cover. Designed especially to appeal to the younger set and the summer vacationer, the Model 5D3 is

available in bright pastels and two-tone combinations.

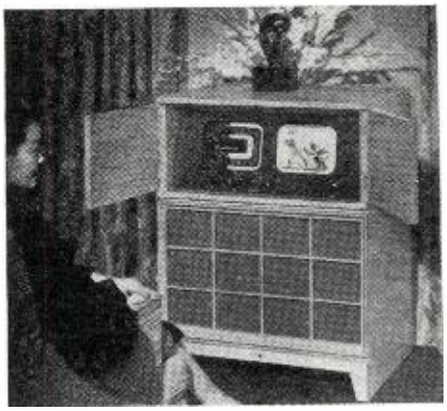
The receiver weighs less than 6½ pounds with batteries and is designed to play anywhere on a.c., d.c., or batteries.

Additional information on this model portable will be furnished by *Garod Radio Corporation,* 70 Washington Street, Brooklyn 1, New York.

"VIDEORAMA" RECEIVERS

Stewart-Warner Corporation of Chicago has begun shipping the first of their new line of "Videorama" radio-television receivers to dealers.

Available in custom-built cabinets of either modern bleached walnut or Georgian natural walnut, the set covers all 13 video bands and can be used anywhere in the United States within range of television broadcasting facilities. The set provides standard AM radio reception as well as television sound on FM. The set has a ten-inch, direct-view cathode tube, plus 21 other tubes and two rectifiers.



A 12" superdynamic speaker has been incorporated.

Illustrated is the Model T-711 "Videorama" in a bleached walnut cabinet. *Stewart-Warner Corporation,* 1828 W. Diversey, Chicago, Illinois, will furnish details on this television line upon request.

TABLE COMBINATION

Andrea Radio Corporation has a new table model automatic radio-phonograph on the market which will cover both standard broadcast and the short-wave bands.

Known as the Model CO-UI15, this a.c. operated receiver is housed in a modern classic cabinet with walnut finish. The full vision illuminated dial

is set into the cabinet at an angle to permit easy tuning on both of the operating bands.

Phono jacks for television sound have been provided on the chassis to meet future requirements.

Andrea Radio Corporation, 27-01 Bridge Plaza North, Long Island City 1, New York, will provide more information on this deluxe table combination unit to those requesting it direct from the company.

-30-

BIZ QUIZ

Test Your Sales Ability

One of a series of sales aptitude tests especially prepared for RADIO NEWS by Mr. George Speer, Director of Institute for Psychological Service, Illinois Institute of Technology.

1. Would you rather read about *(a) slum clearance (b) prominent politicians (c) the way our language is changing*
2. Do you haggle over prices with junkmen or tradesmen *(a) often (b) sometimes (c) never*
3. If a salesman calls on you at your home can you get rid of him without purchasing *(a) easily (b) with some difficulty (c) considerable difficulty or not at all*
4. Within the last five years have you been selected as a leader of a group *(a) none (b) one but less than five (c) five or more*
5. If you were seeking a new position would you *(a) have a friend interview an employer for you (b) write a letter to an employer, applying for a job (c) interview an employer in person to apply for a job*
6. Does it make you uncomfortable to have others regard you as different or unconventional? *(a) yes (b) no (c) not sure*
7. Do you suddenly change from pleasant to unpleasant moods *(a) seldom (b) fairly often (c) frequently*
8. If you were in a strange town and had some time to spend which would you be more likely to visit? *(a) a factory making electric motors (b) a museum of science (c) an advertising agency*
9. If others around you are pessimistic or depressed, do you tend to be *(a) pessimistic (b) optimistic (c) not affected*
10. If income and all other conditions were equal, which would you prefer *(a) to be in business with a partner (b) to be in business for yourself (c) to work for a superior whom you greatly respected*
11. If it were your job to explain a new invention to a large number of people, how would you prefer to do it? *(a) write a description (b) talk to a group to explain it (c) give a demonstration of its operation*
12. For your own personal use do you borrow *(a) frequently (b) occasionally (c) practically never*
13. Which do you prefer to read? *(a) about business trends (b) social customs of foreign countries (c) reviews of recent plays*
14. If you were dining out with a guest whom you were trying to impress, and the bill was more than you had expected it to be, would you verify the bill *(a) surreptitiously (b) not at all (c) openly*
15. In a disagreement with an older person whom you respect do you usually *(a) maintain your views (b) seem to agree with him, but try to carry your point indirectly (c) agree with him verbally, and let it go at that*
16. Would you like to be known as an authority on *(a) contract bridge (b) agricultural problems (c) billboard advertising*
17. At a social affair would you *(a) prefer not to be a leader (b) accept leadership if the others wanted you to (c) enjoy being a leader*
18. To ask and receive pay for debts means *(a) remit (b) collect (c) exchange*
19. Which do you like best *(a) people who borrow things (b) thrifty people (c) emotional people*
20. When people praise you, do you *(a) feel that you are doing well enough (b) feel like doing even better (c) ignore it and remain unaffected*

(Answers on page 165)

AT THE RADIO SHOW!

MAY 13th to 16th, INCLUSIVE
HOTEL STEVENS. CHICAGO

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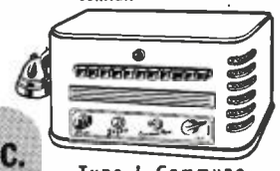
COMMUNO-PHONES • SYSTEMS
AMPLIFIERS • ACCESSORIES

The latest BOGEN equipment will be on exhibit at the show. Stop at Booth # 40 and see what's new in this famous line of inter-communication and amplifier equipment. Our engineers will be on hand to answer all technical questions.

Type A Communophones are designed for efficient service where economy is essential.



Type L Communophones offer exclusive features and flexibility, capable of meeting any requirement.

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COMMUNO-PHONES • ELECTRONIC EQUIPMENT

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R.M.A. Guaranteed Top Quality—
For Immediate Shipment

Good Tubes at Good Prices!

01A	$0.75	6J7G	$0.90	14A7/12B7	$1.59
0Y4	1.32	6L6G	1.59	14C7	1.59
0Z4	1.32	6Q7	1.08	24A	.75
1A5GT	.90	6SA7GT	.90	25L6GT	.90
1A7GT	1.08	6SD7GT	1.08	25Z5	.81
1C6	1.08	6SF5GT	.81	25Z6GT	.81
1LA4	1.92	6SG7GT	1.08	26	.63
1LA6	1.92	6SH7	1.08	27	.57
1LE3	1.59	6SK7GT	.90	32L7GT	1.59
1LH4	1.92	6SN7GT	1.08	33	1.08
1L4	1.32	6SQ7GT	.90	35L6GT	.81
1LN5	1.92	6V6GT	.90	35W4	.90
1N5GT	1.08	6X5GT	.81	35Z3	1.08
1P5	1.32	7A4	1.08	35Z5GT	.69
1Q5	1.32	7A5	1.08	37A	.69
1R5	1.32	7A6	1.08	38	.90
1S5	1.32	7A7	1.08	39/44	.81
1T4	1.32	7AF7	1.08	41	.69
1U4	1.32	7B6	1.08	42	.69
1U5	1.32	7C5	1.08	43	.90
1V	.81	7C6	1.08	46	.90
3A4	1.32	7C7	1.08	47	.90
3LF4	1.59	7F7	1.32	50A5	1.59
3Q4	1.32	7G7/1232	1.59	50B5	1.32
3Q5GT	1.32	7H7	1.59	50L6GT	.90
3S4	1.32	7J7	1.59	57	.75
5U4G	.81	7N7	1.59	70L7GT	1.59
5Y3GT	.57	7Y4	1.08	71A	.75
5Y4G	.63	7Z4	1.08	75	.69
6A7	.81	12A6	1.59	76	.75
6A8GT	.81	12A8GT	.81	77	.75
6C6	.81	12AT6	1.32	78	.75
6D6	.81	12BA6	1.32	79	1.32
6F5G	.90	12BH7	1.32	80	.57
6F6GT	.69	12CS	1.59	81	1.59
6G6	1.08	12Q7GT	.75	84	.90
6H6GT	.90	12SA7GT	1.08	89	.81
6K6GT	.81	12SJ7GT	.90	117L7GT	1.92
6K7	.90	12SK7GT	.90	117P7GT	1.92
6K7GT	.81	12SQ7GT	.90	117Z3	1.32
6J5GT	.75	12SR7	1.08	117Z6GT	1.32

All tubes individually packed. Each tube carries a standard R.M.A. guarantee. Defective tubes returned during the guarantee period will be replaced

ADDITIONAL DISCOUNTS:

30%—orders of 250 or more
20%—orders of 100
15%—orders of 50
10%—orders of 25

Telephone Longbeach 4428

Continental Corporation

1800 WINNEMAC AVENUE • CHICAGO 40
The Oldest Radio Tube Company in Chicago • Established 1920

SURPLUS RADIO PARTS

RADIO SERVICEMEN ● EXPERIMENTERS ● AMATEURS

SAVE BIG MONEY!

"BUILD YOUR OWN KITS"

If you were to buy this equipment you would have to pay from two to three times more. Here are top values in high priced equipment from which you will get dependable performance and lasting life.

BUILD A HEAVY DUTY AC POWER SUPPLY

3 Outstanding Features:

1—270 VDC @ 150 MA 1.5% Ripple
2—110 VAC isolated @ 250 Watts
3—Bias Voltage, 100 V @ 40 MA

ALL FOR **$12** PER KIT

Kit Includes:

1 transformer, 2 sockets (octal), 1 dual choke 3 Hy-15 Hy, 1—100 K ½ Watt Resistor, 1 toggle switch, 1 line cord, 1 fuse holder, 1 chassis 10½x6½x3, 1 8.5x 8.5 condenser, 1 outlet socket, 2 tubes: 1-5R4GY 1-6x5, 2 condensers: 1-2 MFD 1-10 MFD-150 V, 4 resistors: 2-10K-5 W, 1-25K-10 W, 1-1K-½ W, Hook-up wire 1 pilot lite assembly, Diagram.
Less bias parts: 1-6x5 tube, 2 resistors, 1-10K-5 W 1-1K-½ W, 1 octal socket, 1 condenser 2MFD.....$10 per kit

BUILD AN AC-DC POWER SUPPLY

90 V @ 30 MA. Used to replace 90 V batteries. Diagram included.
COMPLETE, per kit **$3**

BUILD AN AC POWER SUPPLY

250 V @ 60 MA. 6.3 @ 2 Amps. Diagram included.
COMPLETE. per kit **$6**

BUILD A TOP QUALITY SIGNAL TRACER

This kit would cost more than double our price. Kit includes: Sloping panel cabinet 14x8x8, meter on one side—speaker opposite, 4 sockets providing for 6 tube circuit, adaptable for electronic voltmeter, diagram included. Unit can be used as a 3 watt amplifier—requries little rewiring—bench tested.
COMPLETE, per kit **$20**

BUILD A 4-TUBE AMPLIFIER WITH 8" JENSEN P.M. SPEAKER

AC, 4-7 Watt, 4 tubes, diagram.
COMPLETE. per kit..... **$18**
Less speaker.....$12 per kit

CRYSTAL TUNING UNITS FOR AMATEUR BANDS

$10 VALUE.
.....Each **$2.00**

BUILD AN AC 4-TUBE SIGNAL GENERATOR

Kit includes: 2 tube oscillator with 6 band switch and 6 coils, ready wound and center tapped, with all necessary parts to make a complete unit. A multi-vibrator circuit included; cabinet size 14x8x8; geared tuning; diagram.
ALL FOR **$15** PER KIT

BUILD AN AMPLIFIER (AC-DC)

Kit includes: 1 chassis 5x 3"-x3, 3 octal sockets, 1 ½ Meg Volume control, 3 10 Watt WW resistors 125 ohm, 1 resistor 5M ½ Watt, 3 tubes 1-12SN7, 2-6SL7, 1 toggle switch, 4 mica condensers .003 MFD, 2 filter condensers, hook-up wire and hardware, diagram.
ALL FOR **$5** PER KIT

BUILD A RECEIVER
Frequency 2-30 MC

Kit includes: 1 chassis 5x 3¾x3, 2 octal sockets, 2 condensers 10 MFD, 1 RF choke 2.5 MH, 4 resistors 1-50 M 1-3 Meg 1-5 M 1-250 M. 1 slug tuned coil, 1 5 M ohm volume control, 2 filter condensers, 1 toggle switch, 1 roll coil wire, 2 mica condensers .003, 2 tubes 1-12SN7, 1-6SL7, 1 condenser 330 MMFD, 3 125 ohm 10 Watt WW resistors, hook-up wire and hardware, diagram.
ALL FOR **$4** PER KIT

BUILD A TRANSMITTER
Frequency 2-30 MC

Kit includes: 1 chassis 5x3¾x 3. 2 octal sockets, 1 toggle switch, 3 10 Watt WW resistors 125 ohm, 2 mica condensers .003, 1 100 M resistor, 1 roll coil wire, 2 tubes 1-12SN7, 1-6SL7, 2 slug tuned coils, 1 filter condenser, 1 RF choke 2.5 MH, 1 100 MMFD mica condenser, 1 key, hook-up wire and hardware, diagram.
ALL FOR **$4** PER KIT

BUILD A CODE OSCILLATOR (Audio)

Kit includes: 2 tubes 1-12SN7, 1-6H6, 2 sockets, 2 resistors 1-100K 1-2K, 3 condensers 1-.001, 1-.01, 1-.005, 1 chassis, 1 oscillator coil, 2 electro condensers, 1 line cord, 1 key, hook-up wire and hardware, diagram.
ALL FOR **$4** PER KIT

BUILD A PHONOGRAPH OSCILLATOR (700 KC, 1400 KC)

Kit includes: 2 tubes 1-6SJ7, 1-6H6, 1 condenser .005, 1 rheostat 5K, 2 octal sockets, 2 condensers, 1 chassis, 1 oscillator coil, 3 resistors ½ watt, 1-100K, 1-5K, 1-2K, 2 125 ohm 10 watt WW resistors, 1 line cord, hook-up wire, diagram.
ALL FOR **$4** PER KIT

COMPLETE KITS OF "HARD-TO-GET" CRITICAL ITEMS!

Cat. No.	Quantity	Description	Price Per Kit
122	3	lbs. Asstd. Radio Parts	$1.00
123	3	lbs. Asstd. Screws and Washers	1.00
124	5	Asstd. CO-X-Cables w/Connectors.	1.00
125	5	Asstd. Volume Controls	1.00
126	10	Asstd. Bath Tub Condensers	1.00
127	300	Asstd. Terminal Lugs	1.00
128	200	Asstd. Cable Clamps	1.00
129	2000	Asstd. Aluminum Rivets (Solid).	1.00
130	200	Asstd. Spacers and Bushings	1.00
131	1000	Asstd. Lock Washers	1.00
132	1500	Asstd. Flat Washers	1.00
133	500	Asstd. Nuts	1.00
134	500	Asstd. Eyelets	1.00
135	100	Asstd. Motor Brushes	1.00
136	200	Asstd. Banana Plugs	1.00
137	5	Asstd. Wafer Switches	1.00
138	3	Asstd. D.C. Relays	1.00
139	20	Asstd. Knobs	1.00
140	20	Asstd. Tube Sockets	1.00
141	12	Asstd. Jewels and 3 Pilot Lights.	1.00
142	100	Asstd. Brackets	1.00
143	25	Asstd. Terminal Strips & Boards.	1.00
144	100	Asstd. Fuse Clips	1.00
145	50	Asstd. Little Fuses 3AG and 4AG	1.00
146	25	Asstd. Fuse Holders 3AG & 4AG.	1.00
147	20	Asstd. Shock Mounts	1.00
148	5	Asstd. Fuse Posts	1.00
149	100	Asstd. Ceramic Stand-off Insulators	1.00
150	10	Asstd. Phone Plugs	1.00
151	25	Asstd. Midget Tube Shields	1.00
152	50	Asstd. Tube Clamps & Brackets	1.00
153	15	Asstd. CO-X-Connectors	1.00
154	100	Ft. Asstd. Vinolite, etc. Tubing, 3 Ft. Lengths	1.00

CHECK THESE VALUES!

100 asstd. ½, 1, 2 watt resistors $2.00
100 asstd. mica condensers 3.00
100 asstd. ceramic condensers 2.00
50 asstd. w.w. 5, 10, 20 watt resistors 5.00

I.F. TRANSFORMERS SPECIAL!

1600 KC—455 KC—2.5 Meg —30 Meg—10 MC...Each $1.00

Buy RELAYS at Low Cost!

115 VAC SPDT; 24 VDC 2 second timing relay 75 ohm resistance operating point at 10 volts; plate relay 8000 ohm SPDT. Each $1.00

25 POUNDS OF RADIO—FM—TELEVISION—ELECTRICAL PARTS

Includes: 1 MOTOR, Chassis, cabinet, relay, condensers, resistors, transformers, coils, sub-assemblies, wire, hardware, etc., etc., etc. WORTH AT LEAST $50.

25 lbs. for $5.00

10 pound kit same as above..$3.00
10 pound kit less motor.... 1.50

All items listed above are subject to prior sale. Terms cash with order F.O.B. Chicago, Ill. Please remit postage charges. Attention Manufacturers: Write us for your requirements.

IRVING JOSEPH

220 S. Halsted St. Chicago 6, Ill.

International Short-Wave

(*Continued from page* 145)

Address is, Emissoras do Aero Clube da Beira, P. O. Box 3, Beira, Mocambique (Portuguese East Africa).

* * *

Radio Club News

England—One of the most unique radio clubs in the world is the Anglo-American Radio and Television Society. In an airmail letter from Leslie Orton, founder of the organization, come these details:

"I founded this organization well before the war as my contribution *towards promoting international goodwill,* about which I feel strongly. There are no charges for joining the club. Members are under no obligation. Club news appears in *Entertainment World* which I personally send freely to all overseas members in order to keep them together. To become a member, one should write to me at my home address—15, Hawthorn Drive, Willowbank, Uxbridge, England. If members desire to be put in touch with members in other parts of the world, this will be done.

"I am founder and Hon. Secretary; Arthur Bird, of World Friendship Society of Radio Amateurs, is Vice-President; other officials include Miss Eileen Harris, in charge of Ladies' Section; C. F. Bachman, American representative; Rex C. Gillett, Australian representative; Leonard Wood, French representative; and so on.

Sweden—Hugo Nordqvist, secretary of the Radio Club of Sweden (SRK), informs me that the club now has about 400 members; club plans for 1947 include the printing of a bulletin, *"DX-Radio,"* each month, contests with overseas radio clubs, a radio course to be given in Stockholm to teach members how to repair small faults and how to read wiring diagrams. Present officers are Birger Lundstrom, president; Uno Forsten, deputy president; Hugo Nordqvist, secretary; Bo Svard, deputy secretary; Bertil Dahlstrom, cashier; Sven-Yngve Carlstedt, master-of-ceremonies; Sven Lindhe, Erik Fredriksson, Thore Bostrom, Sture Eriksson, members of the committee. The secretary may be addressed in care of Sveriges Radioklub, Stockholm 5, Sweden (Sverige).

United States—After an absence of some years, the World Wide Dial Club, Chicago, is again in operation, with meetings to be held once a month in a central location. Officers are Frank Anzalone, chairman; Joseph P. Michaski, vice-chairman; Gerard E. Jansen, secretary; and Joseph Seiler, treasurer. Anyone wishing information regarding the WWDC should contact the secretary, Mr. Jansen, at 2551 W. Monroe Street, Chicago.

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This Month's Schedules

Alaska—The station reported several weeks ago on 8.860 as either WXFG or WXE is definitely WXFG,

Adak, as per verie received by Paul Kary, Pennsylvania.

Albania—ZAA, Radio Tirana, 7.852, is heard in England with *English* news at 3:15 p.m.; usually fades out around 4 p.m. (Bowes-Taylor)

Algiers—Current schedules of "The Voice of the United States of America in North Africa," relaying U.S. international programs, are: Algiers I, 9.610, 1-5:45 p.m. to Western Europe; Algiers III, 6.040, 1-5:45 p.m. to Balkans.

Andorra—Radio Andorra, about 5.985, has a program of British music, 4-4:30 p.m.; asks that reports be sent *direct* to Andorra. (Pearce) Although sign-off is scheduled at 8 p.m., was heard recently in Maine signing off at 6:55 p.m. with slogan, "Vive Andorra!"

Angola—Radio Clube de Angola, CR6RC, 9.470, Louanda, heard in England to closedown at 3:45 p.m.; some QRM from TAP, 9.465, Ankara; *no English.* (Pearce)

Arabia—K. G. Frick, Sweden, reports ZNR, 6.765, Aden, heard at 10 a.m.

Argentina—Widely heard throughout the U.S. these days is LPS6, listed on 14.850 but operating on 14.851, Ushuaia, Territory of Tierra del Fuego, heard around 6:45 p.m.; program consists of march, news in Spanish, march sign-off. Appears to be on only weekdays. Also reported used for point-to-point contact work.

Australia—Radio Australia has announced that VLA8, 11.76, has replaced VLA4, 15.32, in the West Coast daily beam, 11:45 p.m.-12:45 a.m.

VLG6, 15.24 (announced, formerly was 15.23), Melbourne, has replaced VLG7, 15.16, to West Coast, 11:45 p.m.-12:45 a.m. The same applies for the beam to New Caledonia, 2:30-3:45 a.m. (Balbi)

ABC National Program is heard in England from 3 to close at 5 p.m. over VLG7, 15.16; at 3 p.m. announces that VLH4, 11.88, and VLR2, 6.15, are in parallel; Saturday sign-off is 5:15 p.m. (Pearce)

VLQ3, 9.66, Brisbane, is again being heard mornings, good signal in West. (Dilg) Weak to fair here in East; probably runs to 9 a.m. Frick, Sweden, reports good signal there at 3 p.m. with *English* news.

Austria—Radio Wien, 12.212, Vienna, logged with good signal but sporadic CWQRM, coming on at 11:45 p.m.; news in German at 12 midnight and 12:45 a.m.; *English* lesson at 12:35 a.m. (by woman). (Kary) The 7.180 frequency is heard in England with strong signal at 2:05 a.m.; *no English.* (Pearce) Heard in Sweden on 11.790 around 1:30 p.m. and with news in German at 2 p.m. (Frick)

Radio Vorarlberg, 6.005, is heard in New York around 1 a.m. (Legge) Also reported heard there 1-1:45 a.m. with good signal. (Ballard)

Azores—Ponta Delgada moved from 4.040 to 4.845; heard, 5-7 p.m. (URDXC) Has "wonderful" signal in District of Columbia. (Howe) Fine

signal in England; *no English.* (Pearce)

Bechuanaland—ZNB, 5.900, Mafeking, heard very weak in Pennsylvania at 6:35 a.m. with music and occasional announcements by man. (Kary)

Belgian Congo—Leopoldville's revised schedules for OTC2, 9.745 (announced), are to British Empire, 10:30 a.m.-12 noon; to Britain, 3:30-4:45 p.m.; and to North America, 9-11 p.m. In latter beam, *English* news is at 9 p.m., with headline news around 10:45 p.m. (Balbi) Widely heard with good signals throughout United States.

Belgium—Brussels is reported on 9.479, 3:05-4:30 p.m. (URDXC) Heard on 11.89 in Australia at 3:15 p.m. with news in Flemish and music. (Sanderson) Pearson, England, lists this one as ORY3, with schedule of 6-7 a.m., 11 a.m.-12 noon, and 12:25-6 p.m.

British Honduras—In verification just received, it was stated that ZIK-2, Belize, is the Government Radio Station, 10.600, 200 watts. (Kary) Schedule appears to be daily with *English* news program, 1:30 or 1:35 to 1:45 p.m. (Arthur, McLaughlin)

Brazil—PRA8, 6.016, Recife, identifies with four-note chime. (URDXC) PRL8, 11.72, Rio de Janeiro, was heard recently testing around 9:20 p.m., for the Canadian Broadcasting Corporation (*English* and Portuguese); good signal. Regular sign-off of PRL7, 9.720, is 9:30 p.m. (Howe) PSL, 7.930, Rio de Janeiro, heard in Pennsylvania recently signing off at 6 p.m. (Kary)

Bulgaria—Radio Sofia, 9.350 and 7.670, according to letter verie, is scheduled 11 p.m.-1 a.m., 5:30-7 a.m., 11 a.m.-1:30 p.m., and 2-3:40 p.m.; has *English* news at 3:30 p.m. (Pearce)

Canada—CKNC, 17.82, has replaced CKCS,15.32, to Latin America, 6:20-7:35 p.m. (Balbi) This beam runs to 9:05 p.m. Sundays; CKRA, 11:76, parallels.

Cape Verde Islands—K. G. Frick, Sweden, reports Praia on 6.400, 3:30-5 p.m. with 0.03 kw.

Ceylon—Latest official schedules list *Radio SEAC,* Colombo, on 15.12, 9.52, and 3.395, 7:30 p.m.-12 noon, for the "main program" in *English;* 6.075 parallels between 7:30-11 p.m., 11:30 p.m.-5 a.m., 7 a.m.-12 noon; 17.77 parallels irregularly, 11:30 p.m.-5 a.m. Indian Forces programs on 17.77 and 6.075 run 11-11:30 p.m., 5-7 a.m.

Sunday beam to Britain, 1:30-3:30 p.m., is carried on 15.12 and 7.185. (Adey) Widely heard with fine level.

ZOH, 4.900, Colombo, is heard in England with "Epilogue" at 11:45 a.m. just before closedown; has orchestral program of recordings, ending at 11 a.m., and from 11:45 a.m. relays BBC; this is for Sundays; other days has dance music from 11:15 a.m. to closedown around 12 noon; very bad CWQRM. (Pearce)

Chile—CE960, Santiago, moved to 9.585 from 9.600; signs off at 12 midnight. (URDXC) *This is probably one of the stations that interferes with PCJ,* 9.59, *Hilversum, Holland.*

China—XGOA, Nanking, now uses 9.73, 4-11 a.m. sign-off. (Balbi) Is widely heard, some days with fine signal in East around 7-8:30 a.m.; relays XGOY's *English* news at 9 a.m. The widely reported "new" Chinese outlet on about 11.835 has been definitely identified also as XGOA, Nanking; usually parallels the 9.73 outlet; has fair to good signals in East. (Kary) Announces also several medium-wave calls, probably those of relay stations. Among calls heard are XGRX, XTRA. (Harts, Kary)

XTPA, 11.65, Canton, still carries XGOY *English* news at 9 a.m.; some days is very poor signal. (Kernan, Harts) Good signal in Michigan. (Flanagan)

XORA, 11.698, Shanghai, heard with good signal at 7:30 a.m. in Pennsylvania. (Kary) Heard in Ontario at 8:40 a.m. announcing "end of *English* period," good level. (Harts)

XGOUS, 7.55, Nanking, is now heard 9-9:50 a.m., some days later, with press news to U.S. (Balbi) Some days opens around 8:45 a.m. with music. (Dilg)

XMTA, 12.215, believed Shanghai, has been heard with weak signal in East early mornings; call announced often but location was not heard. (Kary) Heard in Australia at 7 a.m. with western type music and news in Chinese. (Sanderson) Heard in New Zealand as early as 5:30 a.m. (Gray)

A new Chinese station is reported as XRAY, 8.89, Peiping, relaying AFRS programs from around 5:30 a.m. While reports indicate location of Peiping, projected location was Pehtaiho. (Radio Australia) Heard at 5 a.m. in New Zealand, with severe CWQRM, announcing as "AFRS in Peiping." (Gray)

An unidentified Chinese is heard to around 8 a.m. on about 6.04. Heard 4:30 to about 8 a.m. (Baxter) May be XGSA, Nanking.

West Coast DXers report a new Chinese station on about 7.100, mornings; call appears to be XGAF; sometimes alternates western and oriental musical numbers. (Dilg) Probably opens at 5 a.m.; signs off at 9:30 a.m. (Baxter)

XLRA, Hankow, has recently been using about 11.490 to parallel its 6.055 outlet. (Dilg, Baxter)

A much-improved signal is noted from XPSA, 7.010, Kweiyang; lately appears to *not* take XGOY *English* news relay at 9 a.m. (Dilg)

Recently the *English* news at 7 a.m. from XGOY, 6.143, has been QRM'd badly in East by a Latin American transmitter, probably HJDE. (Beck)

XOPD, Hangchow, has moved up to about 9.775 from 9.555; heard signing off at 8 a.m. (Dilg)

XGOE, 9.820, Kweilin (?), was heard again recently on West Coast, early mornings, very weak. (Dilg) Sometimes heard in Australia at 6 a.m. with news in *English*. (Gillett)

XMAG is call of a new AFRS sta-

tion in Nanking; uses frequency of 4.275 to 11 a.m. sign-off; a further frequency of 7.340 is used irregularly to 11 a.m.; some days seems to have separate program. (Dilg, Baxter)

Colombia—HJCAB, 9.690, Bogota, appears to be off the air. (Howe)

Egypt—The station reported on 20.135 some time ago is SUP, Cairo; reports to NBC and CBS around 8:15 a.m., from correspondents in Cairo and Jerusalem, presumably by landline from latter; excellent signals. (Kary)

El Salvador—YSR, San Salvador, moved from 6.277 to 6.270. (URDXC) In verifying for Paul Kary, Pennsylvania, YSO gave "old" frequency of 7.270, but is actually heard on 7.315.

England—Changes in North American Service include GRP, 18.13, 9:15-10:15 a.m., 1:30-4:15 p.m.; GSJ, 21.53, 10-11:15 a.m., 11:30 a.m.-1:45 p.m.; GSP, 15.31, 4:15-7 p.m.; GWH, 11.80, 4:15-9:45 p.m.; and GRH, 9.825, 7-11 p.m. (Balbi)

H.M.S. Vanguard was heard from Plymouth at commencement of the recent Royal Tour to South Africa, on a frequency of about 7.800, working BBS station on about 8.615, with BBC pick-ups; this is reported to be one of the most powerful transmitters ever installed aboard ship. (Harrison) Was heard in Ontario on a frequency of 13.990 at 5:30 p.m. on the day it crossed the Equator; had clear signal. (Bromley)

Ethiopia—In a letter just received from W. H. Erholm, Technical Director of Radio Services, Ministry of P.T.T., Addis Ababa, Empire of Ethiopia, it was stated: "Thank you very much for your report on the reception of our station, ETA (or Radio Addis Ababa, Ethiopia), frequency 15.074 in the 19-meter band. Your report was exact and complete. We are using a 7-kw. transmitter with a 'diamond' or rhombic antenna. The station at present is off the air on broadcast, but is on the air daily on c.w., working Mackay Radio in New York *direct* on the hours of 1 a.m., 1 p.m., and 3 p.m. We expect to be on the air *daily* soon with a voice transmission in various languages, at which time we will advise you of complete details. Thank you again for the valuable information you gave us, and we hope you and your American friends will be a constant listener when we are on the air permanently." Verification was recently received by Kary, Pennsylvania.

France—Paris now uses 9.550 between 12:40-1 a.m. (URDXC)

Paris is heard on 7.240 afternoons in England, but with QRM from Moscow on same frequency. (Harrison) Is heard to 5:15 p.m. in Australia, clear of VLQ. (Gillett)

The Latin American Service from Paris is now heard on 7.280 (new) in parallel with 9.620; former very good, latter poor. The North American transmission continues on 9.550 and 11.845, 8:55-10:45 p.m. (Howe)

Paris is heard daily on 9.560, 2:30-3:30 p.m., with programs in *English,* directed to England. (Laubscher, Pearce)

French Equatorial Africa—Radio Australia recently reported in a DX session that Brazzaville has been assigned a new frequency of 17.84 with 50 kw. power.

On West Coast, 17.53 is excellent some nights, as are 11.97 and 9.44 in parallel; *English* news at 12:30 a.m. (Balbi)

European sources list Brazzaville on 7.000, and Rex Gillett, Australia, airmails me that this frequency is heard in Australia at 3:45 p.m. with *English* news, paralleling other frequencies.

French Guiana—For those who are anxious to log this country, it is reported that Rochambeau Airways, Cayenne, operate irregularly on the 4.220 frequency; schedule is not known; has *anyone heard* this one?

French Indo-China—Radio Saigon has moved to 6.19 from 4.81; signs off at 10:15 a.m.; signal is much better than when on 4.81, but suffers QRM from AIR, Delhi, on occasion; 11.78 parallels. (Balbi, Dilg, Baxter) *English* news is scheduled for 5, 9 a.m. The 11.78 frequency is still heard fair in the East around 6:15-7 p.m., full schedule is 6-8 p.m., but suffers bad QRM from U.S. stations on 11.79 during most of the period; French news at 6:30, *English* news at 7:45 p.m.

Pnompenh, 12.36, heard in Australia at 7:30 a.m. with news in French and music. (Sanderson) May carry *English* news around 7:45 a.m.

Hanoi, 7.25, was heard recently in Australia at 6 a.m. with *English* news. (Sanderson)

French Morocco—According to verie received by Moss, Ontario, *Radio Maroc,* Rabat, operates on 9.082 from 1:55 a.m. to 4 a.m. and 12 noon-7:15 p.m.; and on 16.666, 7-10 a.m.; call is CNR3; it was stated that "the antenna-power is about 2½ kw."

Finland—OIX-4, 15.190, Peri, is heard quite well signing on around 7:15 to 7:25 p.m., usually with 10-note chime; *English* news comprises entire program; usually leaves the air around 7:33 p.m.; these times vary from day to day; announces OIX-2, 9.500, in parallel, but this outlet is inaudible. (Kary)

Formosa—XUPA, 9.695, Tai-Pei, has moved to about 7.220; relays XGOY's *English* news from Chungking at 9 a.m. (Dilg)

Germany—Official schedules received from Sudwestfunk, Baden-Baden, French Zone, list the station on 6.321, 12 midnight-6 p.m. (may have short breaks). Relays medium-wave stations located at Freiburg, Sigmaringen, Koblenz, Kaiserslautern, Saarbrucken. Although German is the principal language used, some French programs are relayed from Paris. (Kary)

Official schedules of Munich I, 7.290, are 11 a.m.-4:30 p.m. to Balkans; Munich II, 6.170, 11 a.m.-1 p.m. to Balkans; 1-2 p.m. to U.S.S.R., 2-4:30

p.m. to Balkans; Munich IV, 9.540, same as Munich II. These stations relay U.S. international programs.

"Mitteldeutscher Rundfunk," 9.73, Leipzig, has excellent signals in England, heard before 3:15 a.m. and 5 a.m.-6:30 p.m., *no English.* (Pearce)

Gold Coast—ZOY, 4.915, Accra, heard in England at 12:45 p.m. with local news; says "Goodnight" and plays few bars of "God Save the King" at 1 p.m. sign-off; heard weekdays; may be off Sundays; has bad CWQRM. (Pearce)

Guadeloupe—Radio Guadeloupe has moved back to 7.445 from 5.986, 11:30 a.m.-1:15 p.m., 6-7:30 p.m. (URDXC)

Guatemala—TGLB, 6.095, Mazatenago, is a *new* station reported by URDXC, announcing as "Voz de Mazatenago"; heard, 7-10 p.m., relays TGLA.

Hawaii—Relaying U.S. international programs, KRHO, Hololulu, is scheduled 2:45-3:45 a.m. to China (except Monday), 4-11 a.m. to Japan and China, on 9.65; 5-8:15 p.m. to Philippines and Netherlands East Indies, and 8:30 p.m.-1 a.m. to Japan and China, on 17.80.

Holland—Berne list gives calls for Holland stations as PGD, 6.02; PCJ1, 9.59; PHI, 11.730; PCJ2, 15.220; and PHI, 17.776. (URDXC) Due to recent coal shortage, services were curtailed.

Hong Kong—Hong Kong has reverted to standard time—13 hours ahead of EST. (Radio Australia)

ZBW-3 has moved to 9.515, probably to escape QRM from Perth's VLW7, 9.52; heard to 10 a.m. sign-off. (Dilg) Relays BBC news at 6, 8 a.m. Appears to use Chinese to 8 a.m. An airmail report from Rex Gillett, Australia, confirms move to 9.515, "to get away from Perth"; *English* program heard before 6 a.m. BBC news and after it; also has *English* program after the 8 a.m. BBC news; medium-wave calls are ZBW, 845 kcs., and ZEK, 640 kcs.

India—VUD2, 3.495, scheduled 8:15 a.m.-12:30 p.m.; VUD11, 4.860, 12 noon-12:40 p.m. (Pearce) "You are listening to Bombay" identifies VUB-2, 3.365, at 12 noon during *English* program; scheduled closing time is 12:30 p.m. (Gillett)

Iceland—TFJ, 12.235, Reykjavik, scheduled 9-9:30 a.m. on Sunday *only,* has not been reported lately; *may be off the air.* Has been heard on c.w., however, with very strong signal in Pennsylvania at 3:25 p.m. (Kary)

Iran—Radio Teheran reported on 11.615 with *English* news at 6:30 a.m. (URDXC) EPB, 15.100, has good signal in Britain; *English* news at 6:30 a.m., followed at 6:45 a.m. with news in French. (Pearce)

Iraq—YI5KG, 7.085, Baghdad, is scheduled 9 a.m.-2 p.m. (ISWC) Heard with programs in Arabic to closedown at 2 p.m.; bad QRM. (Pearce) HNU, 6.13, reported heard in England, 8-10 a.m. (ISWC)

Italy—Reported by Per Friis, Denmark, is an AES station in Rome on 6.060, heard 4-4:30 p.m.

Radio Italiana, 11.81 and 9.63, has

an evening program from 6:10-7:20 p.m.; announces in *English* at 6:11 and 7 p.m., and carries *English* news at 7-7:15 p.m., with music to closedown. (Casey) Also scheduled with *English* news for 1.50 p.m.

Jamaica—VRR-4, 11.595 (announced), Stony Hill, is used for special relays; heard with extremely good signals some weeks ago with ZQI's coverage of soccer games at Savanah Parks; verifies. (Kary) Has been heard with good level in South Africa around 5:10 p.m.; asked for reception reports to Cable & Wireless, Ltd., Stony Hill, Jamaica, B.W.I. (Laubscher)

According to verie received, ZQI, Kingston, operates with 1200 watts, 4-5:30 p.m. on 4.70, and 7:30-10 p.m. on 2.33. (Arthur)

Japan—WLKS, "The Voice of the British Commonwealth Occupation Forces" in Japan, operating on a short-wave frequency of 6.105, is scheduled 4:30-6:30 p.m. and 9 p.m.-4 a.m. (Radio Australia) Is heard in Ohio between 3-4 a.m. (Sutton) Now runs to 5 a.m. (Balbi) Takes relays from Australia and Singapore; on 2.465, appears to run to 8:30 a.m. except Saturdays when continues to 9 a.m. (Dilg) Probably begins at 3 a.m.

WVTR, 9.605, Tokyo, carries AFRS program at 4:50 p.m.; has *English* news at 5 p.m.; bad CWQRM in Pennsylvania. (Kary)

The AFRS station in Tokyo on 6.015 (listed as JLR) was recently heard in New Orleans to announce as JKD; gave the 4.860 outlet as JKE; JLW, 7.825, is also heard mornings in New Orleans. (Crandall)

Java—PMA, 19.350, Batavia, is reported heard in England at 8:30 a.m. with news in Dutch, and at 8:45 a.m. with recordings. (Short Wave News) Heard signing off at 8:58 a.m., some days as late as 9:05 a.m., after *English* dance recordings. (Pearce)

An Indonesian heard on 9.41 from around 5 to 10:30 a.m., except Monday, probably is PLV. (Balbi) Has been heard on West Coast signing off at late as 11 a.m. after playing Ted Lewis' "Good Night Song." (Dilg)

English transmissions of "The Voice of Free Indonesia," 11.000, are officially scheduled for 4-4:30 a.m., 5:30-7:30 a.m., 9-9:30 a.m., and 11-11:30 a.m. (Bachman) Usually signs off with playing of "It's Time to Say Goodnight," and clock chimes for 12 midnight (Indonesian time). (Pearce)

Kenya—VQ7LO, 4.950, Nairobi, heard in England with *English* news at 1 p.m., followed by weather forecast and announcements; announces, "This is Nairobi calling"; signal varies daily from S-3 to S-9. (Harrison) Schedule is 5-6 a.m., 11 a.m.-2 p.m. *daily,* Sundays has last transmission *only;* additional, Wednesday and Saturday, 2-3 p.m.; scheduled Tuesdays and Thursdays, 7:30-8:30 a.m., on 6.060. (Levi)

Korea—JODK, 2.510, Seoul, runs to 8:30 a.m. (Dilg)

Lebanon—FXE, *Radio Levant,* 8.036 (actually lower, around 8.020), gives schedule of 12 midnight-1:15 a.m., 5:15-8 a.m., 10:30 a.m.-4 p.m. (Legge) Has been heard in England announcing as "Ici Beirut"; during daily *English* period, 10:45-11:45 a.m. the station carries *English* newscast at 11 a.m. (Pearce)

Macao—According to NNRC, CR9AA, 9.500, operates daily, 4:30-9:30 a.m., with 200 watts; only identification used is "Radio Clube Macao"; call letters are never given over the air; asks for reports and will verify with QSL card; address, Radio Clube Macao, G.P.O., Macao, Portuguese China, Asia; chief engineer is John J. Alvares (CE9AG), who advises that they intend to increase power to 1 kw. soon; Mr. Alvares also advises that these commercial transmitters are in operation in Macao: CRY7, 17.597, 2.5 kw.; CRY6, 14.500, 750 watts; CRY4, 12.250, 1.5 kw.; CRY8, 8.450, 2.5 kw.; and CRY3, 5.900, 300 watts.

CR8AA, 9.254, is reported with schedule of 6-9:20 a.m., mostly in Portuguese and/or Chinese; Portuguese news at 7:30 a.m. and *English* news around 7:50 a.m. (this is read by female announcer); reception is erratic in North America. Peaks on West Coast around 9 a.m.

Madagascar—Tananarive is particularly good on 9.690, fair on 6.065 with identification in French at 11 a.m. (Gillett)

Malaya—Singapore has replaced 4.780 with 4.820; schedule is 5:30-10:35 a.m. (URDXC) *English* news at 9 a.m., headlines around 10:30 a.m. (Dilg) Some days signs off at 10:35 a.m., others at 11 a.m.; signature is "God Save the King"; strong signal in England. (Pearce)

Monaco—*Radio Monte Carlo,* listed on 6.130 but lately reported as high as 6.150, uses 300 watts, but expects to increase power to 25 kw. in July when a new transmitter will come into operation; schedule, 1:30-3:30 a.m., 6-8 a.m., 1-5:15 p.m. (Short Wave News, London) URDXC reports has moved to 6.150. Is heard in Ireland with bad CWQRM. (Levi)

Mozambique—CR7BJ, 9.645 (or 9.650), is heard in England with *English* news at 2:55 p.m.; closes down at 3:30 p.m.; still announces and verifies as on 9.710. CR7BU (listed officially as CR7BF), 4.925, is heard on Sundays between 12 noon and 2 p.m. with sponsored programs; advertisers chiefly in South Africa. (Pearce)

New Caledonia—*Radio Noumea* is now on 6.160 from 6.208, 2-5:15 a.m.; signs off with "La Marseillaise." (Dilg) Heard during the last hour of schedule with weak signal in New York. (Legge)

Nicaragua—YNXW, Managua, previously on 6.275, is now heard on 8.190. (Legge) YNCNN, 6.700, Managua, is heard 6-8 p.m., very weak with heavy QRM. (Howe)

Norway—LLI, Fredrikstad, is correct call and location of the Norwegian station on 6.185, according to verie; relays Oslo Home Service to 5 p.m. (Legge) In verie gave power as 8 kw. (Bromley) LKQ, 11.735, has strong signal in England from 11 a.m.; is heard some days closing at 5:10 p.m.; LLI, 6.185, and LKJ, 9.54, parallel; *no English.* (Pearce)

Philippines—KZRH, 9.64, Manila, has *English* news at 7:30 a.m. (URDXC). I have heard *English* news from KZRH at 5:30 a.m., and it is heard at that time in England by Leslie Holmes. Signals are usually very weak in the East, with considerable QRM from KRHO, Honolulu, 9.650. Fair signal in New York, 6:15-7 a.m. (Ballard)

KZPI, 9.71, Manila, heard weakly in New York around 7 a.m. (Ballard) Usually is covered in East by San Francisco's 9.700 outlet. Good level in New Zealand at 5 a.m., but with CWQRM; announces as "*Radio Philippines,* 800 on your dial"; 800 kcs. is medium-wave outlet. (Gray)

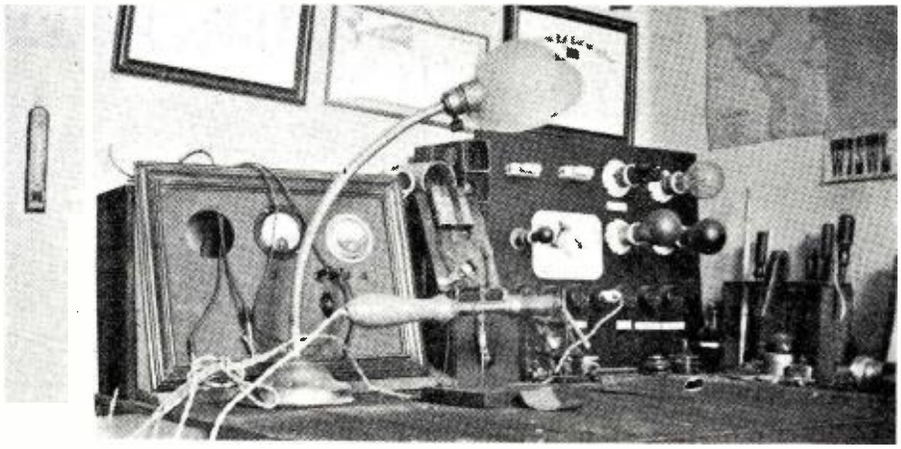
Poland—Warsaw, about 6.10, has good signals in Maine, 3:50-4:10 p.m., with *English* news period. (Beach)

Portugal—CSW7, 9.725, Lisbon, heard 7-8:30 p.m. sign-off. (URDXC) In verifying for Conley, Pennsylvania, listed frequency as 9.726, power of 10 kw., and schedule of 7-8 p.m.

Rumania—Bucharest, 9.252, was heard recently in Massachusetts, signing off at 8:17 p.m. (Harris)

Siam—In verifying, HS8PD, Bangkok, listed frequency of 6.040 (actually appears to be around 5.995) with

This listening Post is that of Luis Diez Alonso, Santander, Spain.



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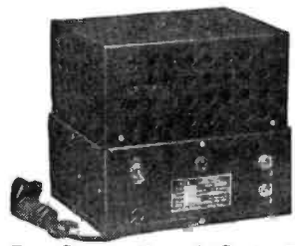

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500 watts output; schedule is given as 5-6:30 a.m. *daily;* HS7PJ, 825.85 kcs., 2000 watts, is scheduled 7-9:15 a.m. (Kernan) I believe the short-wave outlet, HS8PD, may relay the medium-wave station in the 7-9:15 a.m. period, in addition to its own earlier broadcast.

South Africa—Actual operating frequency of Cape Town is 5.878; official frequency is 5.883. (Legge) Is widely heard on the transmission beginning at 11:45 p.m.

Spain—Radio Falange, Alicante, is again heard on 7.951 to 6 p.m. sign-off; usually broadcasts recordings of operas or popular European swing music; has bad CWQRM, weak signal in Pennsylvania. (Kary)

Spanish Morocco—Frick, Sweden, lists Agui Radio Africana, Tangiers, operating on 7.084 with 1 kw., 7-9 a.m., 1:30-6 p.m. ISWC lists call of EA9AA, frequency as 7.09, as heard, 2:45-6:30 p.m.

Sweden—On January 19, *Radiotjanst* inaugurated a new feature for the benefit of Swedish DXers, under the title of "Halla DX-ers" which is heard periodically (probably every other Sunday) over SBT, 15.155, and SDB-2, 10.780, 11 a.m.-12 noon.

SDB-2, 11.780, and SBU, 9.535, sometimes run after 5 p.m., very good signals in New York. (Beck) The 8-9 p.m. period over these transmitters is heard widely now, especially over SDB-2; *English* news at 8:05 p.m. In the daily North American beam, 10-10:55 a.m., SBT, 15.155, is weak to inaudible in the East; SDB-2 is scheduled to parallel.

Turkey—According to Short Wave News, London, the projected 100-kw. transmitter to be put in operation at the end of the year in Turkey, will be located at Istanbul.

U.S.S.R.—The Soviet outlet on 9.545, heard in East around 6:15 a.m., may be Petroplovsk. (Ballard) Moscow now uses 6.130 between 4-5:30 p.m.; last half-hour in *English.* (URDXC) Batum, 6.493, Georgia, heard between 6-6:15 p.m. in New York, man testing and calling in Russian. (Ballard) Moscow, 6.050, on 3:30-9 a.m.; Petropavlosk, daily, on 6.070, 1:45-2:45 a.m.; Tiflis, 11.96, Home Service, 10 p.m.-12:45 a.m. (Balbi) Saratov, 6.220, is reported 12 noon-1 p.m. (URDXC) Stalingrad, 7.790, is heard in England between 8:45-11 a.m., 3-5 p.m. (in Russian). (Harrison)

Espana Independiente, 7.410, heard in England afternoons "with very heavy jamming." (Harrison) Moscow is using 11.876 in parallel with 11.63, good signal, 7-10 p.m.; after 9 p.m., 11.89 also parallels; all good on East Coast. (Howe) RV64, 8.820, Khabarovsk, heard in Canada around 8:10 a.m., in clear but with poor modulation. (Bromley)

The evening North American beam appears to run 6:20-9 p.m. on 6.02, 7.24, and 9.48; also is relayed between 6:20-7:30 p.m. by Komsomolsk on 15.23; may use other frequencies ir-

regularly; the morning beam, 7-8:15 a.m., is carried on 11.63, 11.72, 15.18, 17.82. (Cooley)

Vatican—HVJ, 9.660 and 5.970, has *English* news daily at 10 a.m.; *English* talks are radiated daily at 1:15 p.m. on these frequencies. On Sundays, commentaries are heard in French, Spanish, *English,* German, and Polish, at 5:15 a.m., followed at 5:30 a.m. by Holy Mass. On Tuesdays, *English* news is radiated at 10.30 a.m. on 17.445. (Salmon)

Yugoslavia—Radio Belgrade, 9.42, is being heard again at 12 midnight in New York; very weak. (Beck)

* * *

Acknowledgement

Sincere thanks go to all contributors to this issue of ISW. —30—

Deluxe Transmitter

(*Continued from page* 78)

cated in the accompanying curve (Fig. 6) falls off rapidly below 300 cycles, reaching minus 15 db. at 100 cycles. On the high frequency end the response falls off rapidly after 3000 cycles reaching minus 15 db. at approximately 8500 cycles and is minus 20 db. at 10,000 cycles. The complete schematic diagram of this amplifier is shown in Fig. 7. Because of this lack of linearity very flattering reports are continually being received regarding the speech quality of transmissions.

The apparent improvement in speech fidelity is brought about by a combination of transmitter and receiver characteristics.

A receiver must have a relatively narrow pass band to be very satisfactory for amateur communication purposes. The pass band in most amateur receivers is either limited to 3000 cycles, or is adjusted to approximately that value by the operator. Under these conditions, all frequencies above 3000 cycles represent wasted energy if actually emitted by the transmitter.

If the a.f. response of the transmitter is linear, the effect so far as the listener is concerned is an accentuation of the lower frequencies, since the receiver has eliminated the higher frequency components. It is then apparent that if the lower frequencies are attenuated at the transmitter, the middle range will be accentuated, and the over-all effect as noted at the receiving station will be that of a much higher quality of reproduction than would be possible with a linear audio frequency response at the transmitter.

—30—

ANSWERS TO BIZ QUIZ

1. b	6. b	11. b	16. c
2. a	7. a	12. b	17. c
3. a	8. c	13. a	18. b
4. c	9. b	14. c	19. c
5. c	10. b	15. b	20. b

ARE YOU A SALESMAN? Give yourself 5 points for each answer you had checked correctly. A score of 45 is average, and 75 or better is very good indeed.

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

SOLDER BULLETIN

Alpha Metals, Inc. is offering a new bulletin describing their recently developed "Tri-Core" solder.

The folder describes the product as a self-fluxing solder with three cores just beneath the outer surface of the wire.

Application data and full details of this solder are contained in this four-page bulletin which may be secured without charge from *Alpha Metals, Inc.*, 359 Hudson Avenue, Brooklyn 1, New York.

TUBE BROCHURE

A new 156-page receiving-tube brochure entitled "Recommended Types" is currently available for distribution to equipment designers and radio set manufacturers, according to an announcement made by the Tube Division of *General Electric Company's* Electronics Department.

Covering the complete *G.E.* and *Ken-Rad* receiving tube line and associated circuits, the new publication lists tube types in numerical order by sections. Each section includes a typical circuit, complete ratings, curves, and companion technical data for each tube type.

Distribution of this brochure is limited to receiver manufacturers, designers, and engineers who may secure their copy of the book by writing to W. Hayes Clarke, sales manager of receiving tubes, *General Electric Company's* Electronics Department, Tube Division, Schenectady, New York.

NATIONAL BULLETIN

Information on their new Frequency Shift Diversity Receiving Equipment is contained in a four-page bulletin recently issued by *National Company, Inc.* of Malden, Massachusetts.

This equipment, which provides frequency shift reception in the 2 to 20 mc. range, is completely described with electrical data and design features on the frequency shift receiver, frequency shift limiter and frequency shift keyer covered.

A copy of this bulletin will be sent to those who make their request to *National Company, Inc.*, Malden, Massachusetts.

"Q" INDICATOR

Descriptive material covering their new Low Frequency "Q" Indicator, Type No. 1030, has just been released for distribution by *Freed Transformer Company, Inc.*

Complete specifications on this unit are given in this four-page data sheet including range, oscillator frequency range, accuracy, variable impedance amplifier data, waveform, output impedance and voltage, variable condensers, accuracy of adjustment, temperature coefficient, frequency characteristics, power factor, etc.

A copy of this data sheet will be forwarded to those who request it from *Freed Transformer Company, Inc.*, 72 Spring Street, New York 12, N. Y.

PYRAMID DATA SHEET

Pyramid Electric Company is now offering a one page data sheet which lists electrical and mechanical characteristics for their line of "Twist-Mount" capacitors.

This listing carries part numbers, capacity data, working voltages, can sizes, and prices for almost forty different capacitors in the company's line.

A copy of this data sheet will be forwarded upon request to *Pyramid Electric Company*, Jersey City 6, New Jersey.

OLSON CATALOGUE

Of interest to radio servicemen is the new *Olson Radio Warehouse, Inc.*, catalogue which has been specially designed to be carried by the serviceman in his pocket.

Listing hundreds of everyday items needed by the serviceman, the new catalogue is reissued every thirty to sixty days in order that items appearing in the booklet are currently in stock.

Radio servicemen may secure their copies of the catalogue by writing direct to *Olson Radio Warehouse, Inc.*, 73 East Mill Street, Akron 8, Ohio.

TEST INSTRUMENTS

Radio City Products Company, Inc., of New York has recently made available a comprehensive listing of their complete line of radio, electrical and electronic test instruments.

This listing, Catalogue 129, contains 24 pages of data covering tube testers, multitesters, v.t.v.m.'s, insulation testers, capacity meters, signal generators, combination tube testers, volt-milliammeters and various accessories for these instruments.

A copy of Catalogue 129 may be secured from the company's authorized jobbers or by writing direct to *Radio City Products Company, Inc.*, 127 West 26th Street, New York, New York.

HAM FLYER

Sun Radio & Electronics Co., Inc., of New York is offering the first of a new series of ham flyers designed specifically for the amateur.

Listing all types of radio components, the flyer is unique in that it is

the first catalogue intended for the use of hams only. All the parts catalogued are designed specifically for amateur construction and were selected by Walt Zuckerman, W2LBF.

Distribution will be made by *Sun Radio & Electronics Co., Inc.,* 122-124 Duane Street, New York 7, New York. Only licensed amateurs will be eligible to receive this catalogue. Call letters must be included with your request.

RHEOSTAT CATALOGUE

Catalogue 3 describing the company's line of slide-contact and rotary drive rheostats has just been issued by *Rex Rheostat Company* of Baldwin, Long Island.

In addition to listing physical characteristics of almost fifty models, this catalogue gives electrical specifications and performance data on many of the units.

A copy of Catalogue 3 will be forwarded to those making their request direct to *Rex Rheostat Company,* 3 Foxhurst Road, Baldwin, L. I., New York.

JK DATA SHEETS

The James Knights Company of Sandwich, Illinois, is currently distributing a new data sheet covering their *JK* Stabilized 100 kc. Crystal.

Of interest to the radio amateur, the new data sheet provides operation details on this new crystal under different ham applications.

Also available for distribution is an application sheet covering the company's IBC-3 Impedacoupler. This unit provides a universal type antenna insulator-connector for making a weatherproof junction between *Amphenol* "RG" type flexible coaxial line and any current fed antenna or array.

Either or both of these data sheets will be furnished those who write *The James Knights Company,* Sandwich, Illinois.

BOOK CATALOGUE

Chemical Publishing Co., Inc., of Brooklyn, is currently offering copies of their new 1947 book catalogue to those who request it.

Covering the latest books on chemistry, technology, physics, general science, mathematics, engineering, technical dictionaries, etc., this catalogue meets the specific needs of technical and scientific workers as all items are listed by date of publication, price. number of pages, description and full table of contents.

Copies of this catalogue will be forwarded to those making their request to *Chemical Publishing Co., Inc.,* 26 Court Street, Brooklyn 2, New York.

PHILIPS INDEX

A 20-page index listing all articles which have appeared in the "Philips Technical Review" during the period January, 1936 (the first issue), and June, 1942 (the last issue prior to suspension of publication during the German occupation of Holland), is currently available upon request to

the *Elsevier Book Company, Inc.*, 215 Fourth Avenue, New York 3, New York.

The index, which is distributed free as a service to readers, catalogues all articles by subject as they appeared during the period covered. This index may also be used as a reference source for technical articles.

PARTS CATALOGUE

A new catalogue of interest to the serviceman and the amateur has just been issued by *E. F. Johnson Company* and is currently available either from the company direct or from its distributors.

Covering well over four hundred items, Catalogue 969 describes the company's line of variable transmitting capacitors, inductors, tube sockets, "Q" antennas, insulators, plugs and jacks, couplings, r.f. chokes, and tube cap connectors. In addition to these items, new products appearing for the first time in the company line included multi-wire connectors, tip plugs and jacks, and pilot dial and panel lights. The catalogue does not include the company's directional antenna equipment or large components for broadcast or industrial use.

A copy of Catalogue 969 may be secured from *E. F. Johnson Company*, Waseca, Minnesota, or any company distributor.

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Spot Radio News

(*Continued from page* 22)

facturers as this goes to press. From Holland comes word that the Philips Lamp and Radio Works, Nazi-held but comparatively undamaged during the war, is exceeding prewar records in production of radio tubes. Manufacturers in England are well enough along the road back to prewar production levels to have exported 77,586 units last year, as compared with 47,828 units imported. Elsewhere on the Continent, production was in miniature. Germany, for instance, averaged only 246 (two hundred and forty six) receivers per month during the last quarter of 1946, as compared with a monthly average of 12,000 in 1938. (These figures are for the U. S. zone only.)

ELSEWHERE ON THE FOREIGN FRONT, look for significant developments beginning May 15, when the World Telecommunications Conference is scheduled to meet in Atlantic City. FCC and the U. S. delegation will be prepared at that time to submit a plan for worldwide allocation of frequencies for all radio services, but so will a number of other nationals. Some compromises, affecting radio activities in this country, seem inevitable. Final decisions on the whole complicated problem will, in the estimate of FCC chairman Charles R. Denny, take "at least three months." He adds: "We are confident that a basic work-

able plan can be achieved, but I am sure that what is ultimately adopted will not be the present United States proposal or indeed that of any single nation. It will be a composite plan embodying the best possible way of meeting the requirements of all the nations of the world." He believes that the agreement finally arrived at must provide "not only for the frequencies having long-range propagation characteristics but also for the very high frequencies, the ultra-high frequencies, and even the super-high frequencies where the bands are employed for use on ships or aircraft which travel around the globe." It's going to be a tough, gruelling conference any way you figure it.

DOMESTICALLY, Chairman Denny believes that the two biggest headaches now facing FCC and the industry are the high frequency spectrum and radio heating. The commissioner points to the spectrum between 4 and 25 megacycles as the worst trouble spot. He characterizes it as "a potential bottleneck to the expansion of worldwide communications, worldwide aviation and worldwide shipping." "There is a growing demand," he says, "for additional frequencies from each of these services, but our studies in preparation for the world conference have established that there is no way that any one of these services can be given additional frequencies without robbing one of the other services." What to do? Mr. Denny offers two solutions, both admittedly temporary —more efficient use of the frequencies between 4 and 25 megacycles by application of all engineering techniques available, including highly directionalized antenna systems; and possible reassignment of the spectrum "so as to provide blocks of frequencies for a given country or region of the world, thus making possible an even better utilization of the available supply." But supply will continue to lag behind demand—only further scientific development, in FCC's opinion, can ultimately solve the problem. Mr. Denny recently put it up to U.S. radio engineers in the form of a challenge: "If radio is not to impose a ceiling on the expanding communications and commerce of the world, we must have a means for using the microwaves for communicating between continents. I know that this suggestion that you stretch or bend the microwaves is a big assignment but I doubt if there is an informed radio engineer who would venture to say that it cannot be done. The answer may lie in planes circling in the stratosphere, in reflections from the moon, or in some other technique not yet dreamed of—but it is of the greatest importance that an answer be found."

HEADACHE NO. 2, radio heating, is a service which is growing so fast that FCC believes it "soon may boast a larger investment than radio communications." Chairman Denny points out that it is now being used for such diverse purposes as welding metals, molding plastics, vulcanizing rubber, curing tobacco, fusing glass, drying penicillin, relieving aches and pains, inducing artificial fever and grilling hot dogs. "These radio heating machines," he adds, "must either operate on frequencies assigned to them or some method must be devised for shielding them so that they do not radiate." Best solution yet for the problem is FCC's effort to set up "graveyards" at strategic points in the radio spectrum where all radio heating devices can operate without bothering radio communications. Four graveyards—in the 13, 27, 40 and 2450 megacycle regions—have already been set up. But the radio heating enthusiasts—like everybody else in radio—want more. Where they are going to get it—how they are going to expand in an orderly manner without stepping on the toes of radio communication expansion—is anybody's guess. It is also, to quote FCC's Denny, "going to be one of the biggest headaches of the next decade."

RECOGNITION OF THREE UNSUNG RADIO leaders and their war contributions came recently with Certificate of Merit awards from the U.S. Navy. Two of the recipients were Chi-

cagoans—Leslie F. Muter of the *Muter Company* and Attorney Leonard J. Shapiro. Both got the awards for outstanding contributions to the war effort in expediting Navy electronic production in the industry. Mr. Muter served as president of *Radar-Radio Industries* during the war, and Mr. Shapiro was its executive secretary. Among other things, they recruited 35,000 new workers to meet the vital Navy production schedule. . . . Third man to receive a Certificate for outstanding radio work was Dr. Robert M. Page, superintendent of radio division three of the Naval Research Laboratory, with which Dr. Page has been associated since 1927. He was responsible for many years of fundamental research and development which led directly to the first practical shipboard radar as well as development of the first pulse radar equipment. Dr. Page was head of the special research section, radio division, of the Naval Research Laboratory from 1940 to 1942, and later headed the Laboratory's ship and shore radar research section and fire control section. His home is in Washington, D.C.

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A Sales Control System

(*Continued from page* 65)

to another salesman with better results. Some salesmen are more adept than others at meeting certain objections or situations.

The Customer Card is an example of the evolution that has taken place in the sales control system since prewar days. A customer file is exploited as energetically as a prospect file. This prevents salesmen from forgetting old customers, as too many salesmen do. Old customers are first-line prospects for other products and an excellent source of user leads. This card may be filed alphabetically or by date, if the salesman can judge the customer with regard to the next probable purchase and date, in which event, the card is filed to come up for action at that time, similar to the procedure with the prospect card.

The Transcript of Sale is recorded for ready reference in case of misunderstanding regarding settlement, and to give the salesman, when following up the customer for plus business, an idea of the merchandise or service purchased previously and the price paid, also the size of the trade-in allowance. By referring to the Customer Card, the salesman can tell when going after repeat business or plus sales whether he will be able to satisfy the customer with a limited trade-in allowance or whether the customer will demand the limit, whether the customer pays on the dot or is slow pay, whether the financial arrangements were long-term or short-term, etc. The Customer Card also carries valuable information for the statistical build-up of the Sales Analysis Chart.

The Sales Analysis Chart provides

monthly sales statistics to guide the dealer from every angle, including territorial sales analysis. If salesmen are making too few sales, presumably because they are rushing interviews or are weak closers, if selling or advertising expense is too high for sales volume, if window displays have dried up as a source of sales, if too few demonstrations are given in proportion to qualified prospects, the Sales Analysis Chart discloses these facts and others so that the necessary adjustments may be made.

The forms of a well-devised sales control system fit together like a jigsaw puzzle to produce a perfect picture of selling effort versus selling results versus selling possibilities. Forms may be printed, mimeographed, multigraphed or typewritten in carbon. Prospect Cards and Customer Cards are more adaptable in size 4 x 6 or 5 x 7 for filing in cabinets. The Prospect Register, Daily Report and Sales Analysis Chart are usually kept in looseleaf binders.

Whether you do your own selling or employ one or 21 outside salesmen, you cannot hope to do a topflight job of sales promotion unless you use a systematic method of sales control and this reasoning applies to little business as well as big business.

Salesmanship can only be effective if it is backed by competent business management. An adequate sales control system is essential to this objective. The system outlined here gives the fundamentals of operation and has been devised after analyzing many systems used by dealers in the past. No dealer need use it "as is." Make the necessary changes to conform to your particular business needs.

-30-

TALL CORN HAMFEST

PLANS are now nearing completion for the Tall Corn Hamfest to be held Saturday and Sunday, May 24-25, at Hawkeye Downs, Iowa, the home of the Iowa State Fair.

The program has been planned to provide entertainment for the entire family. Technical sessions for the amateur will be paralleled by special shows for the wives and children of those attending the hamfest.

Saturday evening will be rounded off with a banquet which will be held at the Cedar Rapids Chamber of Commerce Building. The dinner is set for 7 p.m. and will be followed by an address by George Bailey, president of the ARRL and Executive Secretary of the IRE. Dancing will begin at 9:30.

Activities for Sunday include tours of the Turner Microphone Company and Collins Radio Company plants and a trip to the Municipal Airport; a picnic type lunch at noon; and a hidden transmitter hunt in the afternoon.

All requests for tickets and complete program details should be made to D. D. Morgan, 430 35th Street, N.E., Cedar Rapids, Iowa. The tariff is $5.50 for those attending the meeting both days while those attending only the Sunday sessions will be relieved of $4.50. Check or money order should accompany requests for reservations.

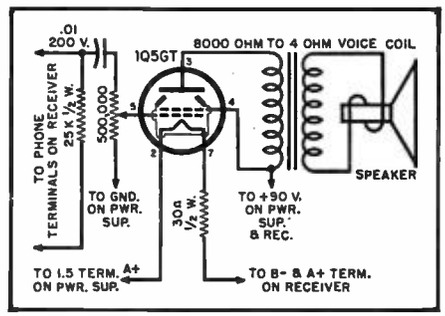
-30-

Although the recent survey conducted by Radio News indicated a predominance of servicemen and amateur readers, we found that many would like simple "how-to-do-it" articles. Accordingly we present this new department for the benefit of these readers.

AUDIO AMPLIFIER

The one tube receiver described in last month's experimenter's pages, will give greatly improved results and increased volume if an audio amplifier is added. In addition, the bother of wearing headphones is eliminated, and comfortable room volume reception of most stations is possible.

No changes will be required in the receiver to use this added unit. Essentially, the unit consists of a 1Q5GT audio amplifier, which drives a four inch PM speaker. Volume is controlled by means of a 500,000 ohm potentiometer in the grid circuit of the tube.



Wiring diagram of one-tube audio amplifier. This unit, when built, can be used in conjunction with the one-tube receiver covered in last month's issue, page 66.

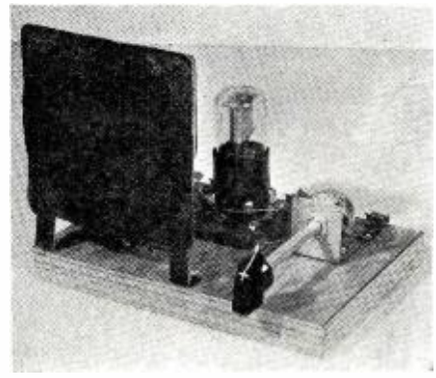
The 90 volts for the plate and screen of the tube as well as the filament voltage are obtained from the power supply described in last month's pages. The published characteristics for this tube call for a grid bias of —4.5 volts. By using the voltage drop across the filament of the tube in the receiver, plus the added drop across a 30 ohm resistor, this bias voltage is obtained.

The speaker used is one of the replacement type sold for use in small receivers. An output transformer to match the 8000 ohm plate load of the 1Q5GT to the 4 ohm voice coil should be chosen. Inasmuch as the power handled is low, the transformer used can be the smallest obtainable.

Wiring is "point to point" for convenience. No particular precautions need be observed in wiring, other than to insure that the polarity of the filament is correct.

The proper connections for the amplifier are shown in the diagram. When these connections are made as shown, the filament voltage and grid bias are automatically obtained.

Over-all view of audio amplifier.



POWER SUPPLY FILTERS

The function of a power supply filter is to reduce the a.c. ripple present in the output of the rectifier to a point where it produces no adverse effects in the equipment fed by the filter. The degree of filtering required varies widely—a microphone preamplifier requires much more filtering than a power amplifier, since any ripple in the preamplifier will be amplified in the successive stages.

Filters may be divided into two general categories—choke input and condenser input. Each has its own good and bad points, and we can take advantage of the good points for certain specific applications. Resistance input filters are occasionally used where the current drain is low and limited filtering is required, but for the most effective filtering, combinations of chokes and condensers are used.

Condenser input filters are most widely used in low power applications. Their principal characteristics are high output voltage and poor regulation. The output voltage of a condenser input filter will closely approach the peak value of the rectified voltage, under no-load conditions, but drops off quite rapidly as the load is increased.

Voltage regulation of a condenser input filter may be improved by increasing the capacity of the input condenser. However, increasing this capacity increases the peak rectifier current, and care must be taken to

see that this peak current does not exceed the rating of the rectifier tube. Usually the tube manual will indicate the maximum capacity which may safely be used with a condenser input filter. Values up to 40 μfd. are in common use.

The input condenser must have a working voltage rating at least equal to the peak value of the rectified a.c., and preferably a little higher for safety.

Choke input filters are characterized by low output voltage and good voltage regulation. If the input choke inductance is at least the critical value, the output voltage will not exceed .9 of the r.m.s. voltage input to the rectifier. The critical inductance in henries is obtained by dividing the load resistance (in ohms) across the filter output by 1000. The load resistance may be computed by dividing the output voltage from the filter network by the total current drain through the filter. If the input inductance is less than this critical value, the filter begins to take on the characteristics of a condenser input filter. Usually a choke input filter is designed so that the input choke has an inductance of approximately twice the critical value. This is called the optimum value.

Choke input filters are usually used in relatively high power applications where good voltage regulation is important or where the load is variable. With a constant load, condenser input filters are satisfactory, and in general are cheaper.

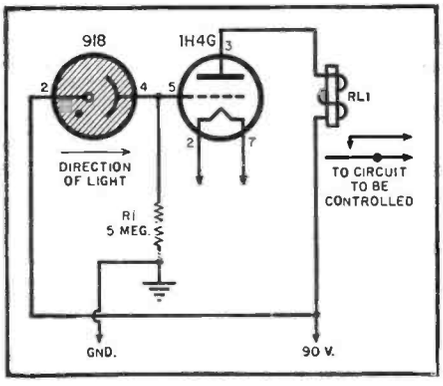
PHOTOCELL CONTROL UNIT

One of the most interesting pieces of equipment for the experimenter is a photoelectric unit. A device of this type may be used for a wide variety of purposes, such as controlling garage doors, burglar alarms, smoke detectors, and a myriad of similar applications.

There are many different types of photoelectric control circuits, each having its particular advantages and disadvantages. For most uses, though, a simple device consisting of a photocell connected to a single stage of amplification will be satisfactory.

With the unit pictured, the beam

Fig. 1. Schematic diagram of photocell control unit. All parts are readily available.



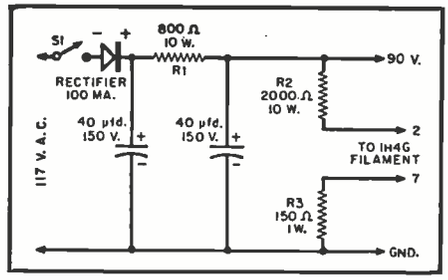


Fig. 2. Schematic diagram of power supply to be used with photocell unit. The power supply covered in last month's issue, page 67, can be easily adapted for this purpose.

from an ordinary two cell focusing flashlight will cause the relay to trip from a distance of over twenty feet. For operation over greater distances, a stronger light may be used. One of the ordinary sealed beam units used for automobile headlights and foglights will permit operation over a distance of several hundred feet.

The entire unit is constructed on a piece of 5 by 7 inch plywood, although any piece of board will serve as well. The sockets for both the 918 photocell, and the 1H4G tube are mounted by means of wood screws and metal spacers, to enable the prongs to clear the base.

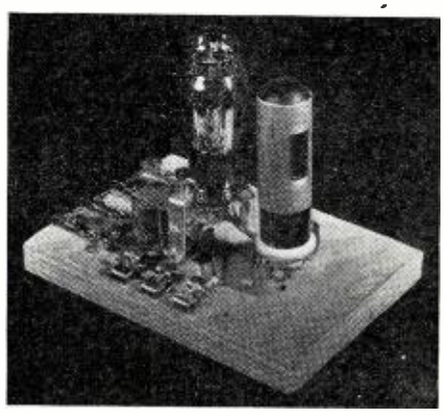
The power for the unit is furnished by the power supply described in the April issue of RADIO NEWS, with minor changes. For those who do not have this issue, the revised power supply is shown in Fig. 2.

The relay, RL_1 may be any sensitive relay that will close on a current of two ma. or less. The resistance is not important as several types ranging from 3500 to 9500 ohms give the same results. Many relays of this type are available at reasonable prices from surplus dealers.

Care should be taken in mounting the parts to orient the socket for the 918 tube so that the light will strike the inner curved surface of the plate. It is preferable to shield the phototube from extraneous light, and in this case a shield was made from a defunct electrolytic condenser can. The top of the tube was covered by black masking tape of the type used by photographers.

The unit may be made to operate

Over-all view of completed photocell unit.



either when light strikes the phototube or when the light is cut off. If operation is desired when the beam is broken, it will be necessary to use a relay that is normally closed with no excitation.

When construction has been completed, the power supply should be connected, and turned on. Care must be taken to observe the correct polarity in the filament connections of the 1H4G tube, or the unit will not operate. A flashlight or some other source of light should be placed close to the photocell tube. The relay will close when the light is turned on if everything is operating satisfactorily. An interruption of the beam should cause the relay to open.

In a brilliantly lighted room it may be necessary to shield the photocell by means of a box to exclude unwanted light. In any case, the only light hitting the photocell should come from the light source.

An interesting application for a unit of this type is the remote flashing of photo-flash bulbs. The relay may be used to control a flash bulb to illuminate unlighted areas, this remote bulb being set off by the flash of the bulb controlled by the camera.

RADIO QUIZ

How's your radio theory? If you miss any of the 10 questions below, you probably need to brush up a bit! Try your hand at answering these questions, then turn to page 183 and see how many you answered correctly. There is only one logical answer to each question. All questions refer to the diagram of a conventional speech amplifier shown on page 72.

The condensers referred to in questions 1, 2, and 3 are (a) coupling, (b) r.f. bypass, (c) filter, (d) a.f. bypass condensers.

1. Condensers C_5 and C_6 are (a), (b), (c), (d).

2. Condensers C_9, C_{10}, C_{11} and C_{12} are (a), (b), (c), (d).

3. Condensers C_3, C_4, C_7, and C_8 are (a), (b), (c), (d).

The resistors referred to in questions 4, 5, and 6 are (a) grid, (b) cathode, (c) load, (d) bleeder resistors.

4. Resistors R_1 and R_8 are (a), (b), (c), (d).

5. Resistors R_2, R_6 and R_9 are (a), (b), (c), (d).

6. Resistors R_4 and R_7 are (a), (b), (c), (d).

The transformers referred to in questions 7, 8, and 9 are (a) power, (b) interstage coupling, (c) r.f., (d) output transformers.

7. Transformer T_1 is (a), (b), (c), (d).

8. Transformer T_2 is (a), (b), (c), (d).

9. Transformer T_3 is (a), (b), (c), (d).

10. The type 80 rectifier is used to provide (a) plate, (b) heater, (c) bias, (d) a.v.c. voltage.

-30-

Within the Industry

(*Continued from page 34*)

vertising, the sale of radio receiving tubes to equipment manufacturers and to the distributor trade will be under the direction of Ernest Kohler Jr., Sales Manager, while Curtis R. Hammond, newly appointed Distributor Sales Manager, is in charge of all *Raytheon* renewal tube sales activities pertaining to jobber distribution of receiving, transmitting, and special purpose tubes. Mr. Hammond will continue his activities in connection with receiving tube equipment sales and the company's sales engineering service.

* * *

RAY R. HUTMACHER has resigned as assistant general sales manager of *Maguire Industries'* Electronics Department to form his own firm of manufacturers' representatives.

The new organization, known as *The Salecrafters, Inc.,* will have its headquarters at 510 North Dearborn Street, Chicago. The company will handle radios and electronic lines on a national or territorial basis.

Mr. Hutmacher has been connected with the radio industry for 21 years and is well known in the trade.

* * *

AMALGAMATED RADIO TELEVISION CORP. recently announced the removal of their plant and offices to a new location.

The company will be located in Mount Vernon, New York, at 152-4 MacQuesten Parkway South.

* * *

ARCH SAMUELSON is the new Sales Manager of the *Operadio Manufacturing Company's* Commercial Sound Division. Mr. Samuelson was formerly the Mid-West District Manager. His experience in sales, distribution, and engineering will complement *Operadio's* extensive sales program.

Appointment of two new district managers was also announced. J. F. McCraigh, formerly chief of the company's Engineering department, will take the post of West Coast District Manager, while the new Southeastern District Manager for *Operadio* will be Fred H. O'Kelley of Atlanta, Ga.

* * *

AUSTIN C. LESCARBOURA, one of radio's old-timers and a publicity and advertising consultant of Croton-on-Hudson, New York, has been awarded the coveted order of "Officier de l'Instruction Publique," according to word recently received from the French Embassy.

The award is made in recognition of the technical services rendered to France in the past.

Mr. Lescarboura is the former Edi-

tor of *Popular Science Monthly, Scientific American* and various trade and technicals journals. He is the author of several books and a frequent contributor to technical journals.

* * *

EUGENE B. LUCAS was recently appointed Sales Manager of *Air King Products Co., Inc.*

Mr. Lucas will head sales of *Air King* radios through the company's nationwide distributor set-up.

Prior to this advancement he was Advertising and Sales Promotion Manager for *Air King Products Co., Inc.,* which is a division of *Hytron Radio and Electronics Corporation.*

Before joining the company in April of 1946 Mr. Lucas was Sales Manager of the Cabinet Division of the *Plymold Corporation* of Lawrence, Mass. and has served with such manufacturers as *General Electric, Colonial,* and *Bendix.*

—30—

MIDGET TRANSMITTER-RECEIVER

OF INTEREST to radio amateurs in the United States is a new British-made transmitter-receiver which is only a little larger than a cigarette package.

The inventor, Michael Kasia, is shown using the unit in the top photograph, while comparative size of this midget transmitter-receiver is shown in the lower picture.

Now being manufactured commercially under the tradename "Tele-Radio" this unit utilizes the miniature tubes adapted from those used in radar-controlled shells during the war.

In use the transmitter-receiver can be carried in the breast pocket of a man's suit while the power pack may be slipped into the side pocket. The aerial is sewn inside the lining of the coat. The small microphone can be fastened underneath the lapel of the coat, if so desired. —30—

Ham Ticket in 30 Days

(*Continued from page* 56)

times whether you recognized the sound or not. We want to burn this proper association right down into your subconscious so deeply that you can never forget or confuse it.

After you have spent your hour and a quarter a day for three days looking first at the "dit-dah" combination and then at the letter, try three more days of reversing the process. Look first at the letter and see if the proper "dit-dah" combination does not come to you automatically. Check to see if you are right and then continue to say the combination while looking at the letter. By the end of six days you should be able to pick up any card at random, paying no attention to which side was up, and instantly call off what is written on the opposite side before turning it over.

When you reach this point, it is time to call in an assistant. It can be the wife, mother, son, daughter, or anyone else you can persuade to give you a little time. The first evening simply have them keep going through the cards, combination-side up, reading aloud the "dit-dahs." As each is read to you, call aloud the name of the letter, number, or symbol for which the combination stands. At the same time, write that letter down. Do not omit this: *Write that letter down;* and write down every single bit of copying you do from here on in. Never "copy in your head." Write each letter down just as quickly as you are able after hearing the combination.

Spend a half hour of the next evening copying down all the two, three, and four letter words you find in a newspaper column or similar piece of writing. Write the words on separate pieces of paper, and write the correct "dit-dah" combinations on the back of each piece. For example, on one side of one slip would appear the word *"and."* On the opposite side would appear the following:

Dit-Dah
Dah-Dit
Dah-Dit-Dit

For the remaining forty-five minutes of the period, have your assistant read over the combinations aloud. He should read each group in a single breath, with a slight pause after each combination that makes up a single letter. You should write down each letter as he says it, and then you should say aloud the complete word you have copied so that he can check you.

For the next evening add to this list several common letter groups that you have picked at random from English words. For instance, the word "carton" could be broken down with "car" on one piece of paper and "ton" on the other; or "caution" could be broken into "cau" and "tion." Mix these in with the complete words so that you will never be sure whether

what you are copying should spell out a complete word or not. Keep going over this list until your errors are few and far between, always urging your assistant to speak the combinations as rapidly as he can do so and still keep proper spacing. *Do not forget to write everything down.*

At the end of the second week you are ready to graduate to your receiver that can be used for code reception, one that produces an audio note with a c.w. signal, that is. Tune across one of the ham bands—probably forty meters would be best in the daytime, eighty at night—until you find a station calling "dah-dit-dah-dit dah-dah-dit-dah." Listen closely, and you will find that he will repeat this several times and then will send "de" or "v" and will next sign his call. In all likelihood, this will consist of the letter "W," then a numeral from 1 through 0, and finally a two-or three-letter combination of letters. He will repeat his call three or more times and then will start calling "CQ" again. This whole process will likely be repeated from three to six times before he finally sends "AR" or "K" and starts listening across the band for an answer. If you like, you can listen with him. The station calling will keep repeating his call for about a half-minute or more and then will send "de" and sign his own call several times.

Try to get each call correctly the first time you hear it. Spend two or three evenings doing nothing but copying calls. They make good practice because they include both letters and numbers, because they are repeated, and because each letter must be copied for itself alone. There is no context to help you. Next, try to find a station sending slowly and clearly and try to copy him solid. Do not worry about it if you miss a letter now and then. Just leave it out and go right on with the next letter. Keep at it, making no attempt to read what you are writing down until you finish. When you do try to read it, do not forget that hams use many abbreviations. For instance, weather is "wx"; signals, "sigs"; crystal, "xtal," etc.

In addition, try to copy W1AW every night Monday through Friday at 10:00 p.m., EST, on 3555, 7145, 14,150, and 28,060 kilocycles. The first ten minutes of these transmissions are sent at fifteen words per minute, the next at twenty, etc. When you can copy fifteen words a minute solid copy, you are ready to take the examination. This allows you a two-word-per-minute leeway for the excitement, strange surroundings, etc., of the examination. Listen to W1AW whenever you can, and spend the remaining part of your hour and a quarter each evening copying on the ham bands, *being sure to write everything down.*

By this time you should find you are having trouble in forgetting the code. By that I mean that you will catch yourself unconsciously translating signs and newspaper headlines into

"dit-dahs." That is good. It shows the old subconscious is beginning to work for you even when you are not sitting at your receiver.

The beginning of the fourth week, and not before, finds you ready to practice sending. You should now know how the code sounds when it is sent right; so you will not be forming a lot of poor sending habits that will have to be broken. Rig up a code-practice oscillator such as you have seen described countless times in issues of RADIO NEWS. Buy a good key, if you do not already have one, and adjust it so that you have a medium spring tension and a vertical movement of the knob of about one-sixteenth of an inch. Grasp it with the thumb on the left, the index finger partly on top and partly on the edge farthest from you, and with the second finger partly on top and partly on the right-hand side. Start sending with a smooth wrist-motion. The whole arm should not be pumped up and down.

At first, practice sending separate letters and numbers. Try to send each letter as a smooth unit, with very small spaces between the "dits" and "dahs." Make the dots as short as you can make them, and make the dashes enough longer that they will not be confused with dots, and no longer. I am deliberately avoiding telling you that a dash "is equal in length to three dots," etc., for I do not think this means anything except in tape transmissions. For your purpose, the length of dots, dashes, letter spaces, and word spaces should be long enough to be correctly recognized for what they are and no longer.

Devote fifteen minutes of each evening of the last few days to sending practice, but keep devoting a full hour to copying. If you want to spend more time sending, do not send for more than fifteen minutes at a stretch, or you will find your muscles tightening up on you making your sending erratic.

You have probably noticed that I said at the beginning that you were to devote an hour and a half each day to this project, but I have been accounting for only an hour and a quarter. The other quarter of an hour is to be devoted to learning the theory and laws necessary for passing the examination.

You should have provided yourself with a copy of *"The Radio Amateur's License Manual."* This can be obtained from *The American Radio Relay League,* West Hartford, Conn., for a quarter, postpaid. In it will be found every question that will be asked you on the examination, together with the proper answer.

Take a pair of scissors and cut the sixty-eight questions in the Class B portion from the manual together with their answers. Glue each question on one side of a piece of paper and the answer on the other. Study each question carefully and the answer even more carefully, underlining

in ink the important phrases, words, etc.

Next, pick a question at random and try to write out the answer. Compare what you have written with the printed answer. If there is any material difference, rewrite your answer. Keep doing this right on through the list of questions; then start over and do it again. Keep right at it, no matter how well you think you know the answers, right up to the time you take the examination. It is very disheartening to pass the code examination and then to flunk out on the written portion.

Let me stress the importance of using the same language the manual uses. Do not try to convert the answers into your own words. Learn them nearly word for word, as a parrot would. The people who grade the papers recognize the clear, straightforward wording of the manual; they may not recognize the same answer when it is cast in altogether different phrasing. *You cannot go wrong in memorizing the wording of the manual.*

Which one of you will be the first to get his license using this method? It can be *you,* you know. Good luck and . . . . . 73!

Simple FM Converter

(*Continued from page* 50)

results in the middle range so that generally the operation is good over the entire band. The design of the *LC* circuits in this unit is such that an extremely wide band is passed. For some sets a very slight adjustment may be required to bring the signals in at maximum efficiency. One capacitor should be tuned to the h.f. band station the other for a station near the same point in the low band.

In most metropolitan areas no new antenna should be required. For the best reception in the range 88-108 mc. a dipole antenna is recommended with a length on either side of center at 30 inches. The new plastic covered parallel transmission line is best for lead-in.

-30-

ERRATUM

The secondary of the discriminator transformers shown in Figs. 2 and 3, page 55, and Fig. 4, page 150, in the March issue should have been shown as a tuned circuit. A trimmer tuning condenser should have been shown across the outside terminals of the secondary winding.

• • •

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SERVICEMEN, amateur special, RG59/U, 72ohm coaxial cable, $.07 per foot. The SCR522, with A.C. power supply, 2-meter band-spread coverage, single RF-Osc. control, other improvements, complete in deluxe metal cabinet, write for information. Television kits, build your own, and a complete line of amateur and servicemen parts. Castle Radio Supply, W2JBM, 677 Euclid Ave., Brooklyn 8, N. Y.

COMPASS for beaming Antennas to Broadcast Stations, determining fields for motor repairs, etc.; brass watch-type case, jeweled bearing, automatic lock, luminous face, sturdy. Price, $1.39 postpaid. Paramount Products, 67-25 Juno St., Forest Hills, New York.

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SELENIUM Rectifiers, full wave, ½ ampere, $1.85; 1 ampere, $2.50. Half wave 5 amperes, $4.50; 2.2 amperes, $2.25; 1.5 ampere, $1.85. Bulletin. Bursma Radio, Route 5, Grand Rapids, Mich.

RCA Television Chassis and Power Supply. No tubes or harness, $90. Meissner Signal Calibrator Mod. No. 9-1006, $65. Alexander Radio & Electrical Shop, Roy Alexander, Jr., Montezuma, Iowa.

FREE wholesale bulletin, Tubes, parts. Bargain prices. Henshaw Radio Supply, 3313 Delavan, Kansas City, Kansas.

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"RECEIVER Alignment without instruments," 10c. Superheterodynes, TRFs. Electronic Publications, 166 N. Sierra Bonita Ave., Pasadena, Calif.

FIFTY Dials, nameplates, switchplates (paper), 10c. Professional appearance. Electronic Publications, 166 N. Sierra Bonita Ave., Pasadena, Calif.

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TYPE BC 610 Transmitters with tubes and accessories, new or used. Box 446, % Radio News.

WIRE Recorders, complete or parts. Give details. Chas. Reich, 415 Walnut, Knoxville, Tenn.

SUB-CONTRACT work on sub-assembly of radio and electronic equipment. Kendall and Kauffman, 25 Woodland Ave., Takoma Park, Md.

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SPEAKER Gauges: Immediate repair for 90% of all dragging voice coils. Ten machined forms to straighten coils. Instructions in packaged unit. $3.50 complete postpaid. Speaker Service Co., 1038 S. 32nd St., Omaha 5, Nebr.

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Signal Generator

(*Continued from page* 59)

of a fine pointer on a nine-inch, three-color dial face which is illuminated by two hooded pilot lights. An enlarged view of the dial and vernier drive are shown in Fig. 6.

This signal generator has been designed and constructed to provide accurate signals for radio servicing without the use of elaborate or involved procedures in setting up the instrument. It may be easily adapted to all types of receiver servicing including FM, television, and AM receivers.

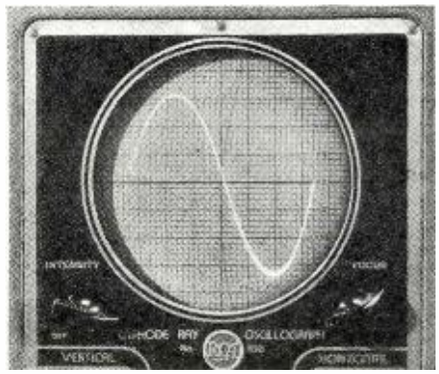

Fig. 5. Actual 400 cycle modulated waveform from signal generator described. This trace was taken after signal passed through the r.f. and audio stages of a commercial receiver. Buffer stage modulation is approximately 45%. A pure sine wave is a factor in checking over-all distortion taking place in r.f., converter, detector, and audio systems of receivers.

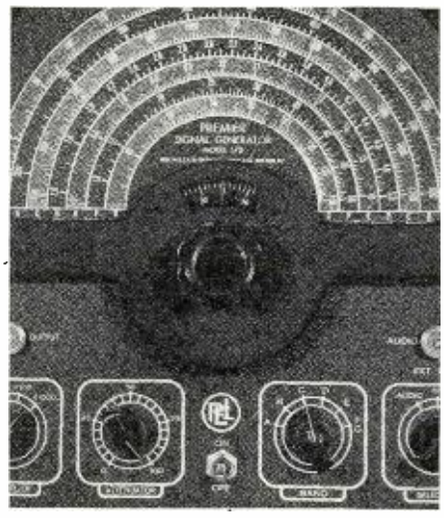

Fig. 6. Close-up view of vernier and "Micromaster" tuning dial of the signal generator shown in Fig. 1. Calibration reference points of from 0-100 available on the geared vernier provide a precision factor for aligning FM and TV sets.

—30—

ANSWERS TO RADIO QUIZ
(see page 175)

1. (a)	5. (b)	9. (a)
2. (c)	6. (c)	10. (c)
3. (d)	7. (b)	
4. (a)	8. (d)	

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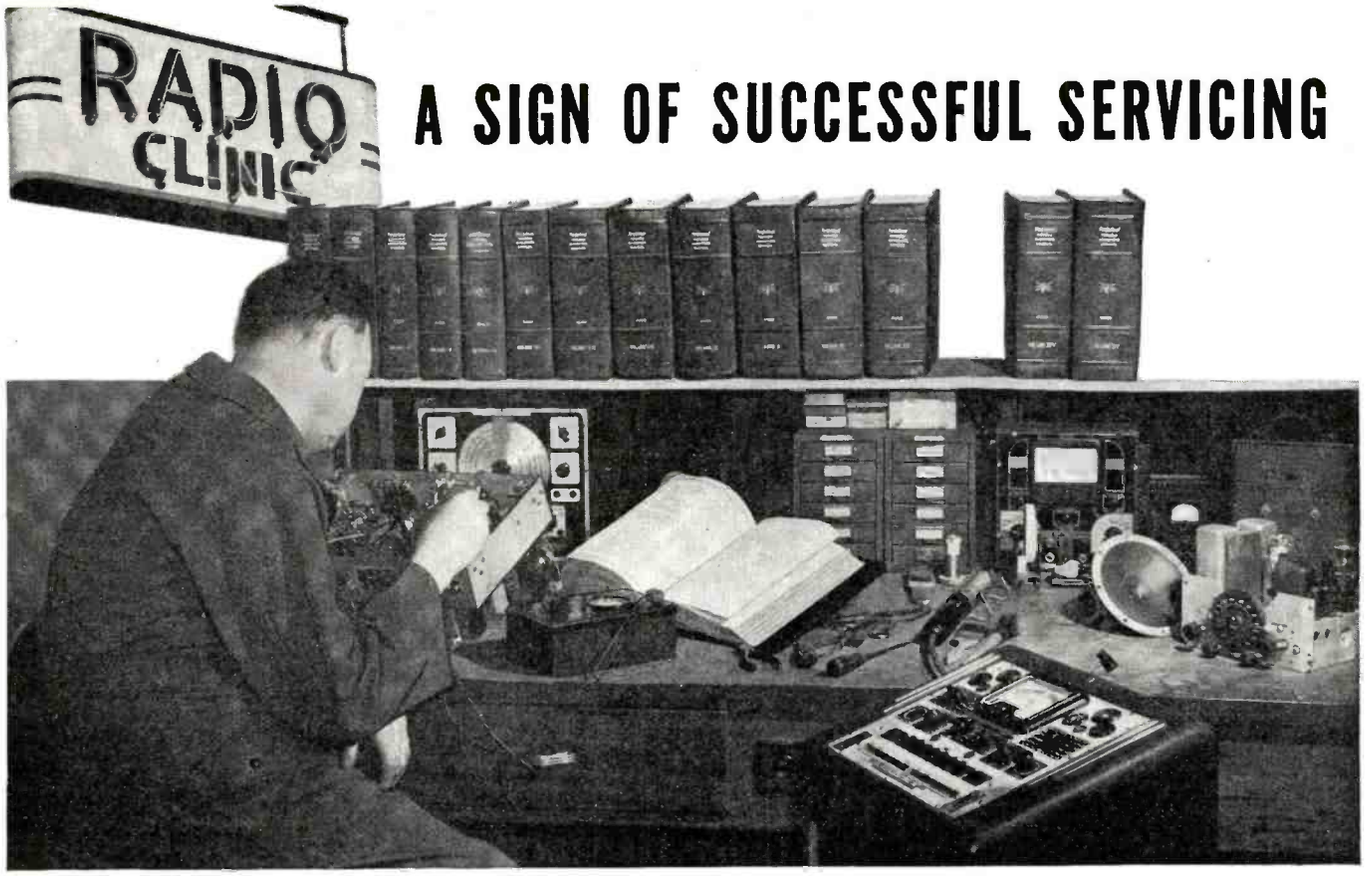

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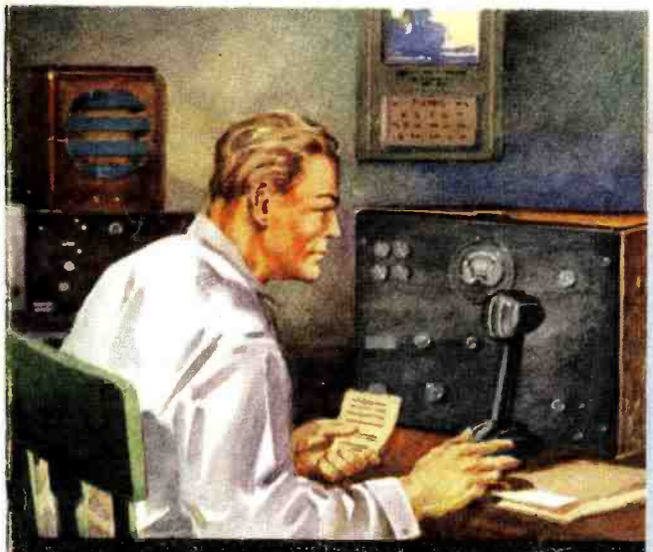

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