RADIO NEWS

NOVEMBER
1947
35c

NETWORKS FOR TELEVISION

PAGE 39

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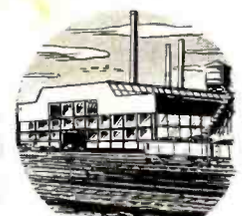

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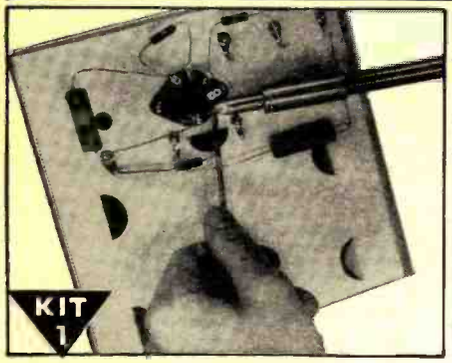
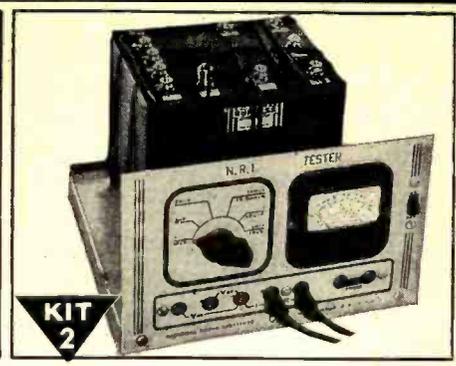
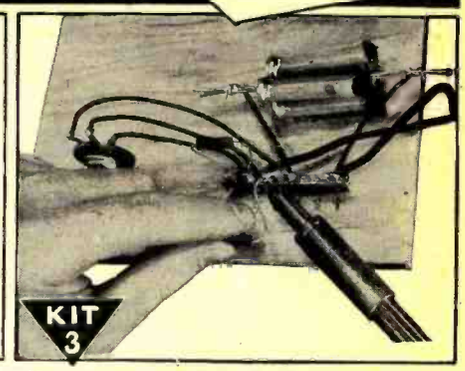


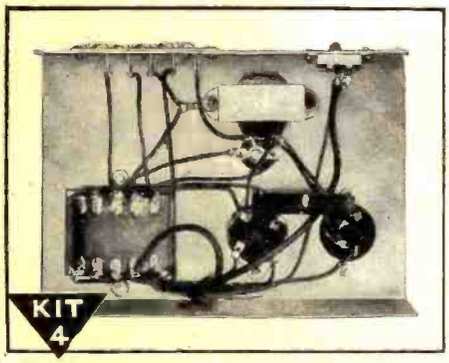
I send you Soldering Equipment and Radio parts; show you how to do Radio soldering; how to mount and connect Radio parts; give you practical experience.



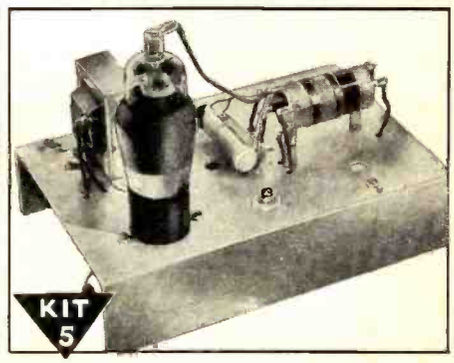
Early in my course I show you how to build this N. R. I. Tester with parts I send. It soon helps you fix neighborhood Radios and earn EXTRA money in spare time.



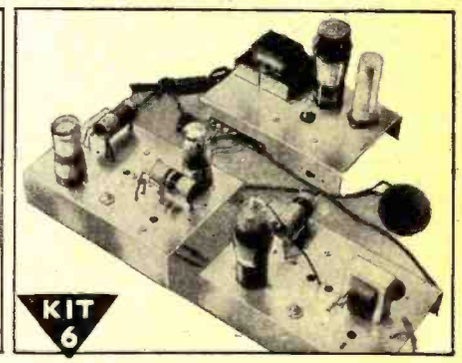
You get parts to build Radio Circuits; then test them; see how they work, learn how to design special circuits; how to locate and repair circuit defects.



You get parts to build this Vacuum Tube Power Pack; make changes which give you experience with packs of many kinds; learn to correct power pack troubles.



Building this A. M. Signal Generator gives you more valuable experience. It provides amplitude-modulated signals for many tests and experiments.



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NOVEMBER, 1947

COVER PHOTO: One of A.T.&T.'s experimental radio relay stations linking New York and Boston. Each of these towers will receive television signals and transmit them to next relay—automatically and unattended. Photo by Western Electric

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Type Number	Characteristic Impedance Ohms	Velocity of Propagation (in percent)	Capacitance Per Ft. mmf	Attenuation, Db per 100 Ft. Frequency in Megacycles				
				1.0	1.7	30	100	300
K-1079	100	71	15.5	.6	.75	2.8	5 2	8.8
K-1128	75	71	19.5	.3	.4	2.0	4.0	7.3
K-1046	300	81	4.0	.38	.57	.85	2.0	—
K-32	73	66	22	—	—	2.0	3.8	7.0
KT-51	95	56	16	—	—	1 8	3 8	7.5

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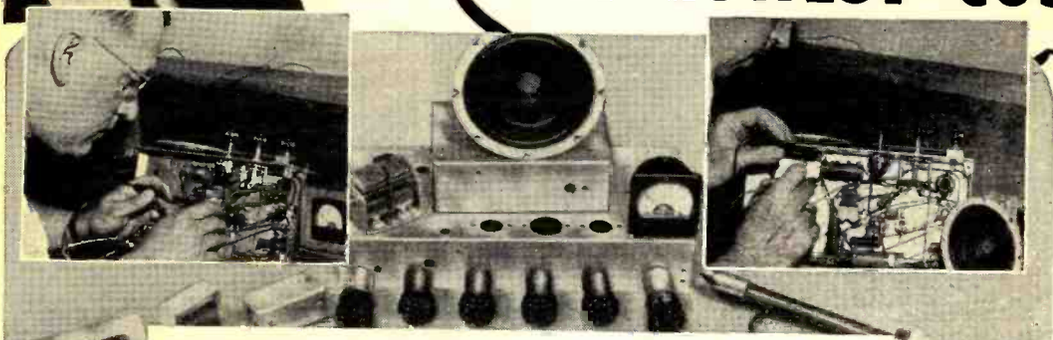

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For the RECORD

BY THE EDITOR

EVERY once in awhile we have occasion to drop in for a visit at some outstanding laboratory to get first-hand information on developments being conducted by their engineers and scientists.

Our latest visit was to the *National Bureau of Standards* in Washington, D. C. Perhaps no other group of scientists has contributed more to the development of electronics than these workers. Few of our readers are aware that from the National Bureau of Standards comes many of our most valuable wartime and peacetime developments. For example, the much-discussed proximity fuse, claimed by many to be World War II's No. 2 weapon, was developed by the NBS with the cooperation of the *Raytheon Mfg. Co.*

The various phases of the Bureau's tube research, for example, are of tremendous importance to the science of electronics. A recent important development is a new type of subminiature tube. In contrast to our prewar miniature tubes, designed primarily for use in hearing aids and other small equipment, these new subminiatures are ideally suited to a variety of other applications such as detectors, oscillators, amplifiers, and rectifiers. It is interesting to note that NBS scientists found that a tube ¼" x 1" would perform specific functions equally as well as larger tubes.

It was by this simplification that further reductions in size were made and from this process of evolution, the tiny microtube was developed. Designed primarily for various military applications, this "grain of rice" tube may well revolutionize and enhance the effectiveness of the proximity fuse and, furthermore, will make possible the ultimate in compact assemblies for non-military use. The microtube gains its name from its size in comparison to a grain of rice.

The manufacture of compact electronic equipment, employing "printed circuits," is another contribution of NBS scientists. As with the proximity fuse, the new subminiatures are used in conjunction with printed circuits and are new tools of great potential value. Other developments which will eventually have a profound effect on our industry are the new long-life tubes developed for use in electronic computing machines and in similar equipment. Such complete machines have used as many as 18,000 tubes while some single machines require as many as 2000 tubes. Tube failure must be reduced to a minimum and tube life must be increased in order to simplify the problem of trouble-shooting and tube replacement. We were told that the new tubes will have a life expectancy of from 15,000 to 20,000 hours. This is 10 to 20 times the expected life of present day computor tubes.

One of the newest units of the NBS is its Tube Laboratory, staffed by a small group of highly trained physicists and technicians and equipped with the most modern facilities available for small scale electron tube design, manufacture, and testing. Work on tubes, whose applications are primarily military, is carried on directly for the Armed Services, often with the cooperation of industry. In addition, they provide services to other sections of the Bureau including data on tube repairs, duplication of special tubes, expert advice on tube problems, the latter frequently requiring new methods of approach, or the development of new techniques.

To do justice to the many associated developments now being conducted by the Bureau would require considerable space. As far as our readers are concerned, probably the most interesting of all NBS developments are radio receivers and transmitters produced by the printed circuit technique. Two-way units for the Citizens band will undoubtedly employ printed circuits wherever feasible. We were told that approximately 60% less time is required to paint a circuit than to wire one employing equivalent components. Even inductances are painted in helical form on the base material or are painted in coil-like fashion directly on the envelopes of the subminiature tubes. Thus space saving results.

Letters from many of our readers show concern over the wide acceptance of printed circuits. Several have indicated their concern as to the future of radio servicing, if industry were to substitute printed circuits for present methods. In analyzing the problem, we see many years of production of compact special equipment before any radical change in technique can be adopted, if ever. Certainly, at the present state of the art, we cannot expect to see complicated television and FM sets being produced in this fashion.

On the other hand, we do see newer opportunities for radio servicemen as soon as printed circuit equipment reaches a universal civilian market. Regardless of what technique is employed, servicing must be conducted. Radio transmitters and receivers just don't operate forever without maintenance.

We say "Hats Off" to these engineers and scientists who, in their laboratories, have contributed so much to our "Electronic Era."..... O.R.

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Hallicrafters S-38	47.50	RME VHF-152 Converter	86.60
Hallicrafters S-40A	89.50	RME DB-22 Preselector	66.00
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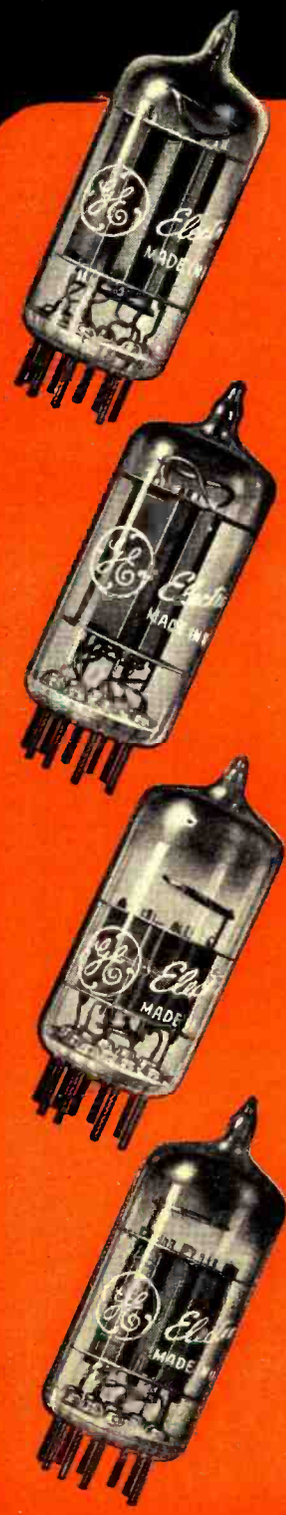


6T8

High-perveance triple-diode triade with 6.3-v, 450-ma heater. For use as a radio detector and audio amplifier in FM and Television receivers.

19T8

High-perveance triple-diode triode, with 18.9-v, 150-ma heater. For FM and Television service as a radio detector and audio amplifier.

12AT7

High-transconductance double triode. Used primarily as a converter in FM and Television receiver applications. Center-tapped heater permits use of the tube either in a-c/d-c receivers or in receivers with a 6.3-v heater supply.

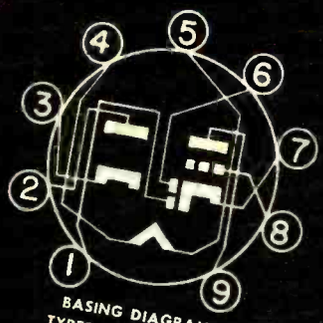
12AU7

General-pupose double triode (its octal-series prototype is the 6SN7-GT). Center-tapped heater allaws use either in a-c/d-c receivers or in sets with a 6.3-v heater supply. Chief applicatians are as a multi-vibrator and for speciat service in Television receivers and industrial-control panels.

Nine-Pin Miniatures

RECEIVER APPLICATIONS

CHARACTERISTICS AND TYPICAL OPERATION



BASING DIAGRAM
TYPES 6T8 AND 19T8

Triode Unit

	Heater voltage	Heater current	Plate voltage	Grid bias voltage	Plate current	Transconductance	Amplif. factor
6T8	6.3 v	0.45 amp	250 v	−3 v	1 ma	1,200 micromhos	70
19T8	18.9 v	0.15 amp	250 v	−3 v	1 ma	1,200 micromhos	70

Diode Units

For both tubes: avg diode current, per unit, with 5 v d-c applied.....20 ma

BASING DIAGRAM
TYPES 12AT7 AND 12AU7

Each Triode Section

	Heater voltage, series	Heater voltage, parallel	Heater current, series	Heater current, parallel	Plate voltage	Grid bias voltage	Plate current	Transconductance	Amplif. factor
12AT7	12.6 v	6.3 v	0.15 amp	0.3 amp	250 v	−2 v	10 ma	5,500 micromhos	55
12AU7	12.6 v	6.3 v	0.15 amp	0.3 amp	250 v	−8.5 v	10.5 ma	2,200 micromhos	17

Proof of G-E tube-design leadership is this great new series of nine-pin miniatures! The dealer who handles General Electric tubes, the radio service-man who installs them, both know that their G-E product marches to the quickstep of today's electronic progress. With G-E tubes you may PROFIT by servicing the new AM, FM, and Television receivers which the public today is buying in increasing volume. Stay well ahead of your competition by installing and selling General Electric radio tubes—*design leaders* in the electronic-tube field!

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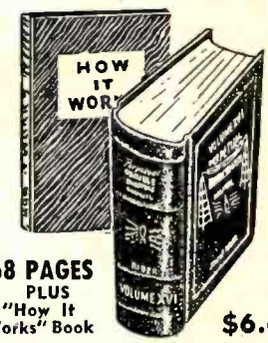
*Rider Manual data is the OFFICIAL AUTHORIZED servicing data right from the servicing departments of the companies that made the sets. No one knows, better than the manufacturer, what servicing procedures are best for his products. That is the basis for the authority and success of Rider Manuals.



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Spot Radio News

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By FRED HAMLIN
Washington Editor, RADIO NEWS

ANYBODY INTERESTED in world peace might well sit down and study the record of the international radio conferences which were in session almost constantly during the summer and early fall in Atlantic City. As we were careful to point out last spring, the meetings had everything imaginable standing in the way of their success. Too many persons—representing the entire world of radio—were attending. There were, we pointed out cynically, too many diplomats scheduled to appear. And the subject before the meetings—resolving difficulties among nations interested in all types of radio and telecommunications—was infinitely complex and open to endless controversy. Odds seemed heavy that the officials assembled would sweat out the summer if not a couple of years without getting anywhere and end the sessions in bitter enmity.

IT IS A TRIBUTE to all concerned and to men of radio in particular to report that exactly the contrary turned out to be true. There were plenty of debates, but few arguments. Week by week, marked progress was recorded. As this goes to press, all but a couple of comparatively minor items had been settled and everybody was happy. The U.S. delegation, led by Assistant Secretary of State Benton and Federal Communications Chairman Charles R. Denny, ably assisted by State Department's Telecommunication division chief, Francis Colt deWolf, took the lead in making generous concessions early in the sessions. Other nations cooperated. Nobody went home mad. Indeed—an indication of the head's-up ball played by the conferees—a new nation was admitted to the meetings after they were well underway. This was Pakistan, recently created following the liberation of India. Just to make the record complete, all and sundry went out of their way to comment on the cooperation of the Russian delegation, headed by Deputy Minister of Communications Alexander Fortushenko.

ANYTHING CAN HAPPEN in electronics, and probably will. Latest field that has been invaded, according to word received in Washington recently, is astronomy, and experts predict a bright future. Indeed, to quote Dr. Otto Struve, honorary director of the Yerkes observatory at Williams Bay, Wis., and head of the University of Chicago's department of astronomy, electronic devices may one day rival the telescope in the star-gazing field. Dr. Struve describes the last fifty years as "the photographic era of astronomical investigation," but predicted that radar and radio would become more and more important in the next five decades. "It is appropriate to suggest," he added, "that the next fifty years may be dominated by the methods of electronics."

TWO OTHER UNUSUAL DEVELOPMENTS—this time in television—also made recent spot radio news. The first is like a scene from a Jules Verne story of the future, although it happened only a few weeks back. Reported in Washington through Navy channels, it paints a graphic picture. The scene is on the deck of a Navy submarine rescue ship, the *USS Coucall.* Standing on the deck, watching a television screen, are scientists and Naval officers. The place is near Bikini. And on the screen are the strangest collection of actors yet to star in television—Pacific deep-sea fish doing what comes naturally in their native habitat, the Pacific ocean, depths 160 feet below the surface, on which the *Coucall* lies at anchor. Far from being a highly technical explanation, the answer to how this was possible is comparatively simple. In the depths lay the *USS Apogon,* a target submarine sunk when the atomic bomb test was made at Bikini. On its deck was rigged an underwater movie camera which was focused and operated by remote control from the *Coucall's* deck. Hooked up with the television set, it converted this five-inch television screen into what looked like an aquarium window. The pictures picked up by television were, observers report, equal to others taken by deep sea divers. No special lighting was needed—just the natural underwater twilight blue—standard at such depths. Equipment used was a Naval aircraft television camera and monitor adapted for the operation by the Cornell University Aeronautical Laboratory at Buffalo, New York. The basic equipment, as a matter of fact, is like

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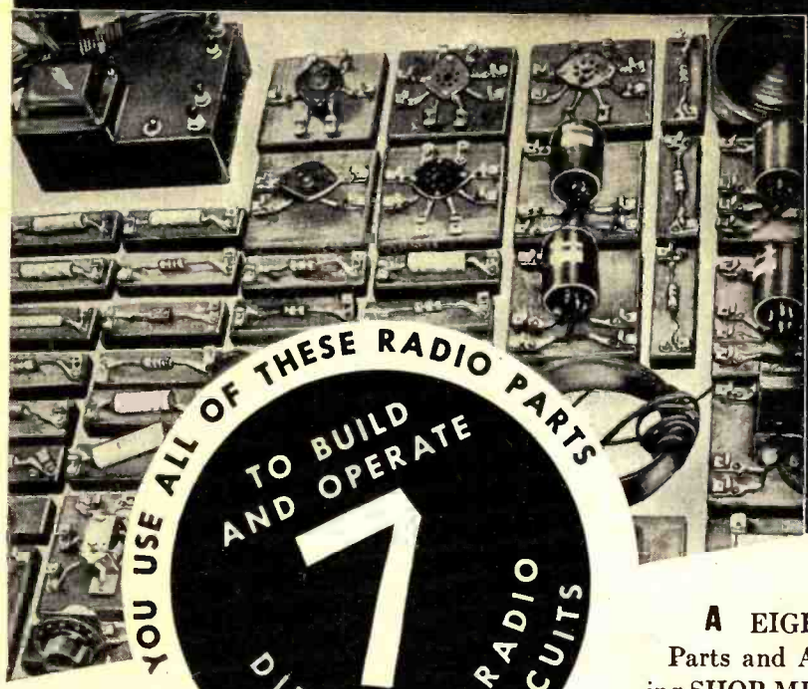

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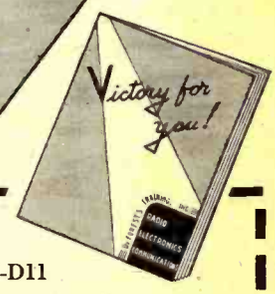

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SPOT RADIO NEWS

that already developed by the Navy for use in drone planes.

CLOSER TO HOME, the second item concerns conventional U. S. telecasting of a very unconventional kind of material. Seems that Betty Jane Williams, president of the WASP Order of Fifinella, and nationally known as an instructor of flying, hit on the idea of doing flight training by television. She outlined the idea to Columbia Broadcasting's station WCBS-TV and they liked it. First program went on in mid-September and a bright future is predicted for the project. All phases of aviation are covered, from plane assembly and the fundamentals of piloting, through take-offs, landings, turns, instrument flying, traffic control, and flight planning. Veteran fliers and instructors are scheduled to come on the program as guests.

ON THE FM FRONT, topping the Washington news for some time to come will probably be a battle begun late this summer between FM broadcasters and that long-distance battler with radio stations, Mr. James C. Petrillo, president of the American Federation of Musicians. First gun in the current war was fired by Mr. Petrillo, who stated that he refused to permit the simultaneous duplication of music on AM and FM stations. The FM Association promptly responded that the Department of Justice should investigate Petrillo's stand for possible violation of the Lea Act against feather bedding and the Taft-Hartley Law. This suggestion was followed by a double-barreled blast in Petrillo's direction by J. N. (Bill) Bailey, executive director of the FM Association, aided and abetted by legal background from Leonard H. Marks, FM general counsel. Mr. Marks declared that, as a result of a Supreme Court decision upholding the Lea Act, "FM stations can now broadcast the same programs, whether local or network, that the AM stations carry, without employing additional program personnel. Since this duplication is solely a mechanical process, additional program personnel would not appear to be needed to perform any additional services." He went on to point out that "it is now unlawful for a union to require a radio broadcast station to employ a greater number of persons than are needed by such licensee to perform actual services. This," he added, "can be construed to prohibit a union from forcing a station to pay 'stand-by' fees." Standby fees being exactly what Mr. Petrillo is reaching for, he replied that his organization "holds that FM broadcasting is separate and distinct from AM broadcasting." FM-ers promptly stated that this wasn't so. "We sincerely believe," added Bailey, "that within a few short years FM will replace AM or ordinary radio entirely. At the same time we know

(*Continued on page* 100)

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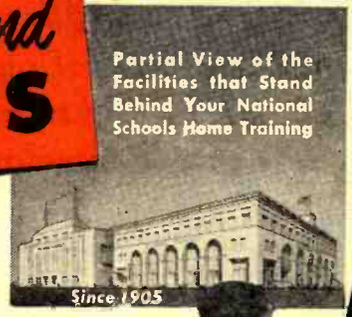
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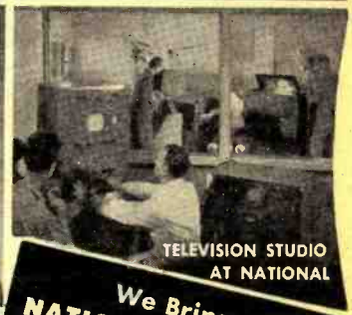
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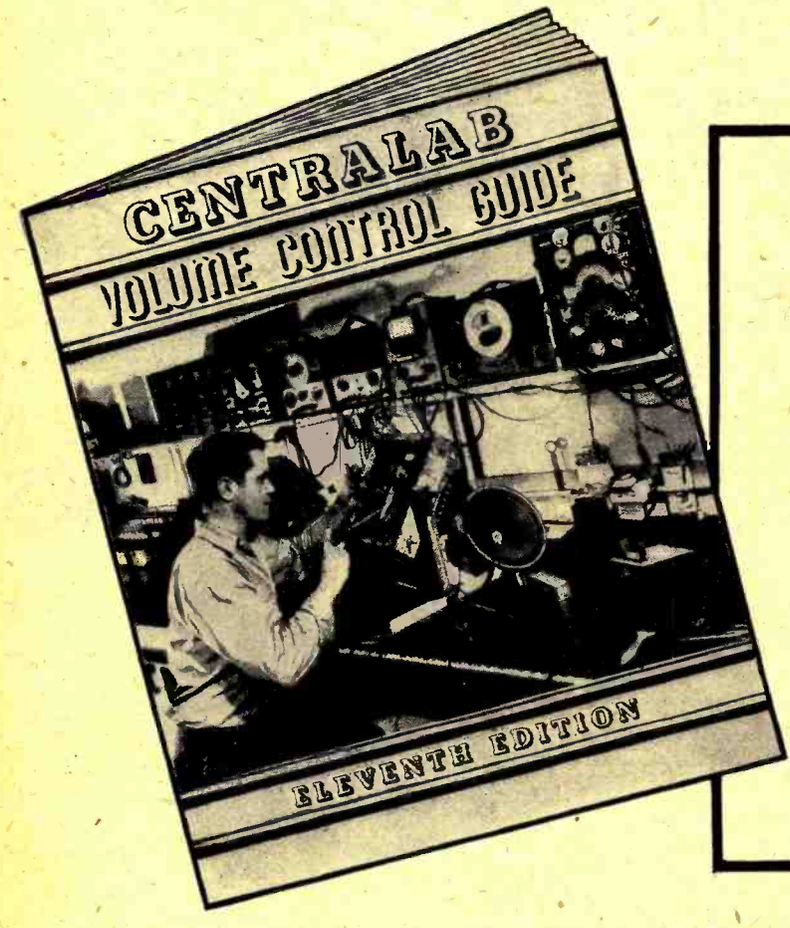

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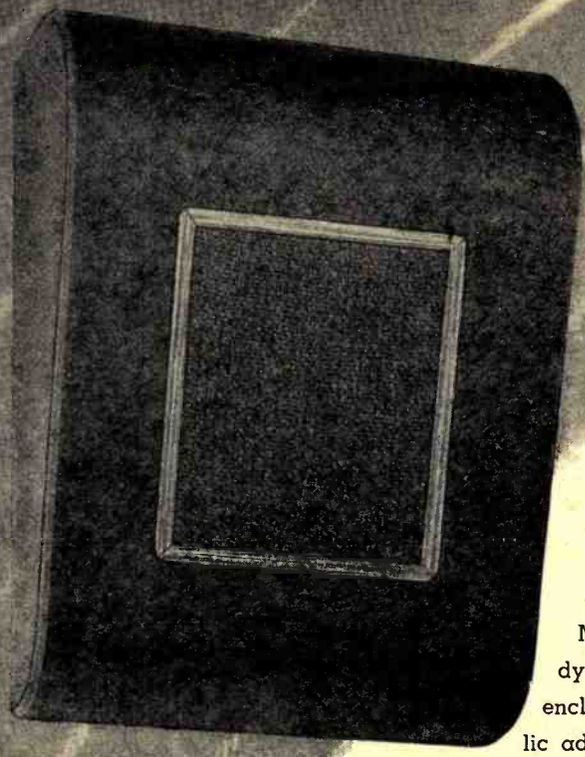

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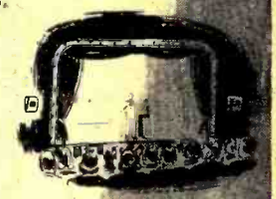

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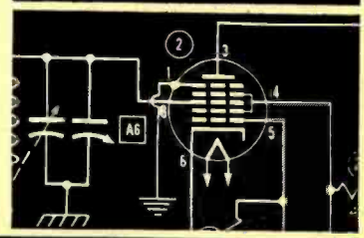

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There's only one *right* way to string a dial cord. And there's only *one* book that shows you how. It's the Howard W. Sams DIAL CORD STRINGING GUIDE. Here, for the first time, in *one* handy pocket-sized book, are all available dial cord diagrams and data covering 1938 through 1946 receivers. Licks the knottiest dial cord problem in a matter of minutes. This low-cost book is a "must" for servicing. You'll want two copies—one for your tool kit and one for your shop bench. Order them today. ONLY.. **75c**

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My (check) (money order) for $.....enclosed

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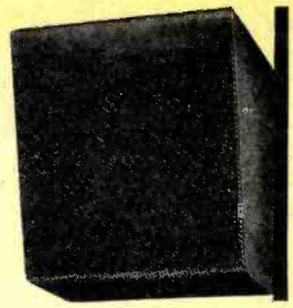
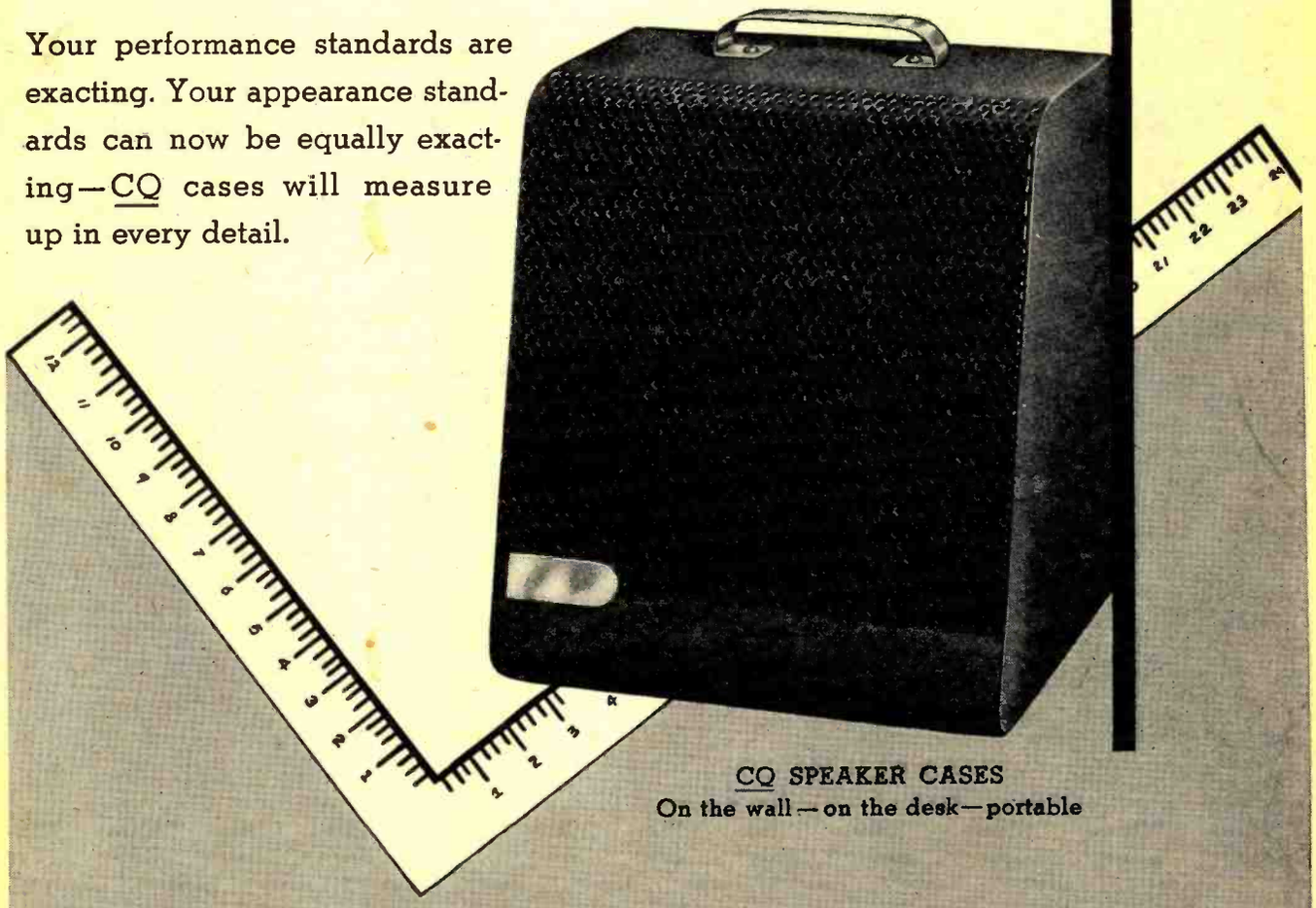


Your performance standards are exacting. Your appearance standards can now be equally exacting—CQ cases will measure up in every detail.



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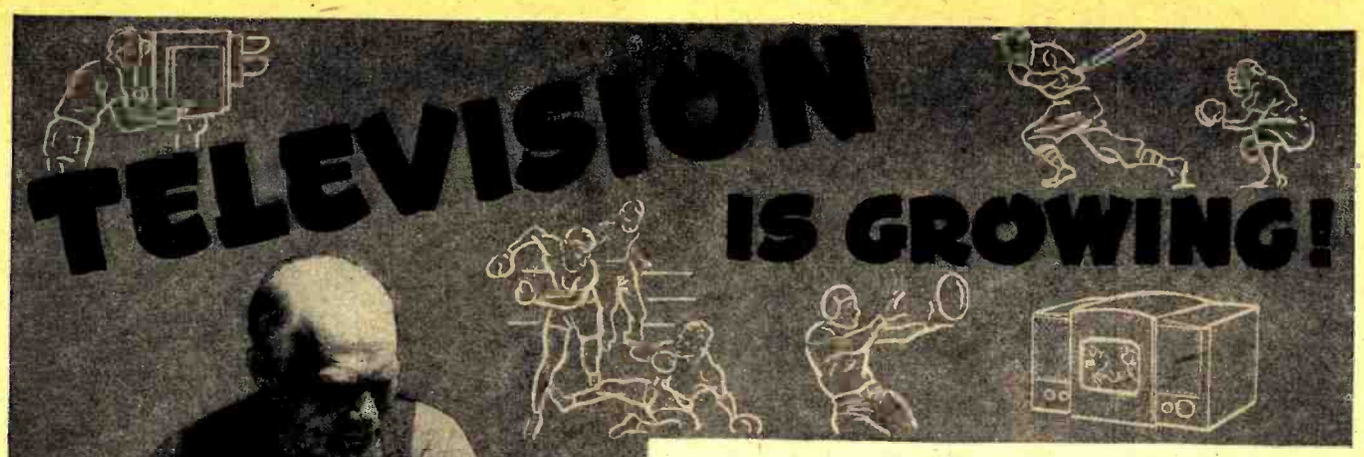
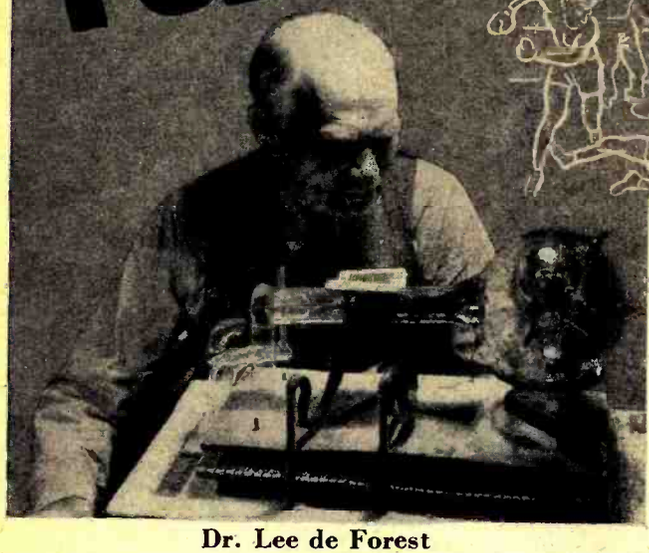




Dr. Lee de Forest

No longer is Television just a laboratory marvel. It is rapidly spreading over the nation. Practically every radio manufacturer has Television models in production. New stations are being licensed. Television is already *big business.*

Are You Ready?

Who will get those new high paying jobs? Who will step into key positions in a rapidly growing industry? Not inexperienced radio men. Not untrained electricians. But men who know Television and can be relied upon to operate and maintain expensive equipment!

American Television—A Great Training Institution!

American Television has pioneered in Television research. Its directors have made fundamental contributions to the industry. Dr. Lee de Forest, our Director of Research and Training, is known throughout the civilized world as the "Father of Radio" through his invention of the radio tube. U. A. Sanabria, President and founder of American Television, Inc. invented the Interlace Scanning System which is now the standard of all Television. Most recently, a revolutionary new circuit which corrects a common television defect known as "ghost images" has been developed by J. M. Sanabria, head of American Television's Manufacturing Division.

Most Elaborate Training Laboratories

Every modern type of equipment obtainable has been installed for instruction purposes in what we believe to be the most extensive and elaborate Television training facilities in the world. You will find complete operating studios with the new sensitive cameras and their associated equipment. A corps of highly qualified instructors will guide your study.

Start Learning TELEVISION at Home—FREE!

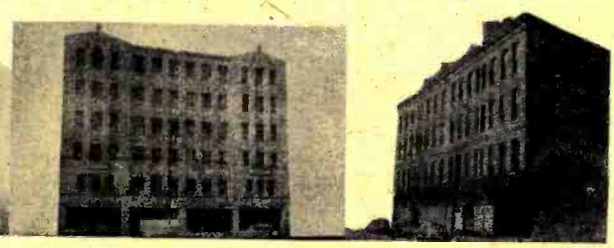
Prepare yourself for the endless opportunities in Television the new "American" way. Now, for the first time, you may discover in advance of entering school, just how your abilities fit into Television. If you qualify under the simple rules, you will be given a complete preliminary home study Television course absolutely free and without obligation.

Your success with the course will not only help you to decide for yourself what phase of Television you like best but will also aid us in qualifying you for residence training.

We prefer that all new resident students take this free course as it provides excellent preparation for residence study. However, there is no obligation on your part to enroll for residence training when you complete the home study course.

We urge you to take advantage of this splendid opportunity at once. Just write your name and address on a penny postcard and say: "I am interested in your free Television Course". Do it today! This offer is necessarily limited.

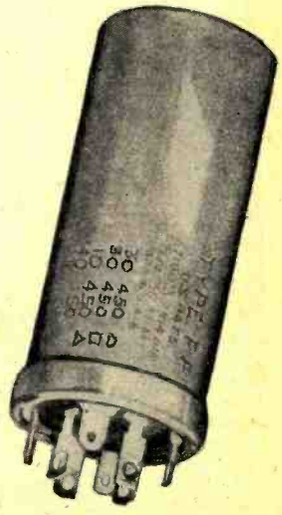
Approved for Veteran Training



American Television, Inc.

5050 BROADWAY • CHICAGO 40, ILLINOIS

What's The Indian Rope Trick Got To Do With MALLORY CAPACITORS?



MALLORY originated and produced the first type "FP" capacitor. These have been famous for performance for so long—have been so consistently preferred for original equipment—it follows they naturally become first choice of radio servicemen. You might imagine there was some special magic in their making.

The popularity of FPs, however, has never depended on tricks of engineering or manufacture. Yesterday, as today, it has been a matter of *quality*. Careful control of materials . . . painstaking manufacturing methods that keep impurities down to a fraction of a part per million . . . rigid standards of testing and inspection . . . explain why Mallory FPs are preferred.

They are the reasons why Mallory FP capacitors *last* . . . why millions are in use all over the world . . . why they can be counted upon for service beyond the normal. They are your assurance that when you install a Mallory FP, the customer can depend on a job well done.

YOU EXPECT MORE AND GET MORE FROM MALLORY

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Within the INDUSTRY

LAWRENCE W. KANAGA, who has been engaged in sales and merchandising for the past 13 years, has been appointed Vice-President of the *RCA Victor Distributing Corporation* and General Manager of the company's Detroit branch. His headquarters will be at 1930 East Jefferson Street in Detroit.

Before joining *RCA Victor,* Mr. Kanaga was, for four years, departmental merchandise manager for *Hale Brothers* in San Francisco. Prior to that time he was associated with *Montgomery Ward & Company,* both in Chicago and Oakland, California.

* * *

OLSON RADIO WAREHOUSE, of Akron, Ohio, has announced the opening of a new branch of the company at 2020 Euclid Avenue, Cleveland, Ohio.

According to Irving J. Olson, President of the firm, this new expansion was necessitated by increased business and the need for larger quarters. The company will still maintain facilities in Akron.

* * *

AIR KING PRODUCTS CO., INC., has appointed *J. M. Cartwright & Sons* of Memphis, Tenn., and Atlanta, Georgia, as sales representatives for the *Air King* line of radios for the states of Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Florida, Georgia, South Carolina, North Carolina, and Virginia.

* * *

GEORGE DYNA, veteran radio and appliance sales executive, has been named Western Zone Manager for *Sparks - Withington Company,* manufacturers of the *Sparton* line of home receivers.

A well-known figure in West Coast radio distribution for the last twenty-five years, Mr. Dyna has been most recently the West Coast distribution manager for the *Bendix Radio Division* of *Bendix Aviation Corporation.* He is a member of the Los Angeles Electric Club.

* * *

H. H. SCOTT, inventor of the Dynamic Noise Suppressor and former President of *Technology Instrument Corp.,* recently announced his resignation as an officer of that company and the formation of a new organization known as *Hermon Hosmer Scott, Inc.,* of which he will be President and Director of Engineering.

Henry Crystie who was associated with Mr. Scott at *General Radio Company* and later at *TIC* will be Vice-president while Ralph G. Glover of Oak Park, Illinois, a consulting engineer, will act as Midwestern engineering representative.

The new company was formed to provide urgently needed increased manufacturing and engineering facilities for broadcast station and amplifier equipment employing the Dynamic Noise Suppressor.

The plant and laboratory of the new firm is located at 358 Putnam Avenue, Cambridge, Massachusetts.

* * *

H. V. SOMERVILLE has been named manager of the East Central Region of *RCA Victor.* He will make his headquarters at 718 Keith Building in Cleveland.

He has been engaged in various engineering, sales, and distribution activities for *RCA Victor* since 1929. Since 1944 he has been field sales manager of the *RCA Engineering Products Department* in the Cleveland region.

Mr. Somerville joined *RCA* as a student engineer assigned to the New England field and later to St. Louis. In 1932 he became field service engineer on all *RCA* products in the Denver area, and later in Omaha.

He is a graduate of the University of Wisconsin with a B.S. in electrical engineering. While a student he operated his own ham radio station, W9AEU. He is a member of the IRE.

* * *

FRED ROSENSTEIN, formerly sales manager of *Krich-Radisco, Inc.,* of Newark, New Jersey, has rejoined the sales staff of the *Terminal Radio Corporation* of New York.

Mr. Rosenstein, who is well-known as a specialist in handling industrial electronic equipment requirements, will devote his efforts to promoting the sale of electronic equipment to industrial users.

* * *

RADIO MANUFACTURERS ASSOCIATION'S Amplifier and Sound Equipment Division has been reorganized and three new section chairmen have been appointed by Division Chairman Fred D. Wilson, Sales Manager of *Operadio Manufacturing Co.*

The new section chairmen are: Com-

WEBSTER ELECTRIC

Telehome

HOME INTERCOMMUNICATION

BY THE MAKERS OF

Teletalk

Telehome

HOME INTERCOMMUNICATION

A COMPLETE PACKAGE MASTER UNIT AND SPEAKER UNIT AT A MODERATE PRICE

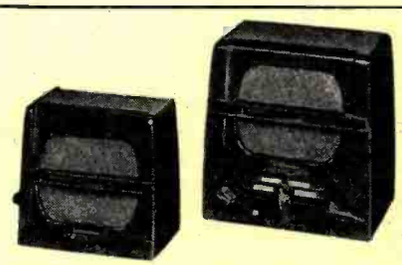
● Intercommunication Systems invade the home with the same high quality units that are available for commercial use.

This opens up the opportunity to sell to retail outlets and the widespread consumer market.

Designed and built specially for home use, it is set up to be sold as a package consisting of a master unit and one speaker unit with connecting wire at a moderate price.

The new "Telehome" is available in a complete line. Additional units are available for those who want them. In addition, a special door speaker incorporates a bell pushbutton. Another unit is provided for kitchen modernization and new homes, and is constructed as a "built-in" for kitchen cabinet or wall.

If you haven't already had the complete story, write to the Webster Electric, Racine, Wisconsin for complete details.



Master Station, Speaker unit and 100 feet of wire... complete in one package.....$49.50

Extra speaker unit.....9.50

Door speaker.....7.75

Prices slightly higher west of the Rockies

Licensed under U. S. Patents of Western Electric Company, Incorporated, and American Telephone and Telegraph Company

WEBSTER ELECTRIC

RACINE WISCONSIN

Established 1909

Export Dept. 13 E. 40th Street, New York (16), N. Y. Cable Address "ARLAB" New York City

"Where Quality Is a Responsibility and Fair Dealing an Obligation"

mercial Sound Equipment Section, A. K. Ward, *RCA Victor Division;* Intercommunication Equipment Section, Arch V. Samuelson, *Operadio Manufacturing Co.;* and Recording Equipment Section, H. A. Crossland, *General Electric Company.*

A Marine Equipment Section will be organized later and committees will be appointed by section chairmen.

* * *

JAMES T. WATSON, former president of *Meissner Mfg. Company* and manager of the *Meissner Division* of *Maguire Industries,* has been named to the board of directors of *Potter & Brumfield Manufacturing Company* of Princeton, Indiana.

Coincidentally, with the announcement of Mr. Watson's election to a directorship of the company, the organization announced plans for an expansion of manufacturing facilities which will approximately double present capacity. The company manufactures a line of standard and special purpose electrical relays.

* * *

P. R. MALLORY & CO., INC., has been awarded first honors for their 1946 annual report in the Electronics and Radio Industry classification by the Financial World Annual Report Survey.

Radio Corporation of America was runner-up in this classification, while the *Stromberg-Carlson Company's* report was adjudged third.

The board of judges was headed by Dr. Lewis Haney, professor of economics of New York University, and included Glenn Griswold, editor and publisher of *Public Relations News,* Sylvia F. Porter, financial editor of the *New York Post,* Elmer Walzer, financial editor of the *United Press,* and Lester Tichy, art critic and industrial designer.

* * *

PAUL WEATHERS has been appointed Vice-President and Chief Engineer of *Airdesign, Incorporated,* transformer manufacturers of Upper Darby, Pa.

He was associated with *RCA* at Camden and Indianapolis for 16 years where he headed many engineering groups in the sound and electronic equipment field.

Under Mr. Weathers' direction *Airdesign* is bringing out a complete line of television transformers.

* * *

GAROD RADIO CORPORATION of Brooklyn, manufacturers of home radio receivers, has been sold to Leonard Ashbach, president of the *Leonard Ashbach Company* of Chicago.

Barney Trott, Secretary-Treasurer and Chief Engineer under the former management, has been retained as Chief Engineer under a long-term contract.

Lou Silver, Sales Manager of *Garod* for the past eight years, was named

(*Continued on page* 154)

NOW

a portable RADIO-CAMERA!

AIR KING'S 2in1 portable Revolutionizes the PORTABLE RADIO FIELD

another AIR KING SCOOP

Right on the heels of the Wire Recorder, AIR KING follows through with another winner . . . . . the AIR KING RADIO-CAMERA *(2 in 1)* portable. Here is an exclusive new AIR KING innovation . . . America's first Radio-Camera . . . completely *new* . . . and different.

The ability of AIR KING to produce the unusual in radios is well known. The country's most successful merchandisers have followed AIR KING'S leadership for the past 27 years.

The Radio-Camera is an important contribution to the radio dealer . . . *today* . . . when he needs it most!

MODEL A410

AIR KING RADIO-CAMERA MODEL A410

SIZE: Height 9½"; Width 4⅞"; Depth 3⅝".
WEIGHT: Less than 4 lbs. complete with batteries.
RADIO: Superheterodyne with latest type miniature tubes.
BATTERIES: 2, flashlight type "A"
1, 67½ Volt "B" Battery

CAMERA

Eveready Camera Case; 50mm. Meniscus Lens, time and instantaneous exposures. Takes black and white or color pictures; #828 Standard Film.
Adjustable strap for shoulder or hand carry.

29.95 RETAIL LESS BATTERIES

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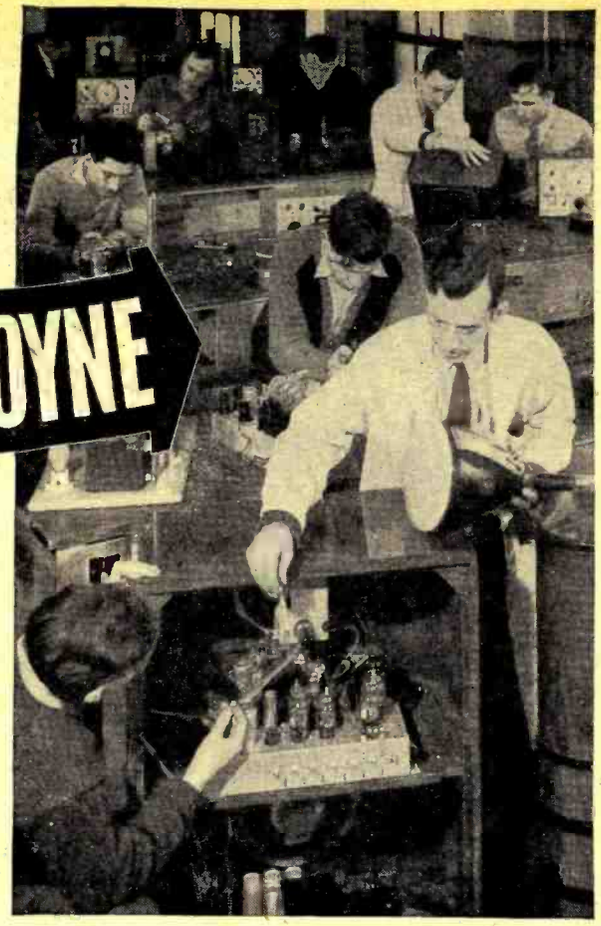
The Royalty of Radio Since 1920 AIR KING RADIO. Division of HYTRON RADIO & ELECTRONICS CORP.

Learn RADIO

IN A FEW SHORT WEEKS



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48 Years of Successful Training

Work on Actual Radio, Sound, Television Equipment! Expert Instructors Train You by Famous COYNE SHOP METHOD

Get ready quickly for YOUR FUTURE. Big opportunities are waiting for properly trained men in Radio Manufacturing, Radio Sales and Service, Television, Sound, Public Address. With COYNE "All Around" Training, many branches of Radio are open to you.

B. W. COOKE

NOT A "HOME-STUDY" COURSE

Learn Radio Fast!

As a **Coyne** student you work on real equipment in our great shops in Chicago — the Radio Center of the World. We do not teach by mail. All **Coyne** training is given right here in our big Shops in Chicago. You make rapid progress at **Coyne** because it's a shop course.

COYNE GRADUATES IN DEMAND

Whether you have had any actual Radio experience or not, we can train you in a few weeks for a better job, steady work and a real future in the Radio field. First we train you for a good Radio job, then help you get it. **Coyne** graduates may use our **Lifetime Employment Service** as often as they wish.

Easy to Start Own Shop

If your ambition is to be your own boss, COYNE makes it easy! We include special training in how to start your own Radio Shop, how to get business, keep records, etc., right along with our course. Then we have Free Merchandising Service for graduates to solve many problems.

We'll Finance Your Training

Non-veterans who are short of cash can finance most of their tuition and pay it in easy monthly payments after graduation. You may earn while learning, to help defray living expenses. COYNE works with you to enable you to get the training you need.

VETERANS!

Coyne is authorized to train those who qualify under the G. I. Bill of Rights.

Physical Disabilities

Men with physical disabilities may qualify for training at no cost for tuition and subsist ence. Coupon brings details.

SEND FOR BIG FREE BOOK!

Our new, fully illustrated **Coyne** Radio Book tells all about our great Chicago shops and our plans to help you. Packed with facts and pictures. No salesman will call. No obligation.

ADDED TRAINING

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This valuable training now included with our Radio course.

B. W. COOKE, President, Radio Division

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Dear Mr. Cooke: Send me your Big Free Radio Book and all the facts . . . also full details of your "Student Finance" plan.

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NEW COMPLETE CONCORD Radio Catalog

The ONLY Complete Up-to-the-minute Catalog of Radio Parts • Sets • Amplifiers Testers • Ham Gear • Electronic Equipment

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Ready now—the greatest, most complete presentation of radio, electronic and television equipment and supplies in Concord history! Packed from cover to cover with thousands of items—160 pages of everything and anything in Radio and Electronics. Special bargain section of hundreds of money-saving values in top quality, standard-make parts, including scores of new items from nationally-famous makers. Immediate shipment from CHICAGO OR ATLANTA. Mail coupon for your FREE copy.

Push Button Tuning Assembly

A real buy! Precision 10-channel selector. Chrome-plated pushbuttons turn shaft to tune a 50 mmf condenser trimmed by 25 mmf trimmer, and throw DP DT switch to connect one of ten 100 mmf air padders. Positive action, easy to set. **$1.95**

X149M—Your Cost

G.I. Record Changer

Simple, gearless, foolproof. Plays 10 12" or 12 10". Reject lever. High-fidelity crystal pickup, needle pressure 1¼ oz. Requires mtg. base 11" x 12", 6¼" above board and 2" below. **$16.95**

C22556M—Your Cost

Tuning Unit TU-10

VFO and buffer tuning, 10-12.5 mc, in aluminum case. Contains 3 Hammarlund double-spaced condensers, 100, 35, and 20 mmf, tuning coils, high-voltage fixed condensers and switches, vernier tuners, etc. A real buy! **$1.95**

5B9542M—Your Cost

TUBES! TUBES! TUBES!

Standard brands at unbelievable prices, fully guaranteed! Order now!

5B611M-1629....29c	5B507M-6SH7GT..29c	5B617M-9003....29c
5B401M-3Q4.....65c	5B506M-6SD7GT..33c	5B402M-GAE5GT/.49c
5B404M-6H6.....37c	5B501M-1L4.....49c	5B405M-6J6.....29c
5B415M-6SC7.....53c	5B513M-2B7.....45c	5B407M-6SR7.....55c
5B408M-6Y6G....59c	5B505M-6B8G....43c	5B400M-1R5.....44c

Speakers

with 3 ohm VC's at real buys:
X150M, 5" Round PM **$1.14**
X151M, 4"x6" Oval, Alnico V PM ... **$1.19**
X152M, 4" Dynamic, 450 ohm field **$1.29**

H.V. Condenser

7500 Volts! .05 mf, oil-filled, sealed case, stand-off insulators. A rare buy for Video, Xmitters, 'scopes, X-ray, etc.

5B3159M..... $1.49

Electrolytic VALUES!

Capacitors for every purpose. **Midget dry electrolytic types ("A", "C")** handle any job requiring an electrolytic capacitor. Polarity clearly indicated. Wire leads. Sizes run from 1¼" by 2" to 1¾" by 3½". Easily replace larger capacitors. **Can types ("B")** are hermetically sealed in spun metal containers with spade terminals and mounting lugs. Sizes run from 1⅛" by 2" to 1¼" by 3". **No off-brands. All nationally known makes.**

Number	Type	Mf.	WV	Each
X154M	A	8	450	24c
X155M	A	8-8	450	39c
X156M	A	10	450	27c
X157M	A	10-10	450	47c
X158M	A	16	450	29c
X159M	A	20	150	22c
X153M	A	20-20	150	49c
X160M	A	40	450	65c
X161M	C	50-30	150	29c
X162M	B	16	500	39c
X163M	B	100	50	15c
X164M	B	100-100 50-20	50	19c

"Western Union"

Buzzes! Flashes! Clicks! Consists of two "Western Union" telegraph signal units. Learn code. Space in each for two flashlight batteries.

C14007M—less batteries **67c**
C20622—Btry, 4 needed **6½c ea.**

Volume Controls

1 meg carbon control, ¼" shaft 1½" lg. **X165M Each... 23c**

½ meg carbon control, with switch, ¼" shaft 2½" lg. **X166M Each... 39c**

Acorn Socket

For 954 or 955 tubes. Low loss ceramic with rugged spring contacts. A **super value! X167M Each..... 9c**

RF and DC Meter Values

0-4 Amp. R.F. Built-in thermocouple. GE type DN-56. 2½" round. **$1.95**

X168M—Each

0-35 V. DC. Red mark at 28.5 V. Simpson type K25. 2½" round. **$1.95**

5B4205M—Each

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Yes, rush FREE COPY of the comprehensive new Concord Radio Catalog.

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68 YEARS OF DEPENDABLE SERVICE TO THE PUBLIC

Acclaimed By Experts

THE NEW NATIONAL HRO-7

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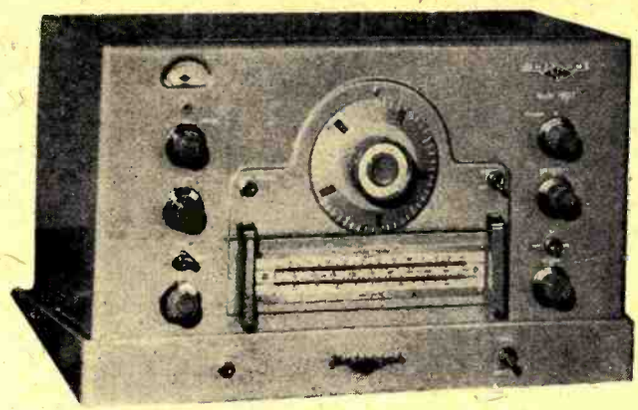

Here are some of the many new features in this outstanding performer. New automatic, adjustable threshold, double action noise limiter. Two new miniature type tubes, a 6C4 high-frequency oscillator and an OA-2 voltage regulator are employed to give a high order of oscillator stability. Eleven tubes plus voltage regulator. Normally supplied with coils for 1.7 MC to 30 MC.

RECEIVER $279.00
SPEAKER 12.00
POWER SUPPLY .. 20.36

THE NEW NATIONAL NC-173

This set has been sweeping the country by storm since its recent introduction to Hams. Newest in radio technic and exceptional in frequency scope, 0.54 to 31 MC and 48 to 56 MC. Speaker $10.00 additional. **$179.50**

THE NATIONAL NC-46

The National NC-46 has 4 bands, electrical band-spread, 10 tubes, push-pull output. Frequency coverage 0.540 to 30.0 MC. AC-DC. Complete with loud speaker. **$107.48**

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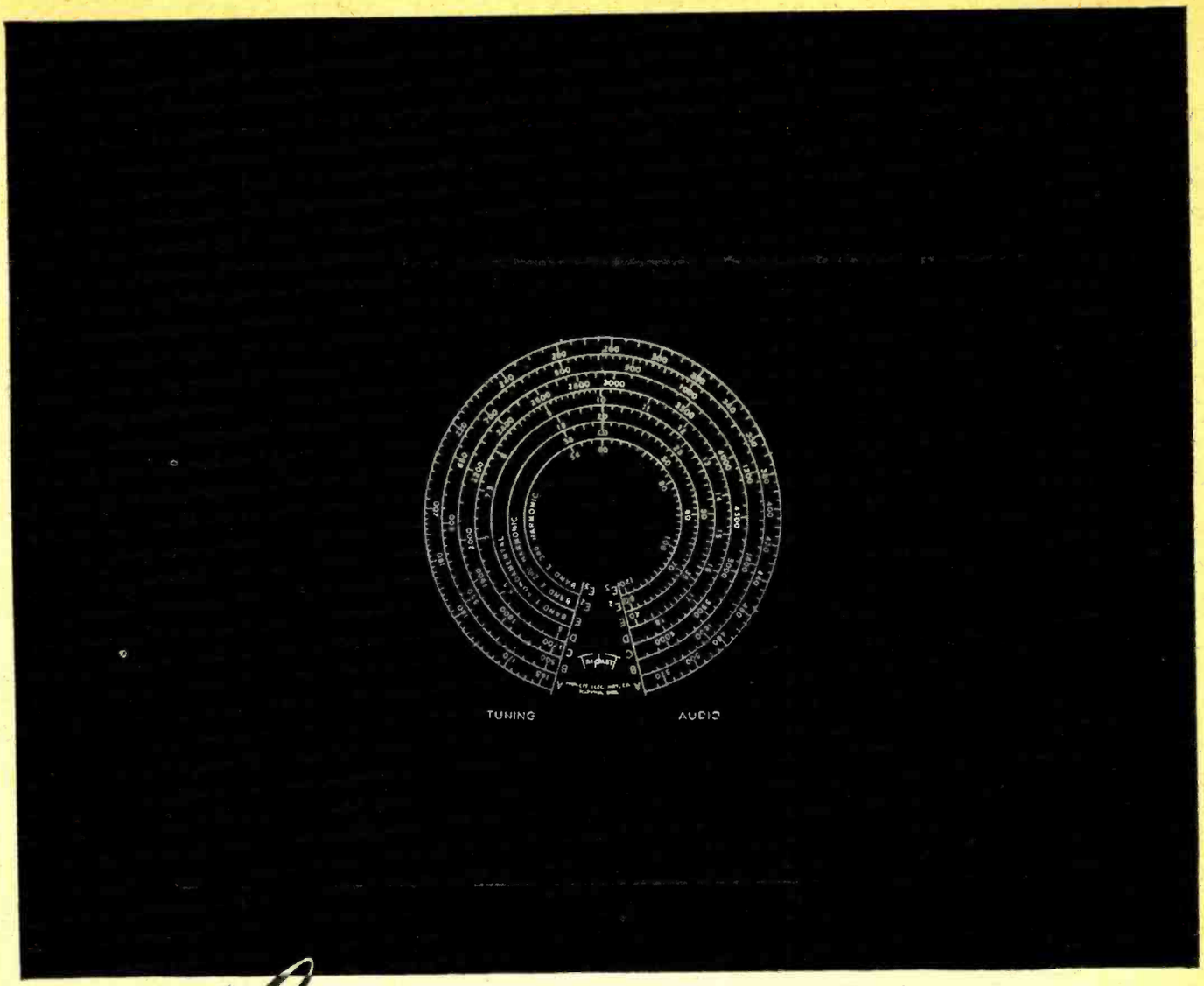

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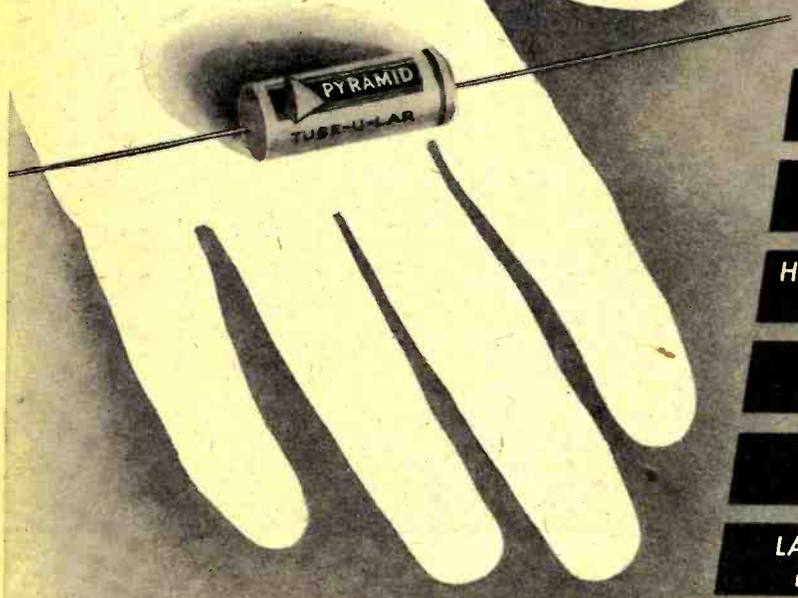

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T6-D2	.002	600	3/8	1 3/16	.25
T6-D5	.005	600	3/8	1 3/16	.25
T6-D6	.006	600	3/8	1 3/16	.25
T6-S1	.01	600	5/16	1 3/16	.30
T6-S2	.02	600	5/16	1 3/16	.30
T6-S5	.05	600	5/16	1 5/8	.40
T6-P1	.1	600	5/8	1 3/4	.45
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T6-P5	.5	600	1	2	.80

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NETWORKS for Television

By
JORDAN McQUAY

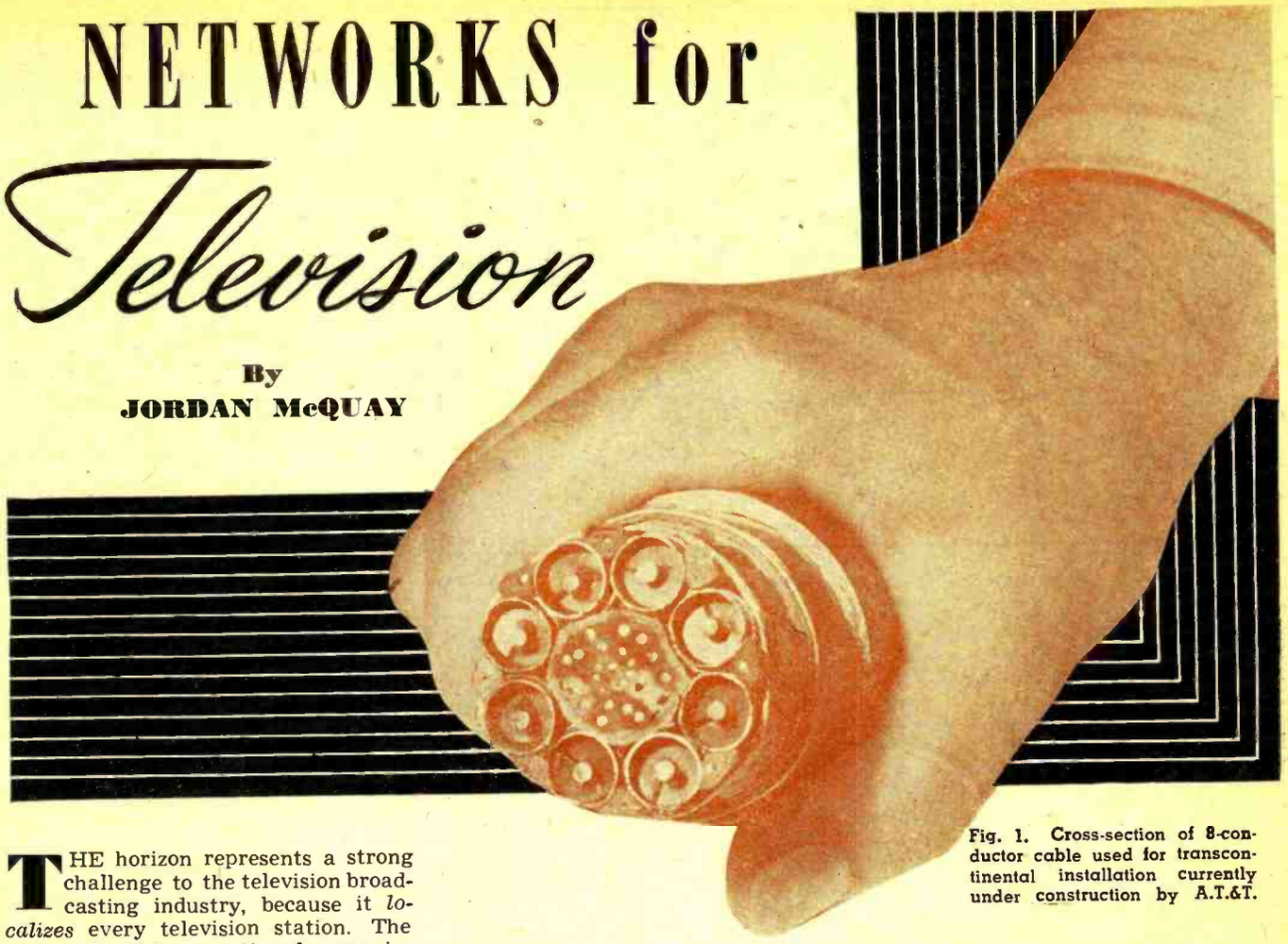


Fig. 1. Cross-section of 8-conductor cable used for transcontinental installation currently under construction by A.T.&T.

The technical status and future of video networks for inter-city programming of multiple stations.

THE horizon represents a strong challenge to the television broadcasting industry, because it *localizes* every television station. The extremely high operating frequencies of a sight-and-sound transmitter are effectively lost when they pass the horizon, thus limiting the area of a station's usefulness and contributing to its remoteness.

To send televised programs to other cities or distant geographical regions or, conversely, to obtain programs originated elsewhere, some sort of inter-city *network* is required to pierce the restricting horizon and link together any number of widely separated *local* television stations.

An even stronger reason for such multiple-station pragramming is the matter of *economics*.

Television broadcasting is a costly enterprise. It requires considerable financial backing, from both the technical and program standpoints. While the purchase of technical equipment is recognized as a tangible investment in material, the high cost of operating and programming a television station is both alarming in magnitude and intangible beyond estimate.

The principal factor in the present retarded growth of television broadcasting is *not* a shortage of equipment, but a general unwillingness of the industry to spend large sums of money for good television programs!

When a *single* production of perhaps an hour requires from 60 to 80 people—actors, actresses, set designers, carpenters, electricians, prop men, grip men, cameramen, sound men, video operators, control monitors, directors, producers, etc.—with rehearsals consuming from 6 to 20 hours or more, some idea of the cost can be estimated. But more particularly, this televised program is available only to a local audience—perhaps only a few thousand sets. So great is the cost of producing large-scale or lavish programs—lengthy plays and musicals, requiring many changes of settings, props, lights, etc.—that few existing television stations can afford to stage and photograph *good* entertainment for such a restricted number of listener-viewers. And *good* entertainment is defined as that on a quality scale comparable to theater motion pictures.

This comparison with the cinema art is important, because television *must* compare favorably with theater motion pictures, if television is to succeed as both an art and an industry.

Television is also in need of a mass audience, so that commercial advertisers will take an interest in the medium.

The only method of lowering the enormous cost of individual programs produced for a local or limited audience is the *syndication* of such programs, as in radio broadcasting, by means of multiple-station distribution *networks*. Also, this is the only method of reaching and developing a mass audience, for commercial purposes. To prevent duplication of local service, such television networks must be inter-city, as well as inter-regional.

Thus, the economic factor of television broadcasting is closely integrated with the *technical* aspects of the new industry.

Confronted with this urgent need of the television industry, practically all of the larger, technical communications corporations, as well as equipment manufacturers, have responded with extensive research and development toward systems of network-linkage for television stations.

There are three principal methods of multiple-station programming for television, and each is a billion-dollar enterprise in itself. The three basic systems to be considered are: 1. Coaxial cable (multi-service type); 2. Radio relay (microwave); 3. Film (prepared for television use).

The first two systems have not been developed entirely for the exclusive use of television, since it is intended for both coaxial cable and microwave radio links to also transmit carrier

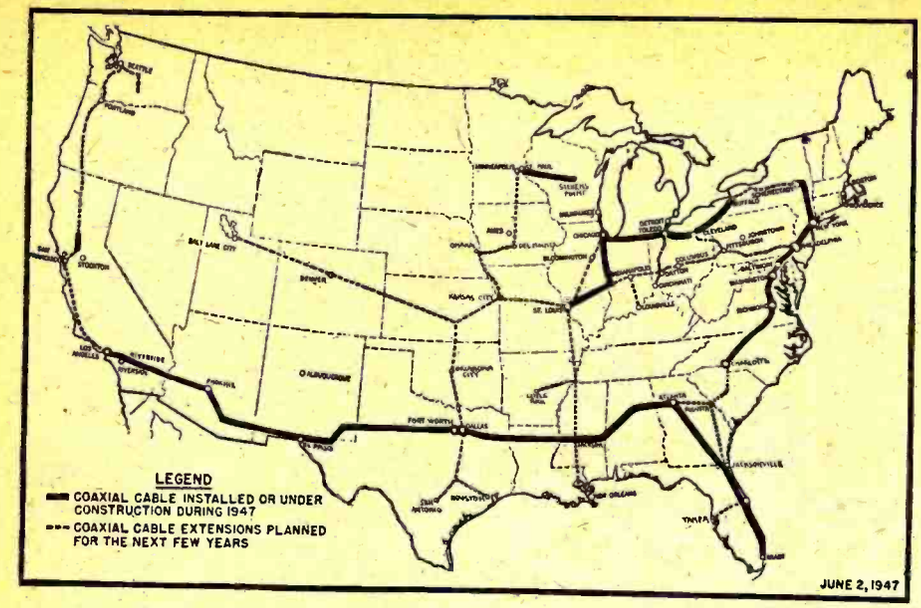


Fig. 2. Map shows existing and proposed routes of coaxial cables.

telephony, telegraphy, telephoto, teleprinter, ticker and high-speed business machine signals, facsimile signals, and other services.

Although not a network in the physical sense, film of the motion-picture type *but prepared exclusively and especially for television* is included in this analysis, because of its inevitable use as an economical substitute (for the first two systems mentioned) during the next decade of television—and, perhaps, the next decade after that!

All of the three systems are as yet in various stages of experimental testing or initial construction. An important time element—of from 6 months to 1 year—permits more careful consideration of each system by the television industry prior to the adoption of one or *more*. And the *cost* of each service is a significant factor in this competition.

Of the three network systems, only one, coaxial cable, is now in use as a limited regional network on the East Coast.

Coaxial Cable

The *idea* of wire or cable transmission of a wide band of frequencies is not new, since a workable system was developed and put in operation by the *Bell System* over ten years ago to provide limited television program service between New York and Philadelphia. The wide-band system of transmission proved feasible, not only for occasional television programs but, more particularly, for handling a large number of carrier telephone channels continuously and simultaneously. An energetic research and development program was then put into effect by the *Bell System*, eventually resulting in the highly efficient coaxial cable system of the present day.

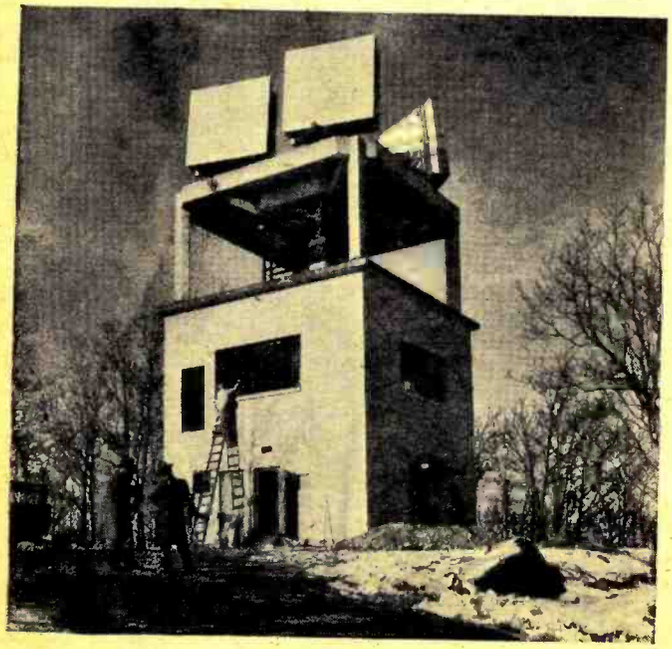
A section of this transmission cable (Fig. 1) actually contains *eight* independent concentric cables—together with 49 paper insulated wires for testing and maintenance purposes. The insulating discs, separating outer and inner conductors of each cable, are constructed of low-loss polyethylene and spaced about one inch apart. A long section of a cable—with repeaters or boosting amplifiers, and other gear—has a bandwidth of approximately 2.8 megacycles, which is adequate for most monochrome video signals. Impedance is about 75 ohms at the higher frequencies of operation.

The complete cable is buried directly underground by enormous, mobile, cable-laying apparatus (Fig. 5), which plows a suitable burying trench, deposits the cable in place (Fig. 7), and then covers the excavation, in a continuous operation.

Originally scheduled for only 6000 miles in 1944, the *Bell System's* present cable construction program now calls for 12,000 route miles of this broad-band facility *to be in service* by the end of 1950. The map (Fig. 2) shows the cable network now in place or now under construction (all solid lines) and extensions to be completed within the next three years (dotted lines). These installations, it should be noted, follow the major telephone traffic routes of the country. *Two* complete coaxial cables have been installed between Washington and New York, which is the heaviest telephone traffic route in the country.

Repeaters for the coaxial cable system are built around a small, high-

Fig. 3. (Left) One of the seven relay stations in the new microwave system connecting Boston and New York, located atop Jackie Jones Mountain near Haverstraw, N. Y. A pair of shielded lens antennas provides two-way transmission with 1-watt beamed waves at 4000 mc. Developed by Bell Laboratories, the radio relay system provides wide-band communications link for television. Fig. 4. (Right) Parabolic reflector antennas in use with two-way experimental radio relay system for television.



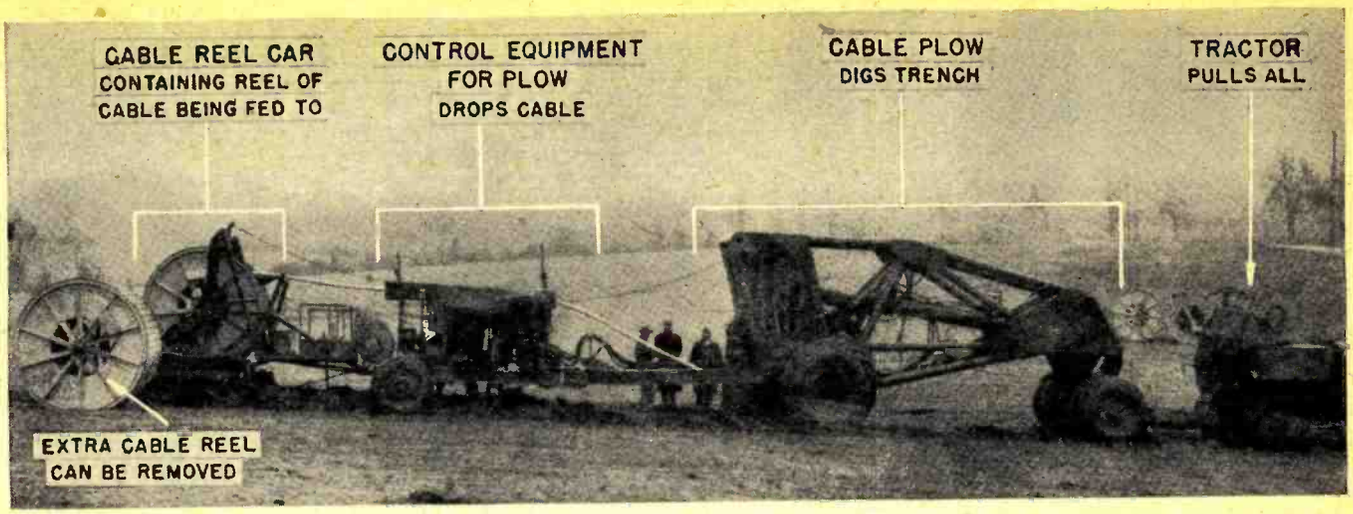


Fig. 5. A giant cable plow used for laying coaxial cable is shown in operation. Line runs from Baltimore to Washington.

gain video amplifier tube, somewhat similar to the type 6AK5. The wide-band amplifier consists of three stages with feedback, giving an over-all gain of 50 db. at the high frequencies of operation. Each amplifier is adjusted to provide just sufficient gain to equal the loss in a fixed equalizer plus the natural loss of the cable. Each stage is equipped with parallel tubes, so that if one tube in any stage fails to function, operation of the amplifier will not be affected. A repeater (amplifier) is inserted in a coaxial line about every 6 or 8 miles.

The 8-conductor cable (Fig. 1) normally provides 480 carrier telephone circuits simultaneously, using r.f. modulation with crystal control. This is the primary purpose for which the coaxial cable was designed and developed; to increase the number of available long distance telephone circuits, and *not*, as many suppose, for carrying television programs.

Two normal channels are combined, by means of suitable terminal equipment, to provide for transmission of high-quality audio programs, as required for *radio* network distribution (for later broadcasting). The cable thus provides audio program channels of greater frequency bandwidth than that needed for ordinary telephone conversations.

Telegraph transmission by coaxial cable requires much narrower frequency bands than those normally used for long distance telephony, and suitable terminal equipment divides a single channel into either 12 or 18 separate telegraph transmission channels.

Use of the coaxial cable for video or television signals, however, requires the entire usable frequency bandwidth, about 2.8 megacycles, of all channels of the cable system. Thus, transmission of a single television program over any given section of coaxial cable prevents the use of that cable section for any other of the multiple services (telephone, telegraph, facsimile, etc.) which it is otherwise capable of carrying.

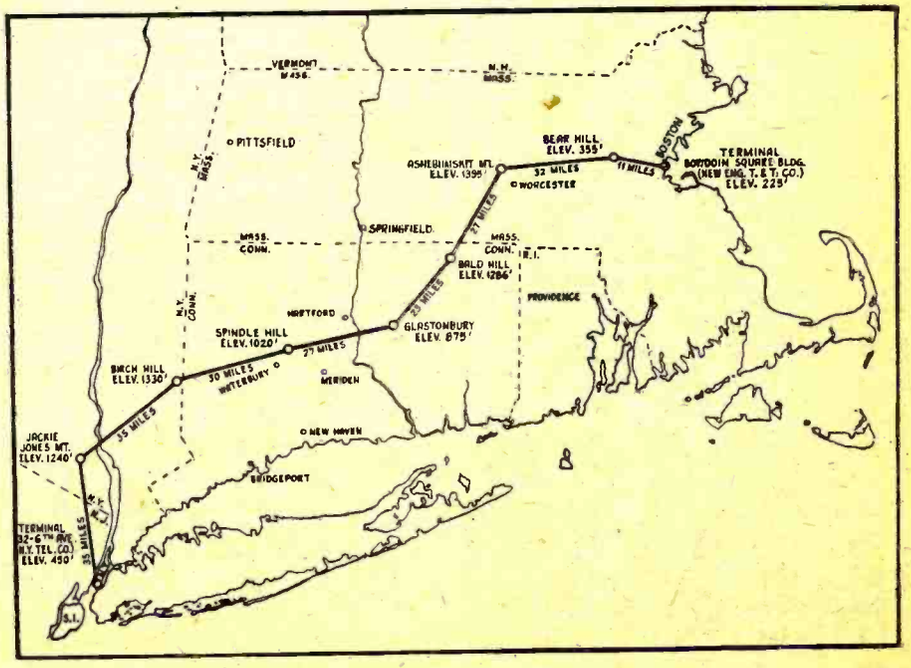
Since development began, experimental television transmission over the inter-city coaxial cables between Washington and New York was furnished free to television broadcasters. Now, however, these facilities are available *only on a commercial basis!* Recent publications of the tariffs created a near-panic in the television industry. The charges averaged better than $40 per circuit mile of cable linking New York, Philadelphia, Baltimore, and Washington. The rate of inter-city movement of television programs now costs almost *ten times* the rate to send audio network programs (for later broadcast) between the same cities. Higher rate for television facilities is justified, however, by the technical difficulties involved in handling video signals and the limited number of cable conductors between cities which must be shared with telephone, telegraph, and other services. But from the operational standpoint, this high cost probably will prevent many television stations from accepting programs originating in other cities. For example: A television station in Washington would pay a *minimum* of $9500 *monthly* for video program service from New York, and vice versa.

While the effective bandwidth of this coaxial cable system is entirely adequate for most television work, it places a pronounced limitation on the degree of picture fidelity. For the transmission of chromatic television, requiring a bandwidth of at least 6 megacycles, the coaxial cable is useless.

Nevertheless, limited facilities for inter-city distribution of television programs are now in existence (Fig. 2) and extensive facilities for national network coverage will be available within a few years—*at a price*. However, considering the economic factor, it's extremely doubtful that the demands of television will ever become so strong financially as to force the

(*Continued on page* 120)

Fig. 6. A. T. & T.'s radio relay system operating between New York and Boston.

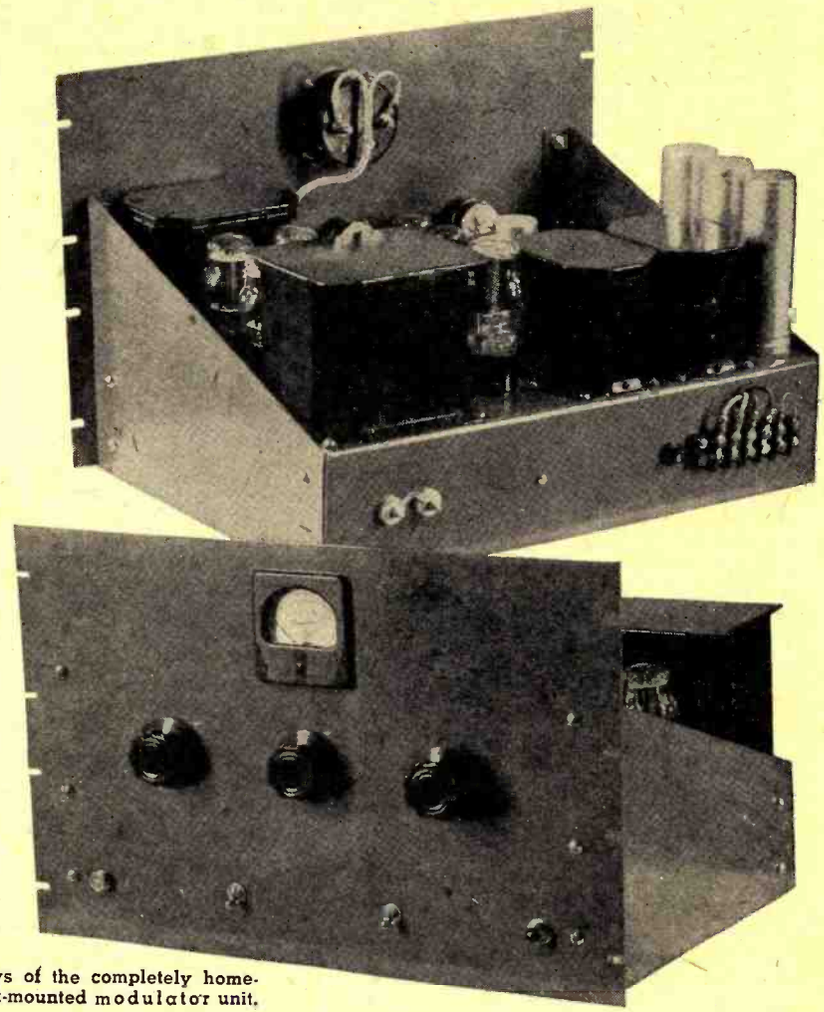


A 50-WATT MODULATOR With Peak Limiting

By

ROBERT LEWIS, W8MQU

Newly perfected limiting circuit holds modulation below 100%, irrespective of input.



Two views of the completely home-built, rack-mounted modulator unit.

SINCE the publication of the article "Compact 75 Watt Transmitter" in the July, 1946 issue of RADIO NEWS, a number of hams and prospective hams have written in, inquiring as to when details on the modulator unit, mentioned at the end of the article, would be available. After many delays, due mainly to the difficulty of obtaining certain parts, especially transformers and sheet metalware, the audio companion to the r.f. unit became a reality.

A glance at the circuit diagram will show at once several unusual features about this amplifier that are not found in other audio units. Several years ago, the writer did some rather extensive home research into the field of peak limiting amplifiers. The first circuits tried out were, of course, the conventional circuits that had appeared in literature for the amateur. One circuit used a single 6L7 as a limiter tube in conjunction with a diode-triode tube operating as an amplifier-rectifier. Another circuit operated on the same principle, except that the automatic biasing voltage was fed back to the suppressor grid of a pentode (6SJ7). Both of these circuits suffered from two disadvantages. First, at unusually high signal level, the limiter tubes had a tendency to "block" due to their sharp cut-off characteristics. Second, so much filtering was necessary in the a.v.c. line to prevent "motorboating" and to smooth out the action, that the time required for the limiting action to take place was excessive. In actual operation, considerable signal of excessive level got through the amplifier before the limiter tube began to reduce the gain.

The solution of the first problem, the elimination of blocking or cut-off, was easily found by using a remote cut-off pentode, in this particular case a 6K7. With this tube functioning in the limiter stage, no cut-off was observed at any signal level. The second problem, that of eliminating time delay in the action was solved by using two tubes in push-pull in the limiter stage, instead of only one, and removing all filtering from the a.v.c. line. Fluctuations in the automatic bias were now applied to the grids of both tubes in equal phase and voltage. The resultant changes in plate currents of the two 6K7's cancel out in the plate circuit, and feedback through the a.v.c. circuit is eliminated. For this reason, it is not necessary to insert *RC* filter networks in the a.v.c. line as is the case when a single tube is used. There now being no impediment in the a.v.c. line, the automatic bias is applied instantly.

The actual operation of the limiting circuit, referring to the diagram, is as follows: Audio signals, taking their normal course through the amplifier reach the 6SR7 grid through C_{14}. The triode section of the 6SR7 amplifies the signal which is then rectified by the diode plates of said tube. The diodes are biased negatively by R_{22} and R_{23}. When the rectified audio voltage exceeds the fixed bias (threshold level), then diode current flows and negative bias is instantly applied to the 6SK7 grids, reducing the gain in this stage, and the over-all gain of the amplifier. The amount of gain reduction depends on the audio level, an increase in audio level above the threshold level causing a gain of the limiter stage, thus holding the output practically constant above the point where limiting begins. To prevent the gain from returning to normal instantly after a peak has actuated the limiter, C_{13} and R_{21} provide a delay circuit resulting in a return time to full gain of about a half sec-

ond, which seems to be about right for voice operation. This delay circuit does not, however, have any effect on the instantaneous application of bias to the 6SK7 grids during limiting action.

This limiting circuit allows the transmitter to be modulated nearly 100 per-cent at all times without fear of overmodulation. It was found during actual measurement that an increase in input, above the threshold level of 10 db., resulted in an increase in output of only 2 db. Therefore, if the transmitter is adjusted for 90 per-cent modulation with limiting action just starting, 100 per-cent modulation will rarely be exceeded.

Aside from the peak limiting feature, the circuit is straightforward, terminating in four 6L6's in "class AB_1," capable of delivering about 50 watts of sine wave audio (probably more in voice wave power). An alternative plan which came to mind was to use but two 6L6's in "class AB_2," but after weighing the relative merits of the two systems, the push-pull-parallel arrangement won out. Two 6L6's in "class AB_2" require driving power, a driver transformer, and a source of fixed bias. In addition, the plate current swing, from zero to maximum signal, is quite high, which would result in poor voltage regulation, were a condenser input filter to be used in this particular instance instead of a choke input. On the other side of the ledger, four 6L6's in "class AB_1" may be resistance coupled to a voltage amplifier, cathode biased, and the plate current, although initially higher, increases little between zero and maximum signal.

The response of the amplifier purposely excludes frequencies in the region below about 400 cycles, as these frequencies do not contribute to intelligibility in voice communication. The plate blocking condenser in the r.f. amplifier causes frequencies above 5000 cycles to be attenuated. If "high fidelity" is desired, it can be obtained by using more expensive audio frequency transformers in the unit and by inserting a 20,000 ohm resistor across the 6SK7 plates. It would be necessary, too, to increase the size of the coupling condensers.

Mechanically, a great deal can be gleaned from a study of the photographs. The foundation for the modulator matches the r.f. unit described previously. Chassis size is 17 inches long, 13 inches wide, and 4 inches high, with a 19 by 12¼ inch steel panel and mounting brackets to fit. In this particular unit the original crackle finish was removed and all layout, drilling, and cutting were done on the bare metal. After all mechanical work was completed, the entire unit was sprayed with gray lacquer. Of course the refinishing job is optional with the individual.

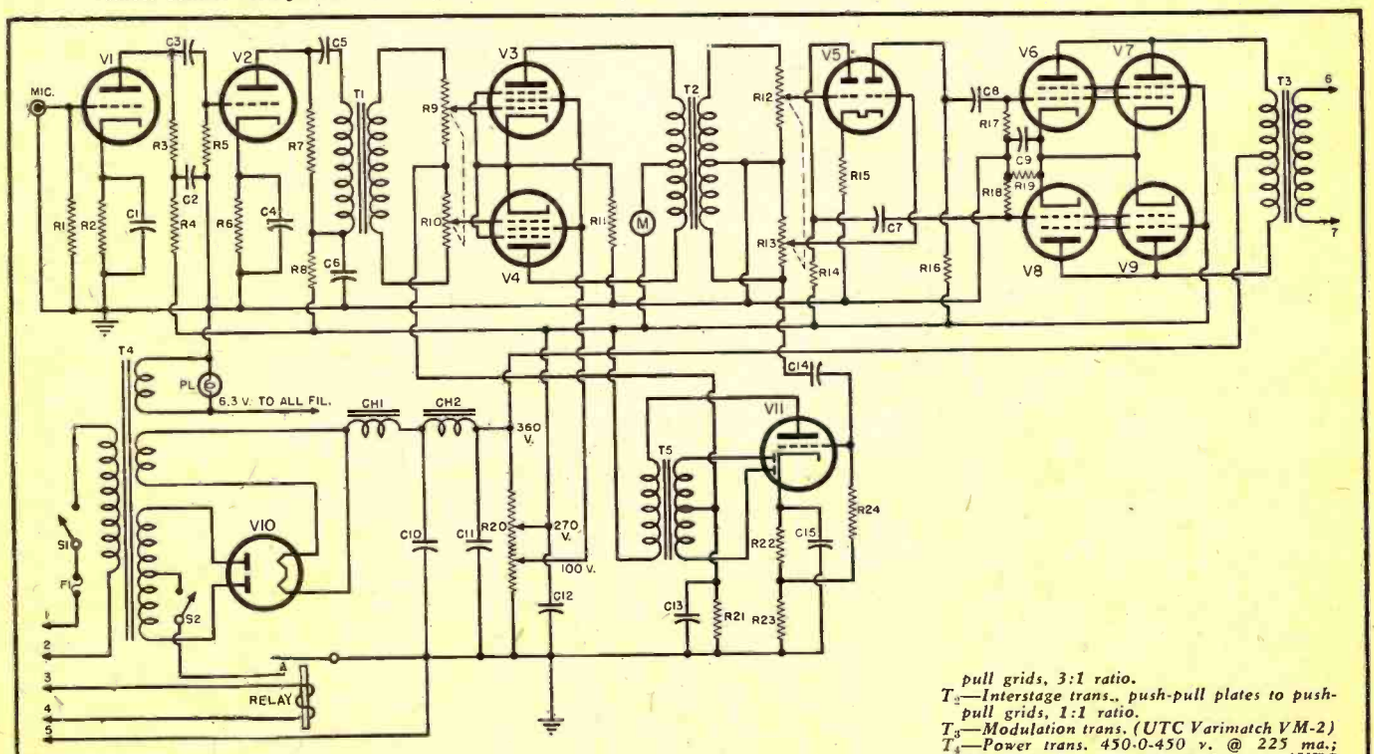
Referring to the photograph of the top chassis view at the rear (left to right in all cases) components are: Power transformer, rectifier, filter chokes, and filter condensers. Across the center of the chassis are the four 6L6's, 6N7, 6SR7. Components at the front of the chassis are the modulation transformer, output control (R_{12}, R_{13}), 6SK7's, input control (R_9, R_{10}), decoupling condensers (C_2 and C_6 in one can), 6C5 and 6SF5.

The meter on the front panel indicates when limiting takes place and the relative amount of limiting. This meter actually measures the total plate current to the 6SK7's. The three large knobs are the input control, output control, and a dummy knob, whose sole function is to balance the front panel layout. At the bottom of the front panel are the microphone connector, power transformer primary switch, plate voltage switch (in center-tap of high voltage winding), and pilot light.

At the rear of the chassis are mounted the terminal strip, fuse holder, and output terminals. A

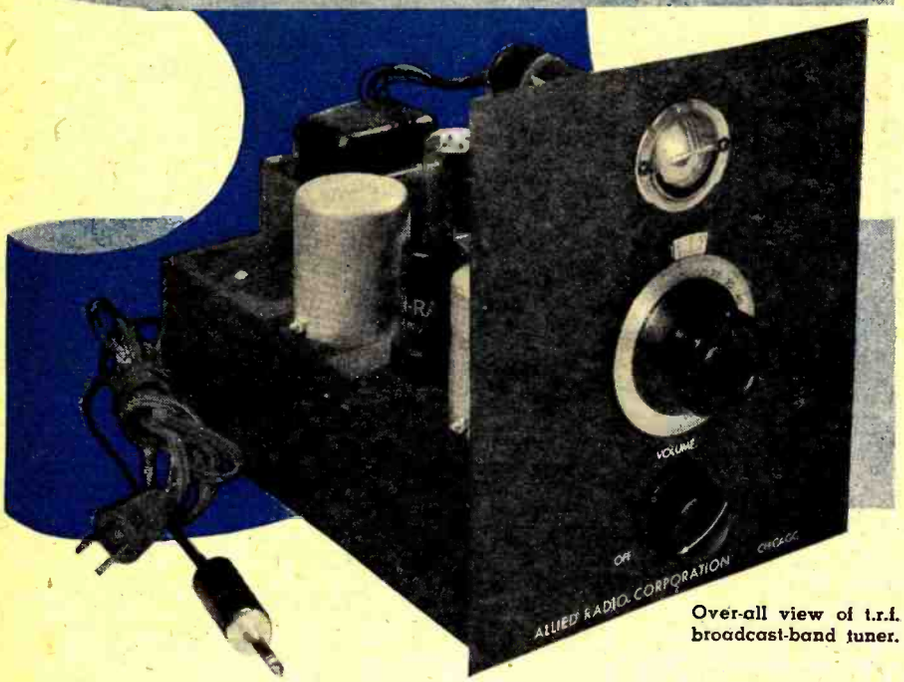
(*Continued on page* 147)

Complete schematic diagram of 50-watt modulator. Terminals No. 1 and 2 connect to 115 volt a.c. line, No. 3 and 4 to remote control voltage (115 volt a.c.), No. 5 to external ground, while terminals No. 6 and 7 are the output of the modulator.



R_1—2.5 megohm, ½ w. res.
R_2—3500 ohm, 1 w. res.
R_3, R_{17}, R_{18}—250,000 ohm, 1 w. res.
R_4—50,000 ohm, 1 w. res.
R_5, R_{24}—500,000 ohm, 1 w. res.
R_6, R_{15}—1500 ohm, 1 w. res.
R_7, R_{14}, R_{16}—100,000 ohm, 1 w. res.
R_8—20,000 ohm, 1 w. res.
R_9, R_{10}, R_{12}, R_{13}—100,000 ohm (per sec.) dual pot.
R_{11}—150 ohm, 1 w. res.
R_{19}—200 ohm, 25 w. wirewound var. res. (Set at 125 ohms)
R_{20}—25,000 ohm, 100 w. wirewound res. with adjustable sliders
R_{21}—1 megohm, 1 w. res.
R_{22}—1000 ohm, 1 w. res.
R_{23}—4000 ohm, 1 w. res.
C_1, C_4—10 µfd., 25 v. elec. cond.
C_2, C_3—8 µfd., 450 v. dual elec. cond.
C_3, C_5, C_7, C_8—.01 µfd., 600 v. cond.
C_9, C_{15}—10 µfd., 150 v. elec. cond.
C_{10}, C_{11}, C_{12}—4 µfd., 600 v. oil-filled cond.
C_{13}—.5 µfd., 600 v. cond.
C_{14}—.05 µfd. 600 v. cond.
T_1, T_5—Interstage trans., single plate to push-pull grids, 3:1 ratio.
T_2—Interstage trans., push-pull plates to push-pull grids, 1:1 ratio.
T_3—Modulation trans. (UTC Varimatch VM-2)
T_4—Power trans. 450-0-450 v. @ 225 ma.; 6.3 v. @ 6 amps.; 5 v. @ 3 amps. (UTC S-40)
CH_1, CH_2—Filter choke, 225 ma.
M—0-25 ma. d.c. meter
S_1, S_2—S.p.s.t. toggle sw.
F_1—3 amp., 115 v. fuse
Relay—S.p.s.t., 115 v. a.c. relay
V_1—6SF5 tube
V_2—6C5 tube
V_3, V_4—6SK7 tube
V_5—6N7 tube
V_6, V_7, V_8, V_9—6L6 tube
V_{10}—5Z3 tube
V_{11}—6SR7 tube

A Hi-Fi Broadcast Band Tuner

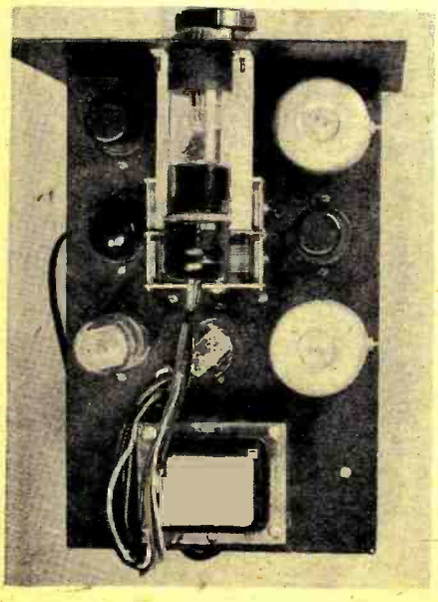


Over-all view of t.r.f. broadcast-band tuner.

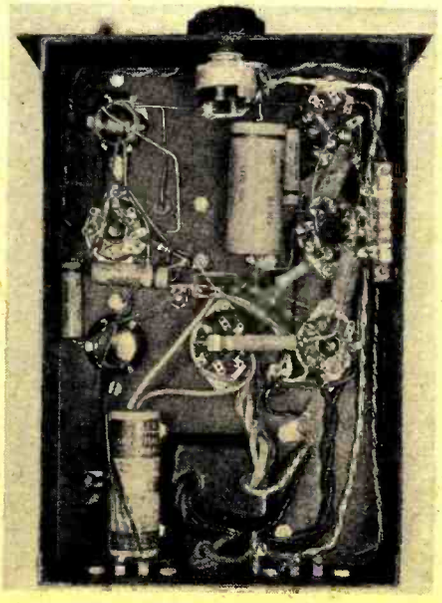
By L. M. DEZETTEL
Allied Radio Corporation, Chicago

This low-cost, easily-built t.r.f tuner provides high quality reception over entire broadcast band.

Top view shows the proper placement of parts. Alignment of this tuner is not difficult.



Under-chassis view of unit showing miscellaneous parts assembly and wiring.



THE ranks of high-fidelity enthusiasts are growing. More and more "radioman music-lovers" are looking for a means of receiving broadcast programs with high quality reproduction but without paying too much for the tuner or construction components. A low priced superhet is usually too selective, its performance generally resulting in sideband clipping. Wide-band superhets involve bandpass filters which are a bit expensive, and not easy to adjust. Here is a tuner circuit that will provide high-fidelity broadcast band reception. All of the parts needed to build it come to about $25.00. It is a t.r.f. circuit—not too sensitive—and not too selective; but otherwise a dandy performer with some good features.

Since t.r.f. circuits are inherently broad-band, only two tuned circuits are used in order to retain these broad-band features. Sensitivity is aided by using a good antenna. It's worth it, and helps cut down on tube noises. Selectivity is good enough to separate stations—that's all that really counts. This circuit will receive local broadcast programs and supply about a 1 volt quality signal for feeding any good amplifier.

There are a few features incorporated in this circuit that are worthy of mention. These features provide better handling, and a better signal. To increase the sensitivity somewhat type 6SG7 tubes are used. as they have about the twice the transconductance of the conventional 6SK7. A 6H6 detector is used for linear demodulation, yet it does not load any tuned circuit. Each diode of the 6H6 is used separately, one for signal detection, the other for a.v c. The action of a.v.c. on only one tube is surprisingly good, because the 6SG7 is a semi-remote cut-off type. The action is good enough to maintain almost constant output while tuning from one station to another. Another reason for using a.v.c. is to provide a negative d.c. voltage for operating the magic-eye tuning indicator. The tuning indicator is a great aid in tuning "on the nose" which is so essential to quality reception.

The dectector feeds a 6J5 cathode-follower. There is no amplification in the 6J5 stage but it has an important advantage. It permits connection to almost any input impedance on a following amplifier, and interconnecting cable length and type has practically no effect on quality or frequency response. A long shielded lead may be run between tuner and amplifier, if desired, without affecting the quality of reproduction.

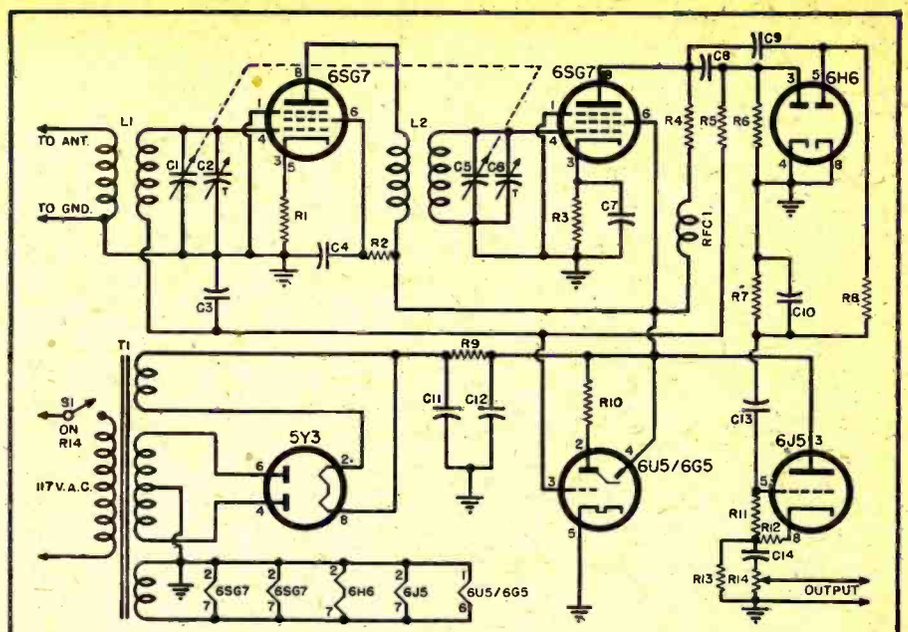
While the tuner is available as a complete packaged kit of parts with the chassis already punched, all the parts are standard, and available at most radio supply houses. Except that the two-gang variable condenser should match the coils to cover the broadcast band, none of the parts values are critical. A planetary drive dial with a 5 to 1 reduction ratio is

used for tuning. Calibrated dials are not made for the coil and condenser combinations available. The coils should have good "Q." The antenna coil should have a high-impedance primary so that antennas of random length may be used.

The pictorial diagram shows the layout of parts on the chassis. Other layouts will work out, too. The only precaution that must be taken is to guard against long grid and plate leads to and from the 6SG7. These leads must also be well separated from each other to prevent the possibility of oscillation. There should be a sequence of logic in the layout following the sequence of individual tube circuits shown in the schematic. Orient the sockets and coils so that the grid terminal on the antenna coil is adjacent to the #4 terminal on the first r.f. tube socket. Mount the tube sockets from the underside of the chassis. Use grommets in all chassis holes that pass wire leads to prevent insulation fraying with its possible consequence of developing hard-to-trace noises later. Use plenty of wiring tie-points, and avoid "up-in-the-air" connections. Fixed resistors and condensers are supported by their own pigtail leads wired in.

Wiring presents no problem except that the precautions mentioned above should be observed. That is, leads carrying r.f. (grid and plate leads on 6SG7 tubes) should be short, and dressed down close to the chassis. Obviously, all of the other rules of good wiring should be observed. Twist the filament leads, use rosin core solder only, and hook leads into terminals securely before soldering. Use solder sparingly, only enough to make a good bond. Pigtail leads on resistors and condensers should be no longer than necessary to reach from one of the connections to the other. Don't run the a.c. line cord all over the chassis, or it may induce some hum. Keep long runs of a.c. well into the corners. For builders whose knowledge of schematic symbols is not too good, the tuner can be wired entirely from the pictorial diagram. Even if you can read a schematic don't be too proud to use the pictorial diagram. You can work much faster with it.

One of the nicest things about a t.r.f. circuit is the simplicity of alignment. Tune in a station at the high frequency end of the band and adjust either condenser trimmer until you get maximum signal. Then detune the trimmer until the volume drops about 25%. It will be slightly misaligned or "double peaked." In a t.r.f. circuit you won't actually get a double peak—but a broad-nosed peak which is exactly what you want for high-fidelity reception. The response curve obtained was the result of this type of adjustment. You can broaden the nose of the curve even more than shown here, but at some sacrifice in sensitivity and selectivity. The choice will depend upon your location and your own preference. Experiment around a little with the trimmers until you get the best results. In a t.r.f. you can never misalign the set so badly that you can't repeak it easily.



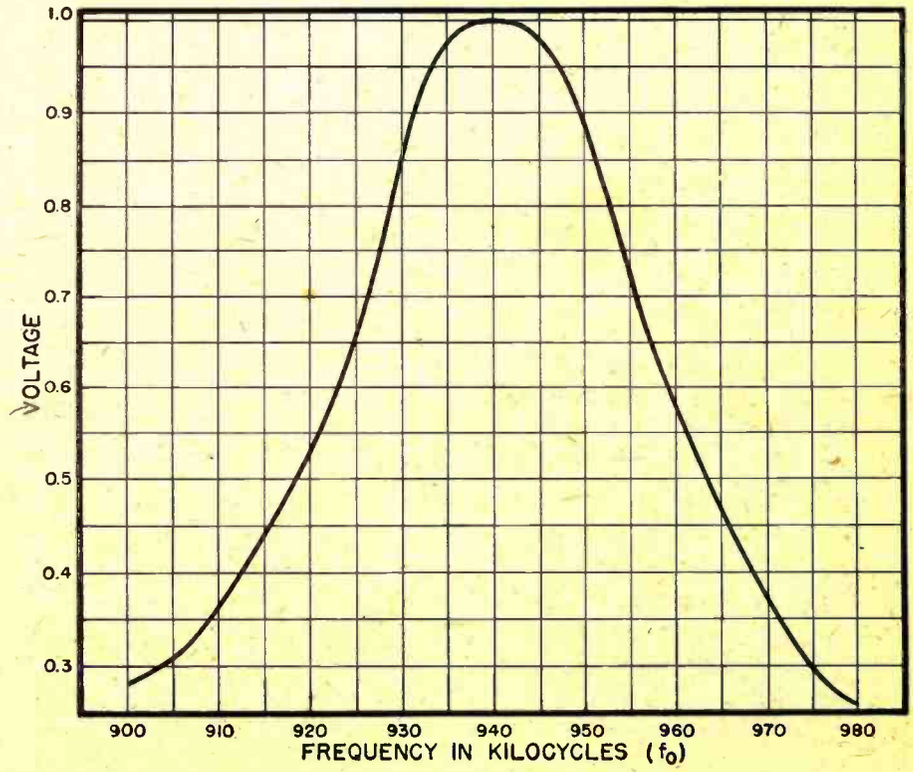
R_1—220 ohm, ½ w. res.
R_2—56,000 ohm, ½ w. res.
R_3—2200 ohm, ½ w. res.
R_4—15,000 ohm, ½ w. res.
R_5—2 megohm, ½ w. res.
R_6, R_{10}, R_{11}—1 megohm, ½ w. res.
R_7—390,000 ohm, ½ w. res.
R_8—150,000 ohm, ½ w. res.
R_9—3900 ohm, 2 w. res.
R_{12}—1000 ohm, ½ w. res.
R_{13}—47,000 ohm, 1 w. res.
R_{14}—100,000 ohm pot.
C_1, C_5—498 μμfd., 2-gang tuning cond. (Knight 61-061)
C_2, C_6—2-17 μμfd. trimmer cond.
C_3, C_4, C_7, C_{13}—.05 μfd., 400 v. cond.
C_8, C_9—400 μμfd. mica cond.
C_{10}—100 μμfd. mica cond.
C_{11}, C_{12}—16/8 μfd., 450/450 v. elec. cond.
C_{14}—1 μfd., 200 v. cond.
S_1—S.p.s.t. sw. (on R_{14})
L_1—Shielded ant. coil (Knight 60-555)
L_2—Shielded r.f. coil (Knight 60-556)
RFC_1—2.5 mh. r.f. choke
T_1—Power trans. 210-0-210 v. @ 40 ma., 5 v. @ 2 amps., 6.3 v. @ 2 amps.
1—2¾" planetary drive dial (Croname 298)
1—5Y3 tube
2—6SG7 tubes
1—6H6 tube
1—6U5/6G5 tube
1—6J5 tube

Complete schematic diagram of t.r.f. tuner. All parts are readily available.

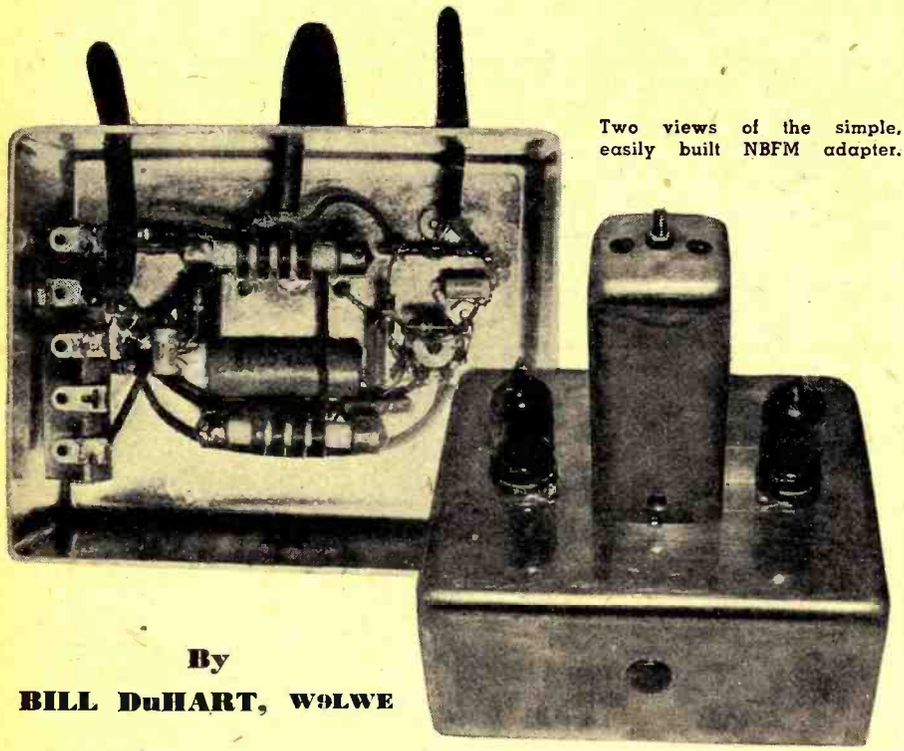
As mentioned before, an outside antenna is required. A doublet type is best for better signal-to-noise ratio. One of the old-fashioned inverted "L"

(*Continued on page* 110)

Response curve obtained—tuner is misaligned to obtain wide-band performance.



A NARROW-BAND FM ADAPTER



Two views of the simple, easily built NBFM adapter.

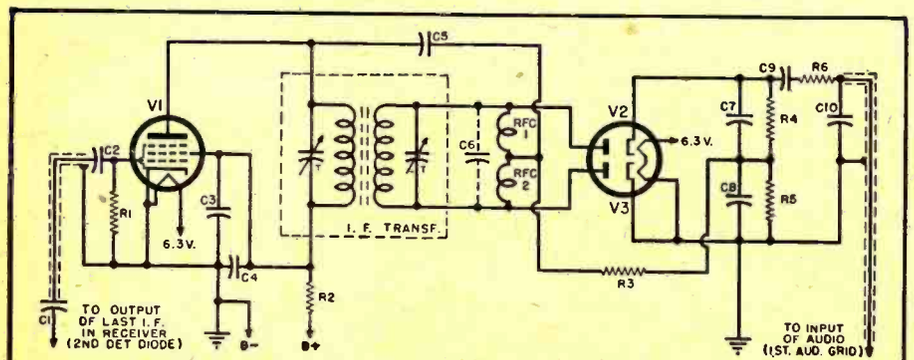
By
BILL DuHART, W9LWE

Any standard type communications receiver can be used with this adapter for reception of NBFM signals.

A SIMPLE, inexpensive, easy-to-construct FM adapter which, when used in conjunction with any type of communications receiver, will enable the proper detection of narrow-band FM signals and the realization of the greatest advantage of FM noiseless reception, should be of interest to the amateur.

This adapter consists merely of a limiter and discriminator—the important feature being the use of any common type of i.f. transformer without a center tap.

Schematic diagram—a limiter and discriminator are all that are required.



R_1—10,000 ohm, ½ w. res.
R_2—(See text)
R_3—50,000 ohm, ½ w. res.
R_4, R_5, R_6—100,000 ohm, ½ w. res.
C_1, C_2—50 μμfd., 300 v. mica cond.
C_3, C_{10}—.001 μfd., 300 v. mica cond.
C_4—.1 μfd., 400 v. cond.
C_5, C_7, C_8—100 μμfd., 300 v. mica cond.
C_6—(See text)
C_9—.05 μfd., 400 v. cond.
RFC_1, RFC_2—1 to 2.5 mh. r.f. choke
I.F. Transf.—Any i.f. interstage, input or output trans. of proper frequency
V_1—Any r.f. pentode V_2—Any dual-diode

The majority of discriminator circuits require a special type of center-tapped transformer or one with dual secondaries. Such transformers are usually slightly more expensive and are not always readily obtainable in all the frequencies employed for the i.f. of the various types of communications receivers, especially those of the surplus type. The operation of a discriminator necessitates a center-tapped secondary, so the center tap will be incorporated, but not in the transformer.

By referring to the circuit diagram, it may be seen that there are two r.f. chokes connected in series across the secondary of a common i.f. transformer and the necessary electrical center tap is at their junction. Although it may be true that transformers especially designed for use in a discriminator circuit have optimum "Q" and coefficient of coupling, this circuit will give satisfactory discriminator operation for the amateur narrow-band FM.

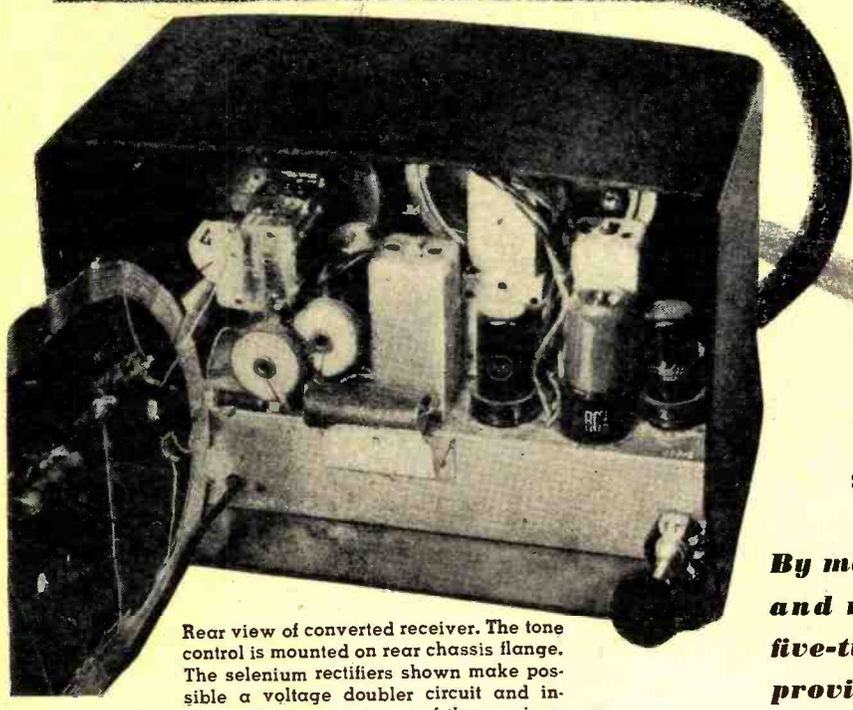
The balance of the discriminator and limiter circuits are conventional. A minimum of components have been used to maintain simplicity and yet not detract from the satisfactory operation of the unit. The placement of parts is not critical nor should any great care be taken in any part of the construction. All that is necessary is that the i.f. transformer be of the same frequency as the i.f. employed in the receiver with which this adapter is to be used.

Although the original design of this unit, the one shown in the photographs, employed a type 9001 tube as the limiter and a 6AL5 as a discriminator, it is not necessary that these particular types be used. For the limiter, any r.f. pentode, such as the 6SJ7, 6AC7, 6SH7, etc., will perform just as well without any modification of the circuit. A type 6H6 is quite commonly used as a discriminator, or for greater simplicity, a pair of crystal diodes such as the 1N35, 1N34, 1N21, 1N23, etc., will work out very nicely and afford the added advantage of avoiding the cathode hum often present when tubes are used.

Following through the rest of the circuit, it will be noted that the coupling condenser, C_1, is at the external end of the shielded input cable. It was found that this method minimized capacity loading, by the shielded cable, of the last i.f. circuit in the receiver to which this adapter is connected. C_2 and R_1 form a conventional RC coupling to the grid of the limiter tube. C_4 is used to prevent any audio voltage from appearing across R_2, while C_3 is an r.f. bypass for the screen. R_2 should be of such a value as to drop the source voltage to from 10 to 25 volts—all that is necessary for the plate and screen of the limiter tube. This voltage should be kept at the lowest value that will give normal audio output from the receiver in order to provide the best limiter action. R_2 can be determined

(*Continued on page* 126)

High-Quality from Standard 5-TUBE RECEIVER



Rear view of converted receiver. The tone control is mounted on rear chassis flange. The selenium rectifiers shown make possible a voltage doubler circuit and increase the power output of the receiver.

By

GEORGE EANNARINO

Sales Eng., Federal Telephone & Radio Corp.

By making minor changes in the audio and rectifier circuits—a standard five-tube, a.c.-d.c. home receiver will provide near-console performance.

HIGH quality performance normally associated with expensive console models, can be obtained from standard 5-tube radios at very low cost. By changing the circuit design of the audio and rectifier circuits, console quality performance can be achieved. Installation of selenium rectifiers in the voltage doubler circuit will increase the maximum power output of the receiver to 5 watts and allow the use of feedback to achieve a high degree of fidelity.

The circuit elements shown in Fig. 1 were added to a standard radio receiver whose maximum power output was 1½ watts and distortion 10% at .6 watt. The maximum power output was increased to 4.5 watts and the distortion at 3 watts was only 8%. Fidelity could be adjusted to meet individual tastes and the hum was reduced to an inaudible level.

The outstanding feature of this circuit, however, is the fact that the additional components, with the exception of the external speaker, can be inserted on the existing chassis.

(*Continued on page* 140)

R_1—47,000 ohm, ½ w. res.
R_2—*In a.c.-d.c. set*
R_3—*1 megohm pot. (tapped at ¼ megohm)*
R_4—*3300 ohm, ½ w. res.*
R_5—*10 megohm, ½ w. res.*
R_6—*47 ohm, ½ w. res.*
R_7—*470 ohm, ½ w. res.*
R_8—*1 megohm pot.*
R_9—*1 megohm, ½ w. res.*
R_{10}—*2.2 megohm, ½ w. res.*
R_{11}—*500,000 ohm, ½ w. res.*
R_{12}—*150 ohm, 1 w. res.*
R_{13}—*250,000 ohm, ½ w. res.*
R_{14}—*4000 ohm, 3 w. res.*
R_{15}—*3 ohm, 3 w. res.*
R_{16}, R_{18}—*Keystone or Globar negative coefficient res. 1400 ohms cold, 200 ohms hot, 5 w.*
R_{17}—*47 ohm, 1 w. res.*
C_1, C_2—*Trimmers (in i.f. can)*
C_3, C_4, C_6—*100 μμfd. mica cond.*
C_5—*50 μμfd. mica cond.*
C_7—*.006 μfd., 400 v. cond.*
C_8—*200 μμfd. mica cond.*
C_9—*In a.c.-d.c. set*
C_{10}—*500 μμfd. mica cond.*
C_{11}—*.001 μfd., 400 v. con.*
C_{12}—*20 μfd., 25 v. elec. cond.*
C_{13}—*40 μfd., 250 v. elec. cond.*
C_{14}—*.02 μfd., 400 v. cond.*
C_{15}—*.25 μfd., 400 v. cond.*
C_{16}—*40 μfd., 300 v. elec. cond.*
C_{17}—*80 μfd., 300 v. elec. cond.*
C_{18}—*40 μfd., 250 v. elec. cond.*
T_1—*Output trans. (in a.c.-d.c. set)*
Ext. Spkr.—8, 10 or 12", 3 ohm, speaker
S_1—*In a.c.-d.c. set*
PL_1—*#47 pilot light*
Rect.—Selenium rectifier (Federal #403D2625)

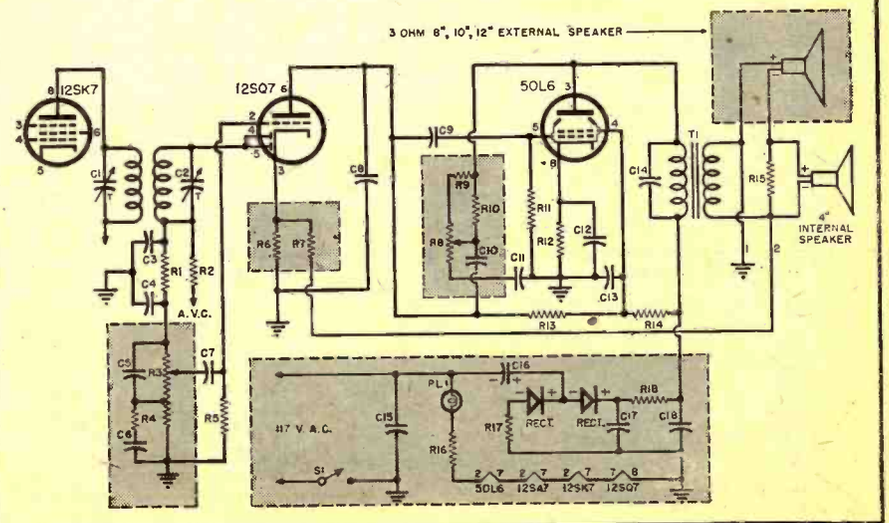


Fig. 1. Schematic diagram shows changes (shaded areas) made in a conventional a.c.-d.c. receiver. The revised power supply and volume control circuits provide added features. An external speaker, tone control, and inverse feedback have been added to improve tonal quality.

The RECORDING and REPRODUCTION of SOUND

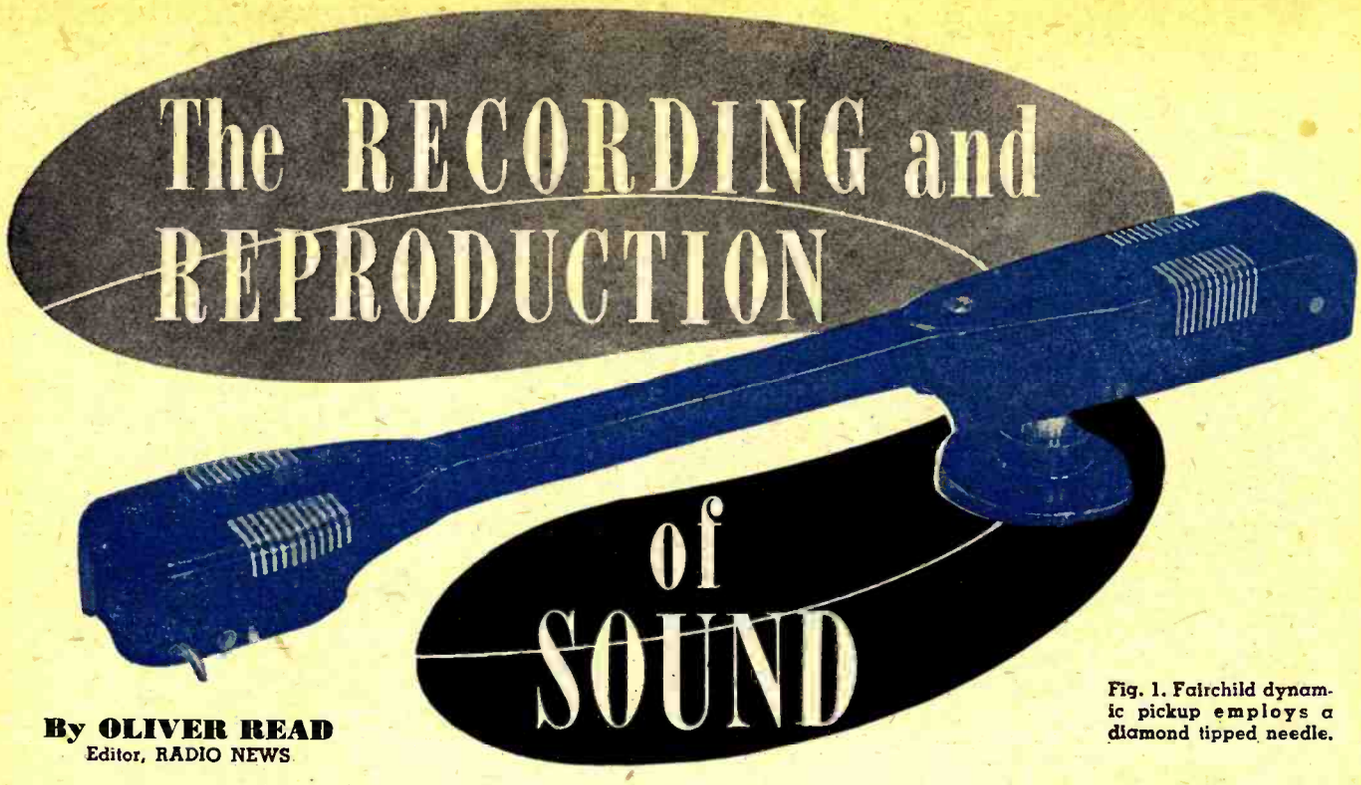


Fig. 1. Fairchild dynamic pickup employs a diamond tipped needle.

By **OLIVER READ**
Editor, RADIO NEWS

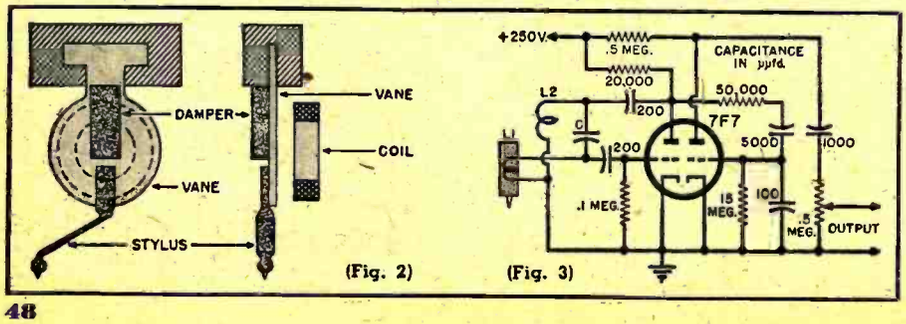
Part 9. Magnetic reproducers—miscellaneous phono pickups comprise many types and varieties. These include magnetic, dynamic, moving vane, ribbon, etc.

THE very earliest types of *magnetic* pickups employed a heavy weight which exerted considerable pressure on the record during reproduction. These often used as much as six or seven ounces of pressure for the needle to track properly and to keep the needle in constant contact with the groove.

As far as the springiness of the needle system is concerned, we must consider the weight of the needle and all of the other moving parts which combine to produce the "needle impedance." If we are to get maximum response, lowest record wear, and good, clean tone quality, these factors must be carefully considered by the manufacturer. Therefore, it is necessary that low needle impedance be maintained. The needle impedance in the modern pickup is kept to a very low value, hence, it is possible to acquire almost ideal reproduction.

Probably the best analogy for magnetic pickup is the generator as used in our large electrical power plants. Here we find that a wire is moved in the vicinity of a magnet. This creates a current of electricity in the wire or, conversely, the magnet may be moved and the wire fixed in a stationary position. The earliest magnetic pickups were also known as "moving iron." These had a stationary coil of wire, a magnet, and an armature which was attached to the needle. The armature moved with the needle inasmuch as it held it stationary in place. This, in effect, shifted the magnet with respect to the coil and created electrical impulses in the coil. This variable current was then amplified in the form of sound.

Fig. 2. Moving vane structure of Zenith "Cobra" pickup. Fig. 3. Movement of pickup stylus amplitude-modulates an oscillating detector amplifier. Audio signal is obtained at output.



(Fig. 2) (Fig. 3)

The modern broadcast station, especially those employing FM, use very expensive and precision made *moving coil* type pickups or variations of magnetic units. These units use a very small needle pressure and record life is greatly increased due to the low pressure of the needle as it rides in the groove. It should be pointed out, however, that there is a minimum weight requirement for any pickup. First of all, too little pressure will cause the needle to "ride up" on one wall of the groove and distortion will take place. Secondly, on a fast whirling disc, the tendency for the needle to "ride out" on the disc will cause the pickup to actually slide across the record without engaging the bottom, or even the wall, of the groove.

One of the most important characteristics that affects record wear and tone quality is the resistance of the needle system to side motion. This is known as "needle impedance." In any pickup it is not possible for the needle itself, or the armature which connects thereto, to move freely in space. Any driving system has a certain amount of spring to it. In addition to this springing action of the needle system, we must consider the weight of the needle itself which strongly resists vibration in the groove.

The inertia presented to a phonograph needle as it is pushed from side to side in the groove at rates to 8000 c.p.s. or even higher, suddenly becomes a very large force working against the record groove.

In the moving coil type of pickup, the magnet is stationary and a tiny coil is attached to the needle in such a manner that it vibrates in cadence with it. This principle is used in many of the finest pickups available today.

They are widely used in broadcast stations as previously mentioned. However, due to their high cost and precise manufacturing methods, they are too expensive to be employed in the average home phonograph.

The FM Pickup (Frequency Modulation)

In previous chapters we described and showed accompanying diagrams for the earliest type of FM or "condenser type" pickup. Actually, modern systems employ very small FM transmitters in the system. The condenser plates, of which there are two, in the pickup are mounted in very close proximity to one another. One of these plates is attached directly to the needle. The two condenser plates are electrically connected to the circuit of the miniature FM transmitter. The needle vibrating in the groove also causes one of the plates to move in direct relationship to the lateral swing of the needle. By varying the oscillator or transmitter capacitance, electrical impulses corresponding to the motions of the needle are transmitted through the system.

The Strain Gauge Pickup

The strain gauge pickup was designed originally for commercial applications. It is still widely used in industry to measure the bending of steel girders, etc. In this pickup a small piece of special wire is stretched between two points on the surface of an object. A current of electricity is passed through the wire and registers the small changes in the amount of stretching of the wire.

In the strain gauge pickup, for phono reproduction, the wire is stretched across and in front of the pickup head and the needle is connected to the middle of it by a lever system. As the needle moves, the wire is stretched alternately one way and then the other. This takes place in perfect cadence with the needle motion. The resulting electrical current, which is variable, is then passed on to the amplifier.

The Zenith Radionic Pickup

Similar to the FM or condenser type of pickup is the "Cobra" pickup (Fig. 2) designed by *Zenith* engineers. This, however, operates on AM principles. A round flat vane is attached to the top of the needle and a small coil of wire placed next to the vane. This coil is connected electrically to an oscillator (Fig. 3). As the vane vibrates in cadence with the needle, it produces a change in the action of the coil. As a result, the oscillator produces a corresponding electrical change. These impulses or changes are then passed on to the amplifying system. This type of pickup is illustrated in Fig. 4.

In the *Zenith* pickup we find that the mechanical impedance is extremely low. In fact, not more than about fourteen grams weight is necessary for proper tracking on the record which makes long record life possible as there is little wear to the groove.

The high resistance vane of the pickup stylus moves in direct relation to the inductance of the resonant circuit of the r.f. oscillator. By varying the mutual inductance between the coil and the vane, the resistance reflected into the coil changes. By so doing, amplitude modulation is produced in the oscillator by varying the loss of the resonant circuit. It is necessary then to detect the variable r.f. currents and to pass them on to the amplifier.

Tests show that a vertical weight of approximately ten grams is required to keep the needle in the groove. The mechanical impedance together with the vertical compliance reduce the noise that is radiated from the pickup and record to the extent that it is hardly noticeable to the average human ear. This applies even when the pickup arm and assembly is uncovered.

This type of reproducer can also be made to operate as a push-pull pickup. To do this, two identical coils are arranged at either side of the high resistance vane and both are tuned to the same frequency. The two circuits are then coupled either by their stray field or by external means.

The Tuned-Ribbon Pickup

A recent contribution to high quality reproduction, especially of soft and pliable discs, is the tuned-ribbon pickup developed by Maxmillian Weil and manufactured by the *Audak Company*.

A novel carrier structure, from which the oscillating member is suspended, is the heart of the system. This is shown in Fig. 5 which illustrates the principle of operation of the vibrating system. As can be noted, the stylus displacement imparts a rotational motion around the axis of a horizontal member. This horizontal member, known as a "limiter," is located just above the stylus and between two horizontal metallic ribbons (Fig. 6), which are approximately .002 inch in thickness. They are securely anchored at points *A* and *E* (Fig. 5). At the other end of the limiter is a universal ball and socket bearing. The ends of the ribbons are carefully welded to a magnesium limiter shaft. These are located at opposite ends of the exact diameter of the shaft.

This design allows the limiter to rotate freely providing the ends of the ribbons attached to it can also move in substantially parallel paths or, in other words, for a displacement of the ends of the ribbons in the order of a few mils. As the ends of the ribbons start to move in arcs away from each other, greater displacements occur and the rotation of the limiter accompanying it. Then the motion of the stylus is stopped. By allowing the stylus to move with complete freedom, a distance of approximately .002 inch each side of the center portion is attained, or far more than enough to take care of the widest amplitude to be expected on disc records. Of great importance, the stylus displacement having been reached, the system will then lock itself against further motion. The stylus

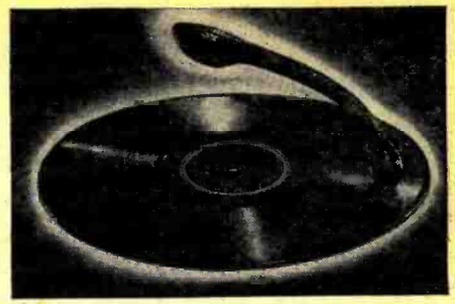


Fig. 4. Offset tone arm houses the "Cobra" pickup cartridge.

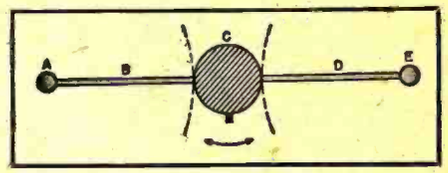


Fig. 5. Simplified diagram of Audak tuned-ribbon pickup. (A) and (E) are anchor points, (B) and (D) are tuned-ribbons and (C) is the stylus support.

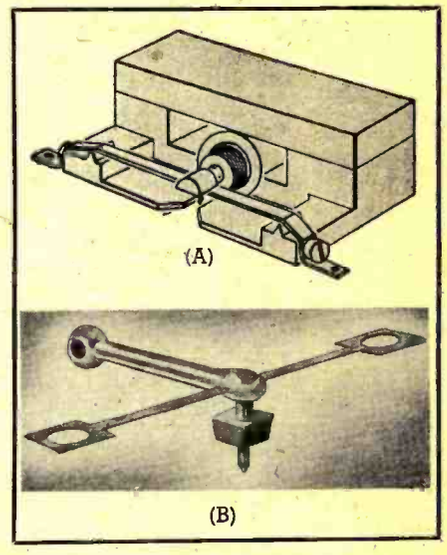
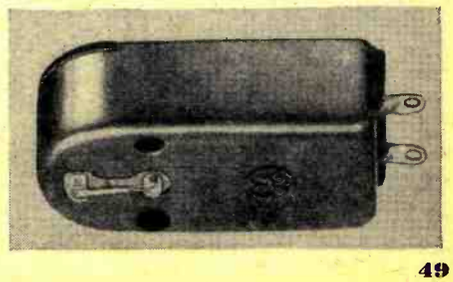


Fig. 6. (A) Armature and magnet assembly of Audak tuned-ribbon pickup. A bar type field magnet is used. (B) Artist's sketch shows over-all view of pickup.

is also permitted to move freely in a vertical direction for approximately the same distance as it moves laterally. Therefore, this type of pickup may be used on either vertical or laterally cut records. Accordingly, turntable equipment which is to be used in conjunction with the above pickup must be free from mechanical vibration either in a horizontal or in a vertical plane. Great care must be

Fig. 7. The G.E. variable reluctance pickup.



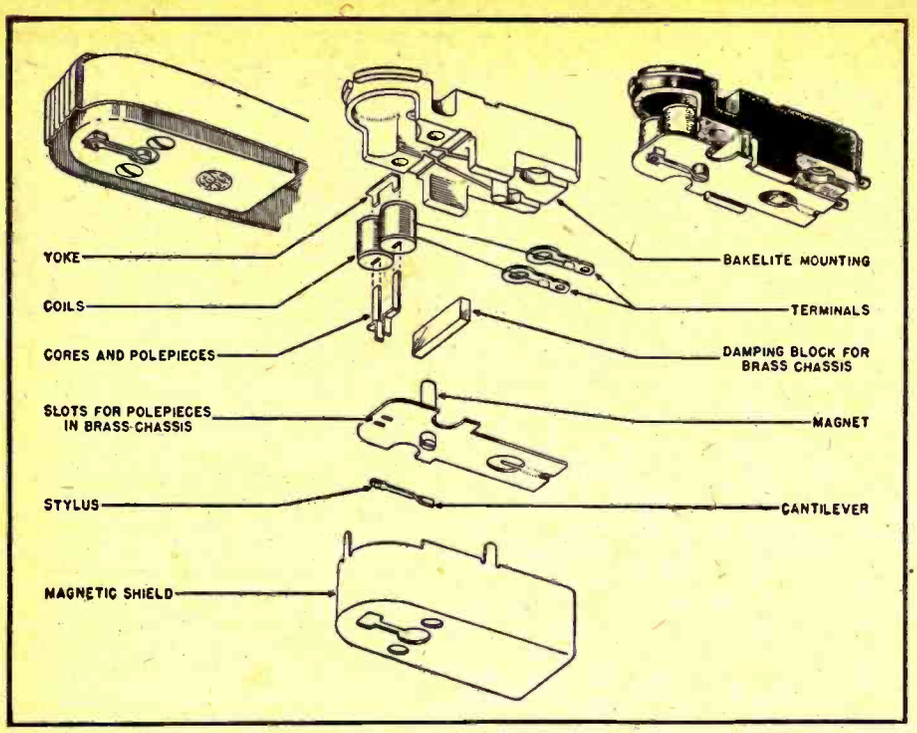


Fig. 8. Exploded diagram shows the construction of the G.E. variable reluctance pickup and the assembly of the various components used.

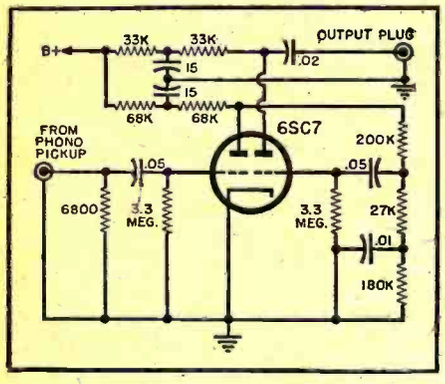


Fig. 9. Pre-amplifier and equalizing circuit used in conjunction with the General Electric variable reluctance pickup. Like extremely high fidelity microphones, this reproducer's output voltage is low.

exercised to anchor the turntable mounting board firmly against any undue vibration which may be transmitted by the motor through the idler pulleys or belts.

One of the features of this assembly is that the dynamic mass of the system is at the truly remarkable low value of only 4.43 milligrams. A reduction in the requirement for stylus pressure, which results from this near-elimination of vibratory mass, permits the pickup to operate with a pressure of approximately ten to fifteen grams. Included, therefore, is a wide safety margin which covers every possible type of groove modulation, the degree of warping, turntable rumble, etc. Under favorable conditions, and assuming that the table were perfectly level, this pickup would track with approximately half the above pressures. This, however, would not be recommended for general use on commercial records.

This type of pickup, due to the near zero mass of the vibrating system, produces a frequency characteristic that is approximately a straight line to about 11,000 cycles. This is more than is needed for the majority of transcriptions.

Fig. 10. The Pickering pickup. A linear response characteristic from 30-15,000 cycles-per-second may be obtained with this unit.

The Variable Reluctance Pickup

One of the simplest and most efficient pickups designed in recent years is the *General Electric* variable reluctance pickup. A natural sapphire stylus is mounted on the end of a small cantilever spring, as indicated in Fig. 7. The lateral motion of the cantilever directs the magnetic flux alternately through the cores of two coils which are connected in push-pull. The exploded view, shown in Fig 8, illustrates the mechanical design of the pickup. Note that a slotted bushing is provided in the brass chassis. The end of the cantilever spring away from the stylus is soldered to the top side of this non-magnetic bushing. A cylindrical Alnico V magnet is soldered to the underside. Pole pieces made of Mu metal extend through the two coil cores and project on each side of the front end of the cantilever which carries the sapphire stylus.

As the stylus is driven laterally in the record groove, the cantilever moves correspondingly with respect to the pole pieces. The flux from the magnet passes through the bushing and the cantilever spring and across the small air gaps to the pole pieces, so that it divides equally between them, providing the stylus is centered. At the opposite end the cores are joined by Mu metal yokes. The flux passes from these through the air to the other pole of the magnet. As the cantilever moves off center, the flux increases through one coil and decreases proportionately through the other. The output voltage generated in the coils is directly proportional to the rate of change of flux. Thus, the pickup responds accurately to a constant velocity signal but requires equalization in a constant amplitude region.

The output voltage from the average record is approximately 11 millivolts at 1000 c.p.s. Therefore, a gain of approximately 40 db. at 1000 c.p.s. is needed for a preamplifier and equalizer (Fig. 9) to make the output compare with the average crystal pickup.

An extremely low needle scratch results with this pickup due to the fact that the device responds only to vibrations in a lateral direction. By eliminating the resonant response in the unit's design, low distortion and low needle talk is provided. Since the output voltage is generated directly by the motion of the stylus mounting structure, there are no losses or long coupling members.

The extremely small mass permits excellent high frequency response. Vertical motion of the stylus is equal with respect to the pole pieces and there is no voltage generated by vertical components. This, combined with the damping effect of the high vertical spring compliance, contributes a great deal to the clean quality of the response by eliminating, to a great degree, the effects of pinching distortion. Then too, the lack of vertical response also eliminates a considerable portion of the frictional noises which ordinarily are transmitted from the record surface.

The pickup chassis is coupled to the bakelite base through a single wire which is supported in the rear and by a viscaloid damping block. Hence, practically all effects of arm and supporting structure resonances are eliminated. A torsional resonant period at 10 kc. in the cantilever spring is damped out with a special viscaloid damping block. Harmonic distortion is very low in this type of pickup. It is further reduced by the use of push-pull connections.

The Pickering Pickup

Another simple and effective pickup is illustrated in Figs. 10 and 11. A

(*Continued on page* 160)

A Gang-Tuned TRANSMITTER

Front view shows tuning dial, calibration chart, and the 807 plate tuning condenser in the upper right hand corner, with bandswitch immediately below. Controls (left to right along bottom) are: mike jack, audio gain control, key jack, phone-c.w. switch, plate voltage switch, filament voltage switch, and 807 cathode switch.

By
J. F. CLEMENS, W9ERN

A 50-watt, variable frequency, gang-tuned, phone and c.w. bandswitching transmitter — complete with power supply, all on a 10 by 14 inch chassis.

WITH the tremendous increase in the use of variable-frequency transmitters, more and more amateurs are turning to single dial tuning in order to realize the full advantages of this highly flexible frequency control system. The luxury of single dial tuning, mandatory in communications receivers, has been neglected by amateurs because of the relatively infrequent change in tuning with crystal control and the apparent belief that ganging the tuning of different stages of a transmitter is fraught with difficulty. While it is true that hit-or-miss methods are apt to yield discouraging results, a simple procedure in designing the tuned circuits will reduce the job to cookbook radio.

Actually, the job of ganging a transmitter is less difficult than ganging a superhet receiver, since in a communications type superhet ideal tracking is only approached and never fully attained, while in a transmitter precise tracking can be achieved.

The transmitter to be described features gang-tuning of the oscillator and the doubler stages. By proper choice of the tuning capacities, tracking has been made nearly perfect over the various ranges with the result that the output over any of the ranges is constant.

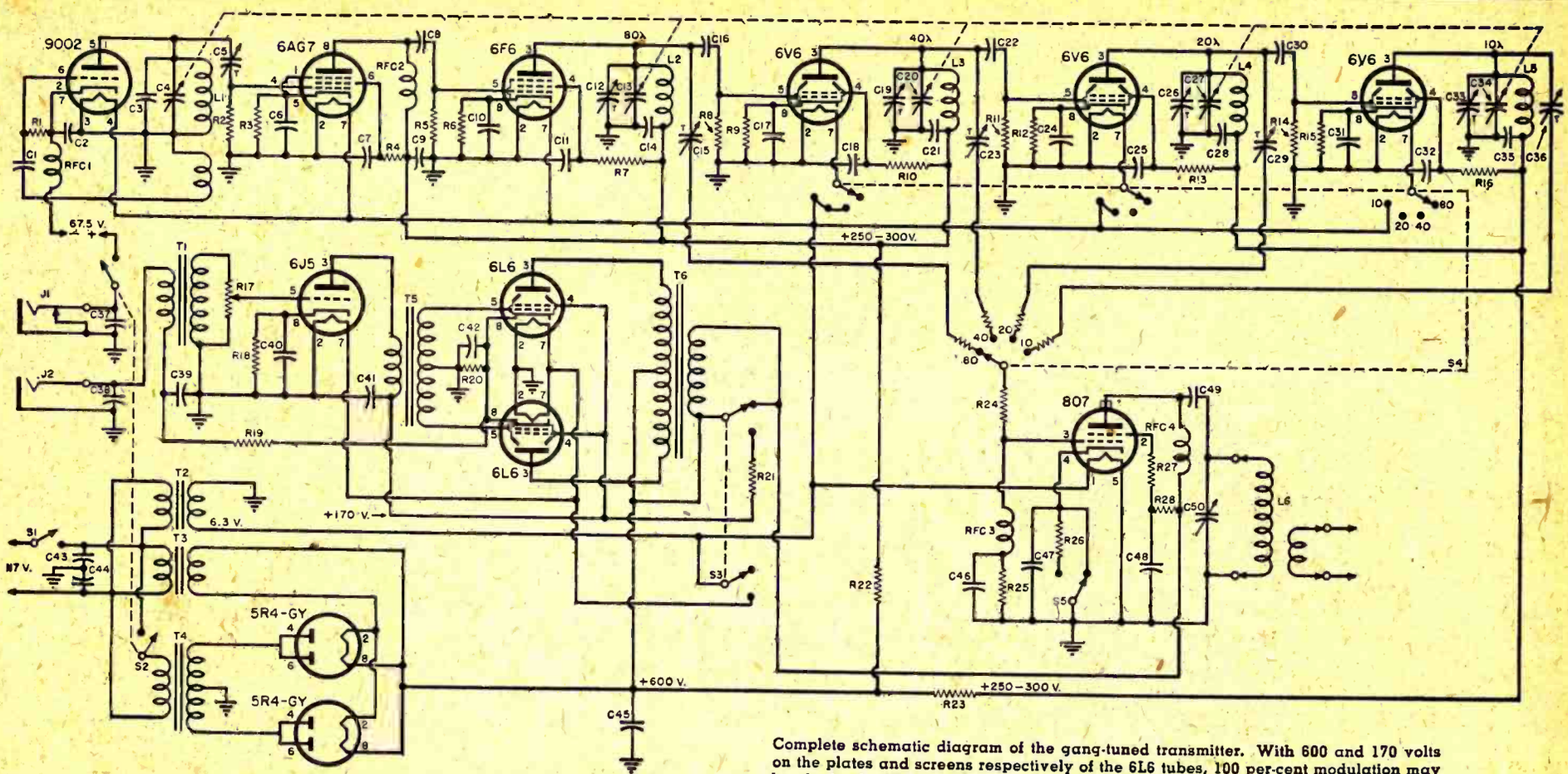
The final r.f. amplifier, an 807, is not ganged to the preceding stages. Previous experience has shown that the detuning of the final amplifier by the reflected reactance of the antenna as the operating frequency departs from the resonant frequency of the antenna upsets the tuning so much that a panel-controlled padder condenser is necessary. If a purely resistive load is anticipated, as in the case of operation of the transmitter as an exciter for a following amplifier, it is feasible to employ gang-tuning in the final amplifier. The final amplifier is broad tuning however, and departures of at least 50 kc. either side of the resonant frequency may be readily achieved with minimum detuning.

The transmitter incorporates bandswitching except in the 807, where the necessarily longer leads with bandswitching would be incompatible with efficient high frequency operation, as high as 30 mc. The system of bandswitching is novel and of interest. Referring to the circuit diagram, it can be seen that all the doubler stages are connected in cascade and no provision is made to disconnect an inoperative stage from the preceding stage. Except for the 807 grid which, through a selector switch, receives excitation of the desired frequency, there is no r.f. voltage on the bandswitch. As a result the switch may be located to shorten these 807 excitation leads as much as possible. Also, no unwanted coupling occurs between the doubler stages. Since it would be undesirable to allow the unused doublers to operate, their *filaments* are switched on or off as they are needed. A two-section (two poles per section, four position) ceramic switch (S_4) performs all the switching.

An effect of the switching of the filament is employed to preserve resonance as the 807 grid circuit with its stray and input capacity is added to a given driver stage. Since the doubler preceding the 807 driver is now out of use, its filament is switched off. As the tube cools off, its amplification drops to zero. Since the input capacitance of an amplifier is C_{gp} $(1 + A)$ where C_{gp} is the grid-plate capacity and A is the amplification, the input capacity of the stage drops to C_{gp} and compensates for the added capacity of the 807 grid circuit.

In this transmitter, the calculated values of the tank circuits performed satisfactorily except that slight adjustment of the tank inductances was necessary on 20 and 10 meters. This results from inaccuracy in calculating the dimensions of these coils to secure the necessary inductance. Rather than use cut-and-try methods of making these slight modifications, a step-by-step procedure may be employed. Poor tracking is indicated by variation in the 807 grid current as the dial is tuned over the frequency range. No more than 10 per-cent variation need be tolerated. In case the tracking does not meet this figure the following test may be performed in order to determine whether to increase or decrease the tank inductance.

Set the transmitter at the low frequency end of the dial and resonate the doubler plate circuit for maximum grid current to the 807 by adjustment of C_{12}. Now tune the unit to the high frequency end of the dial. If it is found



Complete schematic diagram of the gang-tuned transmitter. With 600 and 170 volts on the plates and screens respectively of the 6L6 tubes, 100 per-cent modulation may be obtained without carrier shift and without exceeding dissipation ratings of tubes.

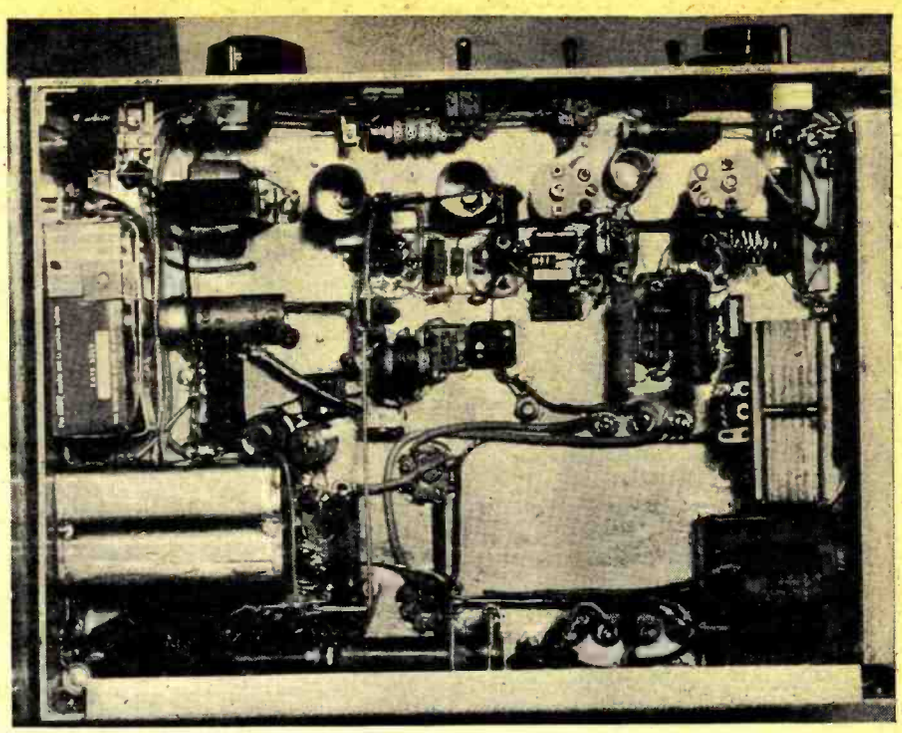
R_1, R_7, R_{10}, R_{13}, R_{16}—50,000 ohm, ½ w. res.
R_2, R_4, R_5, R_8, R_{11}, R_{14}—25,000 ohm, ½ w. res.
R_3, R_{19}—300 ohm, 1 w. res.
R_6—450 ohm, ½ w. res. *(See text)*
R_9, R_{12}, R_{15}—1500 ohm, ½ w. res.
R_{17}—500,000 ohm pot.
R_{18}—2000 ohm, ½ w. res.
R_{20}—250 ohm, 10 w. wirewound res.
R_{21}—25,000 ohm, 10 w. wirewound res.
R_{22}—5000 ohm, 20 w. wirewound res.
R_{23}—7500 ohm, 20 w. wirewound res.
R_{24}—20 ohm, ½ w. res.
R_{25}—15,000 ohm, 2 w. res.
R_{26}—650 ohm, 10 w. wirewound res.
R_{27}—50 ohm, ½ w. res.
R_{28}—40,000 ohm, 2 w. res.
C_1—300 μμfd., zero temp. coefficient cond.
C_2, C_6, C_7, C_{10}, C_{11}, C_{14}, C_{17}, C_{18}, C_{21}, C_{24}, C_{25}, C_{28}, C_{31}, C_{32}, C_{35}, C_{37}, C_{38}, C_{43}, C_{44}, C_{46}, C_{47}, C_{48}, C_{49}—.01 μfd., 600 v. cond.
C_3—400 μμfd., zero temp. coefficient cond.
C_4—140 μμfd. var. cond. ganged with C_{13}, C_{20}, C_{27}, C_{34}
C_5, C_{15}, C_{23}, C_{29}, C_{36}—3-30 μμfd. mica trimmer
C_8, C_{18}, C_{22}, C_{30}—100 μμfd. mica cond.
C_9, C_{41}—8 μfd., 450 v. elec. cond.
C_{12}, C_{19}, C_{26}, C_{33}—50 μμfd. air trimmer cond.
C_{13}, C_{20}, C_{27}, C_{34}—*See coil table*
C_{39}, C_{40}, C_{42}—25 μfd., 25 v. elec. cond.
C_{45}—4 μfd., 1000 v. elec. cond.
C_{50}—140 μμfd. var. cond.
RFC_1, RFC_3—2.5 mh. r.f. choke
RFC_2—8 mh. r.f. choke
RFC_4—Approx. ½ mh. r.f. choke *(See text)*
T_1—Single button carbon mike-to-grid trans.
T_2—Fil. trans., 6.3 v. @ 6 amps.
T_3—Fil. trans., 5 v. @ 3 amps.
T_4—Power trans., 650-0-650 v. @ 300 ma.
T_5—Single plate to push-pull grids trans.
T_6—20 w. mod. trans., 6000 ohms plates-to-6000 ohm load
S_1—S.p.s.t. toggle sw.
S_2—D.p.s.t. toggle sw.
S_3—D.p.d.t. toggle sw.
S_4—4-pole, 4-pos. ceramic bandswitch
S_5—Single-pole, 3-pos. sw. *(See text)*
L_1, L_2, L_3, L_4, L_5, L_6—*See coil table*
J_1—Closed circuit jack
J_2—Open circuit jack
1—67.5 volt "B" battery
1—9002 tube
1—6AG7 tube
1—6F6 tube
3—6V6 tubes
1—6J5 tube
2—6L6 tubes
1—807 tube
2—5R4GY tubes

necessary to increase the capacity of C_{12} to reestablish resonance, excessive inductance is present and the inductance in the circuit should be slightly reduced. By repeating this procedure, the tracking may be carried to any degree.

The v.f.o. has been stabilized by employing a 9002 tube. Because of the low interelectrode capacity of this tube, vibration effects produce only very small changes in the capacity across the tank circuit and microphonic effects are minimized. Also, this tube has a 150 milliampere heater so that heating of the oscillator compartment by the filament is very small. The plate current of the oscillator is 1 ma. at 67½ volts, resulting in a plate dissipation of approximately .034 watt, assuming 50 per-cent efficiency in the oscillator. A small battery provides perfect voltage regulation and long life at such a small current drain. The life of the battery is over one year in normal use in the transmitter and will be practically shelf life. Also, since the negative is not grounded, we may key the "B plus" lead of the oscillator and still have the keying jack grounded. It will be noted that the oscillator is somewhat unconventional in that the plate circuit is grounded while the cathode operates at minus 67½ volts. This circuit has been employed so that the tuning condenser of the oscillator may be grounded. Of course, the d.c. could have been fed in thru the coil or by means of shunt feed but both methods would have introduced additional components into the frequency-determining circuit with the attendant possibility of thereby increasing the frequency instability by temperature and/or humidity effects in these components.

The top of the v.f.o. compartment is shown covered with a piece of heavy cardboard. This was done after tests showed that humidity variations caused by sudden changes in the air inside the compartment affected the frequency. Such changes will occur if the box is left open and the transmitter operated in a draft. Tests made using a heating element to warm the box showed the thermal stability of the oscillator was very high but moisture blown into the box caused frequency change even though the temperature remained constant. Since negligible heat is generated inside the oscillator compartment, the temperature will remain quite stable at close to the ambient temperature.

The 6F6 80 meter doubler and the 6AG7 "class A" amplifier are operated from a common dropping resistor (R_{22}) from the plate supply. The cathode resistor of the 6F6 stage is so adjusted that the key-up voltage at the 6AG7 plate is the same as the key-down voltage. In regulating the voltage in this manner the stability of the load on the v.f.o. is enhanced. Even though the 6AG7 is operated under "class A" conditions and draws no power from the oscillator, it must have stable plate supply since its input capacitance is a function of the transconductance of the tube, which, in turn, in a function of the plate voltage. Keying is free from chirp on all bands. The constants of the oscillator keying circuit have been carefully selected to provide maximum softening of the keying without "tails" and should not be altered.

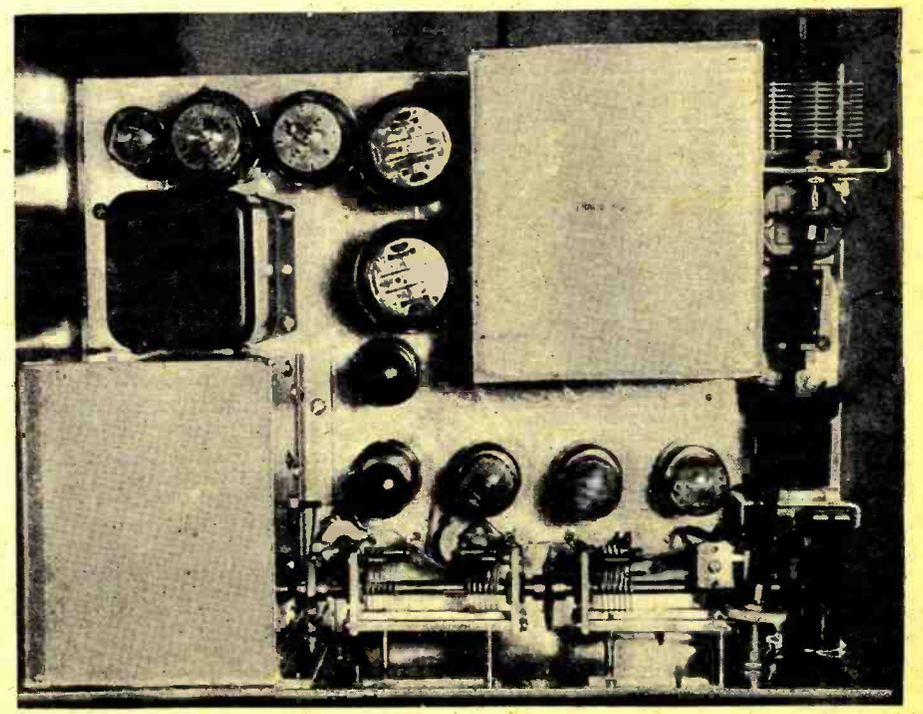


The filament transformers, doubler plate coils, and mike and audio coupling transformers are all mounted beneath the chassis. The oscillator plate supply battery is mounted on the left side flange.

The 807 final amplifier stage is mounted horizontally, providing very short leads, and good shielding of the plate circuit is achieved by the power transformer and the baffle shield which mounts the tank condenser and coil socket. The resistors in the grid and switch leads are employed to suppress parasitic oscillations and need be employed only if parasitics occur. An-

(*Continued on page* 153)

The large square box is the power transformer. The box shown in the lower left hand corner is the oscillator compartment. Tubes in order from upper left to lower right are: the 6J5 speech amplifier, the two 6L6's, the two 5R4GY's, one 6AG7, one 6F6, the three 6V6GT doublers, and the 807. The 807 is shown mounted in a horizontal position.



LOW-COST FM TUNER

Over-all top view of completed tuner. The chassis which was used is considerably larger than is necessary.

By JACK NAJORK, W2HNH

A simplified circuit design, without sacrificing performance, makes this new band (88-108 mc.) FM receiver low in cost and relatively easy-to-build.

THE increasing popularity of FM reception has undoubtedly created much interest in FM receiver construction among radio experimenters and amateurs. However, inspection of conventional FM receiver circuits is usually a disheartening revelation for the constructor who desires to build his own with a minimum of expense and effort. Since FM receiver production has just begun, components are expensive and often difficult to obtain. Conventional FM receivers require more than the usual signal generator and output meter for proper alignment and this factor must also be considered by the individual builder.

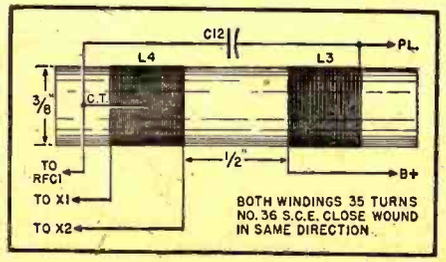
A study of present-day FM receivers reveals the following typical stage line-up; 1. r.f. stage, 2. mixer, 3. local oscillator, 4. i.f. stage(s), 5. limiter, 6. discriminator, 7. audio amplifier, and 8. power supply. From this it is evident that the design and construction of a "typical" FM receiver is a major project requiring considerable skill, time, and most important, money. However, by taking advantage of new circuits and efficient tubes and omitting the audio stages (which are usually available), it is possible to greatly simplify the design and construction of an FM receiver without sacrificing performance.

The FM tuner described here was originally designed by Don Nigg, W2OWC. It provides excellent reception of FM signals in the new, high band (88-108 mc.) within a radius of 20 to 50 miles from the transmitting antenna. The maximum range is, of course, dependent to a great extent upon the height of the receiving antenna with respect to the transmitter site and the intervening terrain. In general, it has been found that the line-of-sight thumb rule for ultra-high frequency reception can be stretched considerably, particularly when the radiated power is in terms of kilowatts rather than watts.

Since simplicity and low cost were the main objectives, the original circuit has been modified slightly to reduce the cash outlay for new parts to a minimum. All coils and i.f. transformers are easily made and the tubes and remaining components are available at low cost on the surplus market. Alignment is simple and requires no elaborate FM signal generator or oscilloscope.

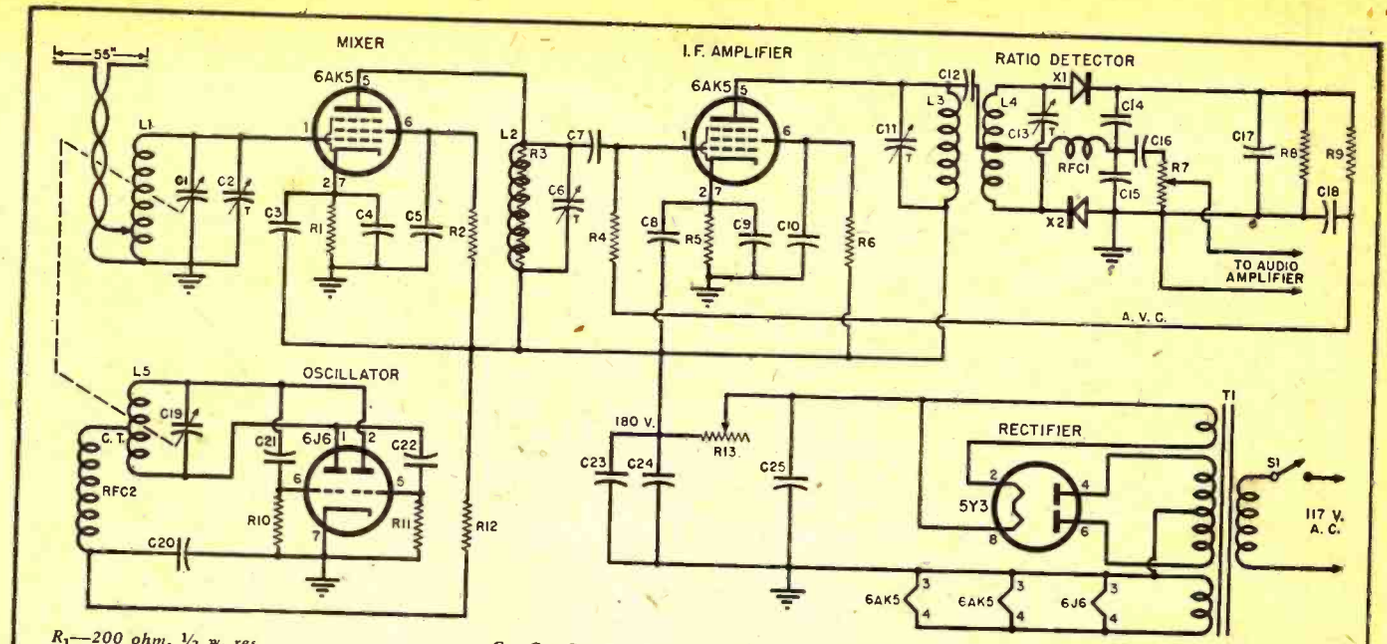
The circuit consists of a 6AK5 mixer, 6J6 oscillator, 6AK5 i.f. amplifier, two crystal diodes as a ratio detector, and a 5Y3GT rectifier. If desired, the power supply can be omitted and the necessary voltages "robbed" from an existing b.c. receiver or amplifier, provided the latter equipment is capable of handling the additional drain. Power requirements are 6.3v @ .8 amp. and 180v. @ 25 ma.

Mechanical details of discriminator coil.



The 6AK5 mixer is inductively coupled to the 6J6 push-pull oscillator which tunes approximately 7.4 mc. *below* the incoming signal to produce an intermediate frequency of 7.4 mc. The antenna is directly coupled to the mixer coil by means of the adjustable tap which is varied for optimum coupling. This method of antenna coupling is simpler mechanically than inductive coupling and also permits small experimental variations in coupling without the usual "coil-bending." Some unbalance is introduced but this is not serious with a low impedance antenna system.

The 6J6 push-pull oscillator develops the required r.f. injection voltage with very low d.c. power input; hence frequency stability is greatly improved over the conventional single-ended oscillator. Actual tests have shown the 6J6 oscillator to be superior in stability to several different types of oscillators commonly employed in commercial FM receivers. Warm-up drift is entirely eliminated and the annoying necessity of having to retune after five minutes of operation is not encountered. The one disadvantage of the push-pull oscillator is the fact that both the stator and rotor of the tuning condenser are "hot" with



R_1—200 ohm, ½ w. res.
R_2, R_6, R_{10}, R_{11}—22,000 ohm, ½ w. res.
R_3—68,000 ohm, 2 w. res. (IRC type)
R_4—100,000 ohm, ½ w. res.
R_5—150 ohm, ½ w. res.
R_7—1 megohm pot.
R_8—33,000 ohm, ½ w. res.
R_9—220,000 ohm, ½ w. res.
R_{12}—33,000 ohm, 1 w. res.
R_{13}—3000 ohm, 10 w. wirewound var. res.
C_1, C_{19}—10 or 15 μμfd. tuning cond. (Type APC with 2 stator and 1 rotor plates)
C_2—6 μμfd. ceramic trimmer
C_3, C_4, C_5, C_7, C_{18}, C_{20}—.001 μfd., 300 v. ceramic cond.
C_6—35μμfd. mica trimmer
C_8, C_9, C_{10}, C_{14}, C_{15}—.004 μfd., 400 v. cond.
C_{11}, C_{13}—35 μμfd. mica trimmer (in i.f. can)
C_{12}—47 μμfd. ceramic cond.
C_{16}—.05 μfd., 400 v. cond.
C_{17}—8 μfd., 25 v. elec. cond.
C_{21}, C_{22}—5 μμfd. ceramic cond.
C_{23}—.01 μfd., 400 v. cond.
C_{24}—30 μfd., 350 v. elec. cond.
C_{25}—16 μfd., 350 v. elec. cond.
S_1—S.p.s.t. sw. (on R_7)
X_1, X_2—Crystal diode. (See text)
RFC_1—2.5 mh. r.f. choke
RFC_2—20 t. #18 en. on ¼" i.d., 1¼" long form
T_1—Power trans., 250-0-250 @ 40 ma., 5 v. @ 2 amps, 6.3 v. @ 2 amps.
L_1*—4 t. #14 en. on ¾" i.d., ¾" long form
L_2—65 t. #26 en. closewound on R_3
L_3, L_4—See drawing, bottom of page 54
L_5*—4 t. #14 en. on ¾" i.d., ⅜" long form
2—6AK5 tubes
1—5Y3GT tube
1—6J6 tube
* Note L_1 and L_5 to be spaced 1¼"

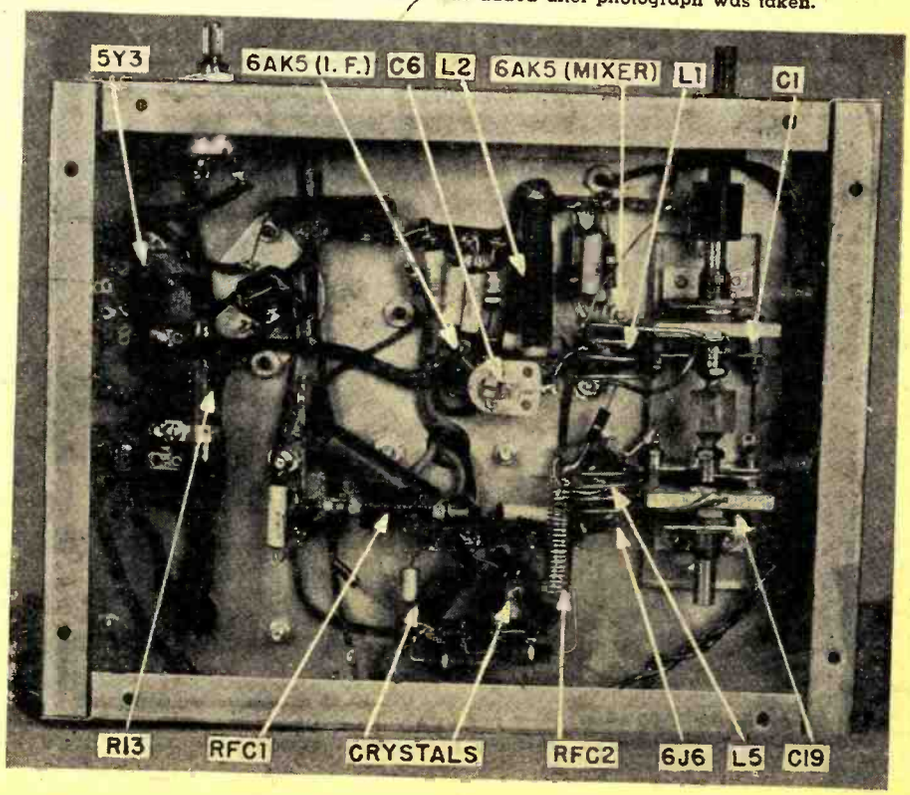
Schematic diagram of FM tuner. The i.f. system tunes to 7.4 mcs. instead of the standard 10.7 mcs. This value has been chosen so that hams, not having access to signal generators, can use their 40-meter transmitters as a signal source for i.f. alignment.

r.f. and d.c. with respect to the chassis. The tuning condenser must, therefore, be isolated from the chassis and this is done by using a lucite mounting plate and a rigid, insulated coupling.

A broadly-tuned, resistance-loaded circuit is used to resonate the plate of the mixer tube to approximately 7.4 mc. The plate coil is wound on a 68,000 ohm, 2 watt *IRC* resistor to lower the "Q" of the inductance sufficiently to obtain the broad-band characteristic necessary for FM reception. Capacitive coupling is employed between the plate of the mixer and the grid of the i.f. stage, thus avoiding the necessity for a conventional transformer. The plate of the 6AK5 i.f amplifier feeds into the discriminator transformer which is made from a discarded 455 kc. i.f. transformer. The old windings are stripped off the form and two new windings are wound as specified on the detailed drawing. Before this is done, however, the inside of the form should be inspected for powdered iron cores. If the form contains cores, these should be removed, otherwise the final inductance of the new coils will not be correct. The new windings are held in place by small dabs of wax which are heated with a soldering iron and run over the end turns. A tie point for the secondary center tap and the 47 μμfd. condenser is made by piercing the bottom of the form and inserting a short length of bus wire. The ends of the bus are then wrapped together and soldered to form a small lug to which is connected one side of the 47 μμfd. condenser and the c.t. of the secondary winding. The other side of the condenser is connected to one end of the primary winding as illustrated. The ends of the two windings are soldered to the trimmer condenser lugs which serve as tie points for the transformer leads which are brought down through

(*Continued on page* 166)

Under-chassis view shows position of various component parts. Trimmer condenser, C_2, is not shown as it was added after photograph was taken.



TELEVISION INSTALLATION

By W. W. WAYE

Part 3. "How-to-do-it" illustrations covering a TV installation in remote suburban residences. Elimination of ghost signal is explained.

PREVIOUSLY discussed was the installation of the simplest antenna—the single dipole—in a suburban location ideal for television reception. Now, following much the same procedure *up to a certain point,* let's adapt the *Basic Procedure* for another, almost identical, remote suburban residence—which promises to produce a very significant television problem!

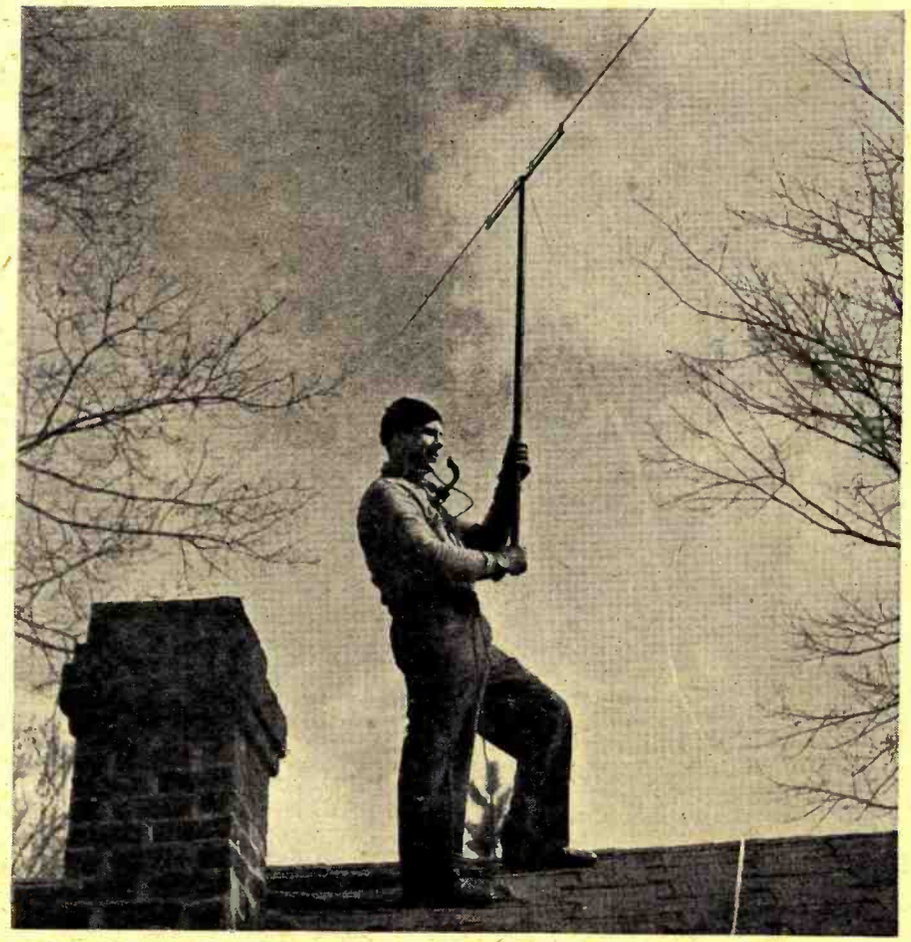
Site for this installation was a frame dwelling in northern New Jersey near the Hudson River, and about 16 miles from the midtown district of New York. The two-story house was located on the side of a hill, providing a distant view of the City over relatively flat land. Also visible, at a distance of about two miles northeast of the dwelling, was a large group of factory buildings in a well-exposed location. No other buildings, houses, metal obstructions, hills, or mountains were in the vicinity of the house. The installation site was specifically chosen by Jack McNally, New York television engineer, who also participated in all roof operations.

Initial Steps

After the sale of the television receiver, the dealer made a preliminary survey of the place of installation, in this case the customer's home. There, the best interior position for the television set was established, and the dealer estimated the approximate length of lead-in necessary—between the set and roof—to permit "probing" operations.

The customer wanted a single antenna. For the condition of "best reception" he preferred two New York stations: WABD (on Channel 5) as the *Primary Channel,* and WNBT (on Channel 4) as the *Secondary Channel.*

Input impedance rating of the customer's set was marked 300 ohms, which meant that conventional, 300-ohm "twin-lead ribbon" was to be used for the lead-in. But this arrangement required a short Matching Section—constructed from a 30-inch piece of 150-ohm "twin-lead ribbon"—for insertion between the dipole (center) terminals of the antenna and the actual lead-in.



1 Single dipole used to locate best antenna site. Lead-in connects dipole with receiver where relative signal strength and picture quality is observed for each different roof position of dipole. A portable telephone system provides communication.

The single dipole first used in the installation (for "probing" on roof, Fig. 1) consisted of two fixed metal rods held in a horizontal position by wooden supports. This assembly was mounted upright on a 5-foot wooden pole. This antenna was specifically chosen as a prototype because of its generally good design, its bi-directional properties, and easy adjustment of all tunable factors. Being well constructed, this single dipole can actually be used as the final antenna for all simple installations presenting no interference problems.

Length of each of the two metal rods determined the channel, or frequency *band,* best received. Since the preferred *Primary* and *Secondary Channels* (4 and 5) were close to each other (in frequency allocation), the *average* length for a metal rod to receive *both* stations would have been 34 inches. But to favor reception of the station most desired (the *Primary Channel*), the best length for each rod

was selected as being 32 inches long.

After locating the television set in the buyer's home, the single dipole (or "probing" antenna) was assembled. A 2-inch center separation between the two rods was allowed, and the wooden insulators fastened securely. The two conductors at one end of the Matching Section were soldered to appropriate terminal connectors of the two metal rods. The other end of the Matching Section was connected to the considerable length of 300-ohm "twin-lead ribbon" lead-in. Then the entire assembly was taken to the roof.

The receiver was switched to the *Primary Channel,* station WABD. And by adjusting all controls, the picture image was brought into the sharpest focus (with low intensity), without regard to its erratic action or complicated appearance on the screen. The received image was the conventional test pattern of station WABD, which happened to be transmitted during the entire time of the installation.

On the roof, the second technician began "probing" operations (Fig. 1). Holding the dipole upright, he began exploring various likely or accessible locations on the roof. The best site was to be judged *at the receiver* in terms of signal strength and picture quality of each location.

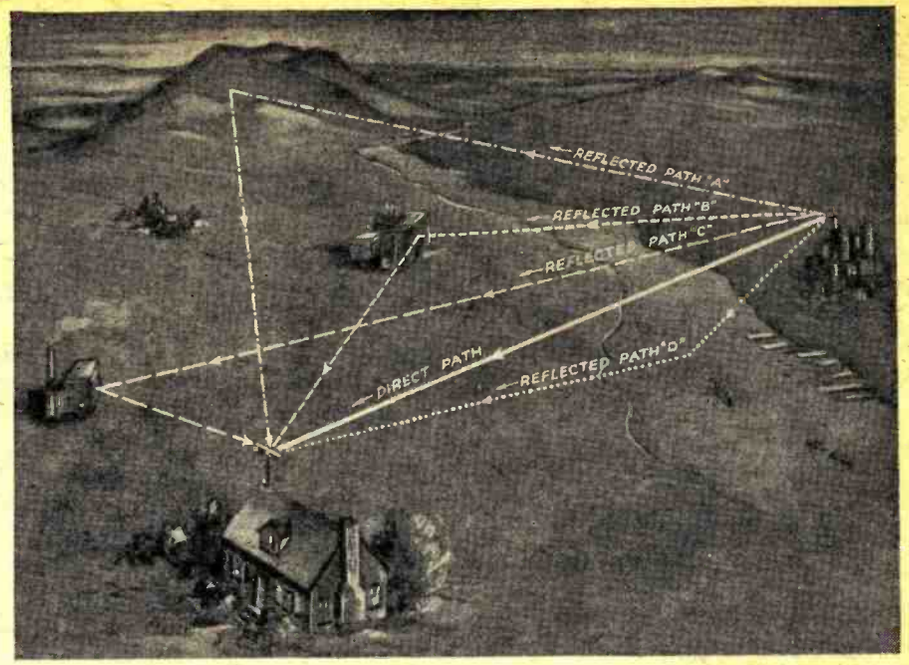
However, it was soon apparent that something had "happened"! A very unusual picture effect was observed on the screen of the receiver.

Whenever the normal or usual picture image was received (on Channel 5), the observer at the set noticed the appearance of *second image* of the same WABD signal. In some positions of the "probing" dipole, there were occasional appearances of *a third image* of the normal signal from WABD.

The normal (unaffected) test pattern *as it should have been received* (Fig. 2) differed considerably from the double-image test pattern (Fig. 3) and the triple-image test pattern (Fig. 4).

With the roof dipole held in any fixed position, it was impossible to eliminate or cause any change in these background images.

Their appearance was dull and blurred, and not as bright or brilliant as the normal image. Both were displaced horizontally, but by different distances on the screen, so that they seemed to be shadows or "ghosts" of the main image.



5 Some typical causes of image reflections or ghosts. Picture signals following path "A" are reflected by mountains; those following paths "B" or "C" are reflected by large buildings, but travel different routes; signals following path "D" are reflected by the surface of the water. All reflected signals arrive at dipole after direct signal.

But otherwise, the second and third images were similar in every respect to the normal image, usually known as the *direct* image. Changes in the receiver controls affected both this image *and* the "ghosts" in the same way.

However, the intensity of the "ghost" images could be varied slightly by changing the roof position *and bearing* of the "probing" dipole. And *at certain bearings,* the third "ghost" image was eliminated altogether!

Thus, the only clue to their cause and cure: The "ghost" effect *varied* according to the directional position of the receiving dipole!

So important is the problem of "ghosts" in television, let's digress briefly. Before continuing with siting, orienting, and tuning procedures of this installation, let's examine the cause and character of such "ghosts," with a view toward eliminating them!

Presence of these images *in any installation* is objectionable, since the receiver screen is filled with confusion and distortion. But they are particularly troublesome in many metropolitan or city locations.

They are *not* due to incorrect adjustment or defective operation of the television receiver. They are *not* due to faulty transmissions of a television station. In fact, their "cause" can't be affected or controlled.

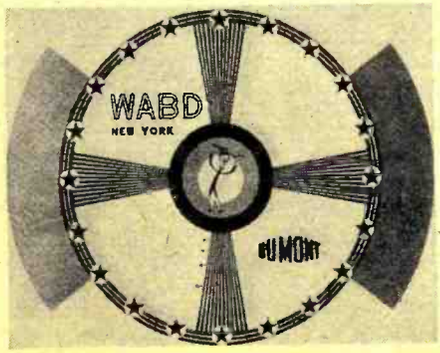
"Ghosts" *can* be eliminated with a suitable antenna installation, which is adapted to the individual requirements of a specified location.

Waves and "Ghosts"

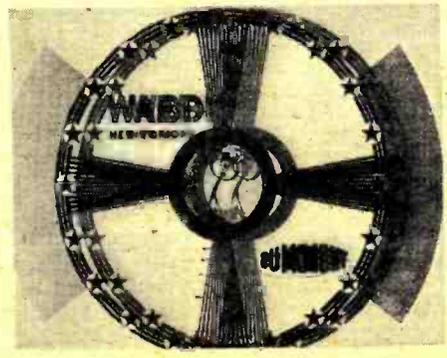
The radio waves used for television are extremely short. They act something like light waves. They travel in straight lines, and when they happen to strike a large surface or object of almost any kind, they are *reflected* as though the surface was a mirror!

After leaving the *transmitting* antenna of a television station, the radio waves travel in straight lines but in all directions. When they reach a dipole antenna that's tuned for tele-

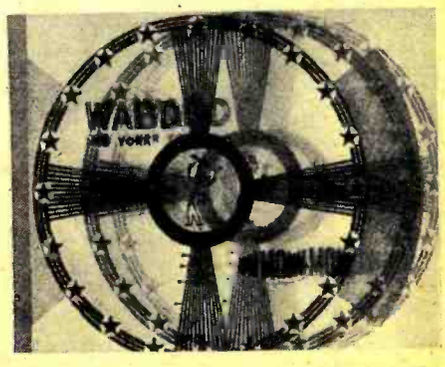
2 Normal picture signal of test pattern as received on primary video channel.



3 Double-image (ghost) reception resulting from an additional reflected signal.



4 Multi-image reception caused by several reflected signals appearing at antenna.



LOCATING THE RECEIVER

Best position must be satisfactory to customer, free from sunlight and electrical interference, ventilated; with adequate space for observing screen.

1. Install receiver carefully.
2. Check operation of set, using makeshift dipole if needed.
3. Determine customer's choice of 2 stations, for Primary Channel and Secondary Channel.

PREPARING THE LEAD-IN

Best lead-in is "twin-lead ribbon." Match impedances. If set input is marked 300, use lead-in with rating of 300 ohms. For 75-ohm input, use 75-ohm lead-in. With 300-ohm lead-in, insert short Matching Section before connecting to a dipole. Connect 75-ohm lead-in directly to a dipole.

1. Cut extra-sufficient length of proper lead-in.
2. Construct Matching Section, if required. [Consists of 36-inch piece of "twin-lead ribbon."]
3. Assemble single dipole and bracket. Dipole length is 78 inches to receive **all** channels. To favor certain channels, use:

Channel	Rod length	Dipole length
1	53.5 in.	108 in.
2	44.5 in.	90 in.
3	40 in.	81 in.
4	36 in.	73 in.
5	31.5 in.	64 in.
6	29.5 in.	60 in.

4. Connect lead-in (with Matching Section) to dipole. Take assembly to roof.
5. Connect lead-in loosely, from roof to set.
6. Run wires and install two-way telephone or intercom between roof and set.

SITING THE ANTENNA

Best site is high and clear, determined by "probing" system using two men. While man on roof uses "probing" dipole to test various locations, man at set observes merit of locations in terms of signal strength and picture quality, and absence of "ghosts" or reflections.

1. Best site is selected for reception of Primary and Secondary Channels, with **least** effect of "ghosts."
2. Attach metal mounting bracket to roof.
3. Antenna assembly put in the bracket, but left free to rotate. If "ghosts" are not too serious and signals are strong, use "probing" dipole. For weak signals or for bad interference due to "ghosts," use directional antenna.

ORIENTING AND TUNING ANTENNA

Use previous two-man coordination system for orienting and tuning antenna.

1. Based on picture results: antenna is oriented by rotating entire assembly to best position for receiving Primary and Secondary Channels **without** "ghosts" or other interference.
2. Based on picture results: antenna is tuned by carefully adjusting all tunable factors for best signal strength and quality.
3. Repeat above orienting and tuning procedures **at least** 3 times for improvement.
4. Install lead-in permanently, with no slack, using stand-off insulators.
5. Recheck operation of set.

Table 1. Basic procedure for television antenna installation.

vision reception, they are absorbed by the antenna and reach the television receiver.

When these radio waves travel along a *direct path* between the transmitter and the receiving dipole, that is, without interruption due to intervening buildings, mountains, or other large surfaces or objects—the radio waves are known as the *direct* signals from the television station.

Usually, *direct* signals can only be received when the transmitting antenna of the station is visible—or "almost" visible—from the exact site of the receiving antenna. Direct signals are particularly desirable, because they provide the receiver with the strongest and least distorted signal.

During this same time, however, similar radio waves travel out from the transmitting antenna in all other directions. Because of the large number of such waves, a few are bound to strike some large surface or object and then be reflected *at such an angle* that the waves reach the site of the receiving dipole.

In this way, television signals from a single transmitter may reach a receiver via one, two, or more *reflected* paths, in addition to the *direct* path.

A typical situation (Fig. 5) shows a *direct* path and four possible *reflected* paths from a transmitting antenna to a receiving dipole. Path "A" shows the route of radio waves reflected by the steep face of a distant mountain. Paths "B" and "C" represent radio waves reflected by large buildings. Path "D" indicates the route of radio waves actually reflected by the surface of water. There are many such sources of image reflection, and various *reflected* signals arrive at the receiving dipole from as many different directions.

Since the path of every *reflected* signal must be longer than the *direct path*, the *reflected* signal reaches the receiving dipole slightly later than the *direct* signal. This delay is consistent, however. Thus, the reflected signal appears on the screen with the same fixed constancy as the *direct* signal. "Ghosts" appear to duplicate the main image.

Sometimes very *slight* reflections cannot be observed on the screen as a separate image. The effect is to make the *direct* image blurred or fuzzy in appearance.

Reflected signals may be black or white, depending upon their polarity at the time of arrival.

The intensity of *reflected* signals may vary from extreme brightness to very weak or faint images. Often the "ghosts" are merely weak parts or portions of the complete *reflected* signal. As a general rule: *Reflected* signals are weaker in strength than the *direct* signal.

The difference in intensities of several reflected signals from the same transmitting antenna (Fig. 4) is caused by differences in the kind or nature of the *reflected paths.*

Very rarely, a *reflected* signal may actually be stronger and more desirable than the *direct* signal; in which case, the *reflected* signal is assumed to be the *direct* signal for purposes of orienting, tuning, and adjusting the receiving antenna system.

Chasing the "Ghosts"

Elimination of "ghosts" is primarily a matter of *directivity.*

Referring again to Fig. 5, all of the various *reflected paths* arrive at the receiving dipole *from different directions.* This is the *only* characteristic of this problem that permits a solution.

The antenna atop the house (Fig. 5) is a single dipole, the simplest tele-

(*Continued on page* 169)

6 The directional antenna consisting of a dipole fronted by a director, with its "ribbon" lead-in and matching section.

7 Orienting the directional antenna for selective reception. Best position is based on picture as observed at receiver.

8 The directional antenna mounted in its permanent position. The "ribbon" lead-in is run as direct as possible to the TV set.

A SIMPLE ANTENNA SYSTEM

BY CARL V. HAYS, W6RTP

Readily available "twin-lead" ribbon makes this folded dipole low in cost, yet highly efficient. "Cutting to length" is only critical factor.

NECESSITY has mothered many new developments in the art of radio. This was especially true of the war years just past. Not the least of these "war babies" has been the phenomenal growth of the solid-dielectric coaxial line. Before the war, the stumbling block to an efficient line of this type was its poor r.f. dielectric properties, but with the advent of materials such as polyethylene, etc., the barrier was cleared and high efficiency was readily attainable.

To the average amateur, this new acceptance of the solid-dielectric coaxial line means that he can have an easily constructed, foolproof, and efficient antenna at low cost. The dielectric material referred to has been on the market for some time as an insulating material for various types of spaced line. The "twin-lead," made by *Amphenol*, is available in various impedances, but for the purpose of this article, the 300 ohm variety will be considered to the exclusion of the other types since it permits the construction of an extremely simple antenna and matches most receivers now in use.

The average impedance of the so-called folded dipole antenna is very close to 300 ohms and amateurs were not long in taking advantage of the fact that the "twin-lead" ribbon met this requirement. Since the line has a surge impedance of 300 ohms, and a folded dipole antenna has a feed impedance of 300 ohms, the solution for that type of antenna construction was obvious.

The construction consists of simply taking a length of the line, a half-wave long, and soldering the parallel wires together at each end. Then, at the exact center of one of the parallel wires, cut and attach a convenient length of the "twin-lead" for a feeder. This produces a theoretically perfect match, but from the ensuing arguments over the air concerning the relative merits of the system, one would think bedlam had broken loose. Each one had his own answer as to why it worked as well as a four-element beam, or why it "wouldn't get a signal out of the back yard."

The obvious answer lies, of course, somewhere between these two extremes. A really efficient beam is hard to beat, everything considered, and there is no argument there. However, the fact remains that in many cases properly constructed "twin-lead" folded dipoles have equaled the performance of very satisfactory beams, much to the dismay of amateurs whose folding money and hours of effort have gone into the beam. The other extreme, "not being worth the poles to hold it up," as someone said, is almost invariably due to a misunderstanding of fundamental antenna principles.

One of these principles concerns the resonant length of an antenna and, closely related, the velocity of propagation of various materials at r.f. frequencies. It so happens that the usual dipole is resonant when cut about 95% of a physical half-wave, which length becomes the electrical half-wave, as most amateurs know. Now, since the 300 ohm line will be used not only for the feeder but the antenna as well it is necessary to investigate this business of velocity of propagation. The so-called "end effect" of antennas which usually causes the actual length to be something shorter than a calculated physical half-wave is of utmost importance since that "end effect" plus the velocity of propagation factor of the dielectric used in *Amphenol* "twin-lead" can cause grief if not taken into account in cutting to frequency.

Many of the complaints regarding inability to load the antenna properly, too high a standing wave ratio, inability to hit a resonant point on the band, etc., are simply the result of not allowing for the difference in speed at which radio waves travel along air insulated wires and on wires using polyethylene, etc. as dielectric material.

W6RTP, along with everyone else, had to try the new "twin-lead" and like almost everyone else, ran into trouble. An antenna of the folded dipole variety was made for ten meters and, lacking a better place, was stuck up in the rafters of a one story house, about ten feet off of the ground. Some peculiar things were noticed, chief of which was the fact that a terrifically high standing wave ratio was present. The antenna would load to half the mils normally obtained, and at no place in the ten meter band could a resonant spot be found.

In spite of all that, the reports were

(*Continued on page* 151)

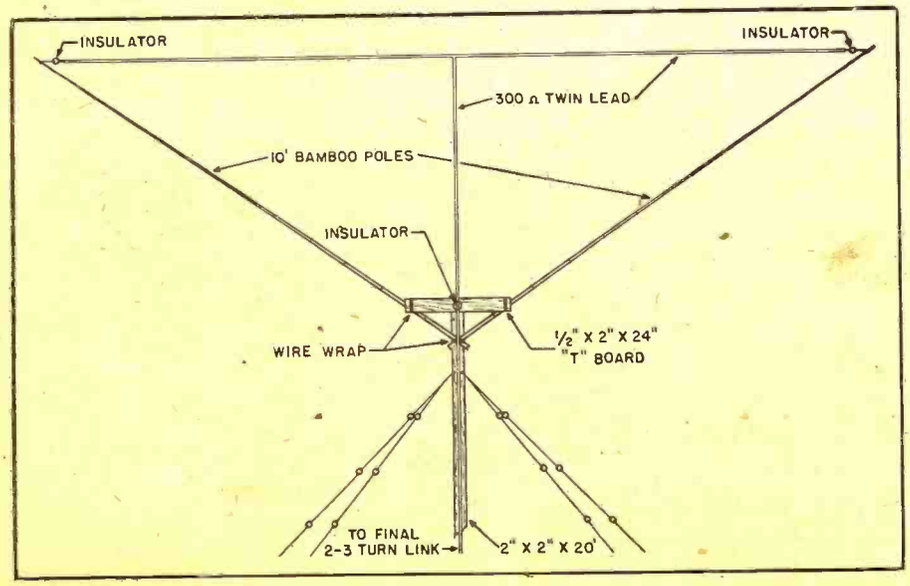
The following lengths, calculated approximately for the 10-meter band, are accurate enough for general usage. Application of the formula below will, when carried out two places, give spot location lengths more accurately. If better results are desired, for one particular frequency, use factor of .95 in formula below, then prune to resonance at desired transmitter setting, using crystal.

$$\text{Length} = \frac{492}{F_{mc}} \times .92$$

Mc.	Length	Mc.	Length
28.1	16′ 1¼″	28.9	15′ 7¾″
28.2	16′ ⅝″	29.0	15′ 7¼″
28.3	16′ 0″	29.1	15′ 6¾″
28.4	15′ 11½″	29.2	15′ 6″
28.5	15′ 10¾″	29.3	15′ 5½″
28.6	15′ 10¼″	29.4	15′ 4¾″
28.7	15′ 9¼″	29.5	15′ 4¼″
28.8	15′ 8½″	29.6	15′ 3⅝″
		29.7	15′ 3″

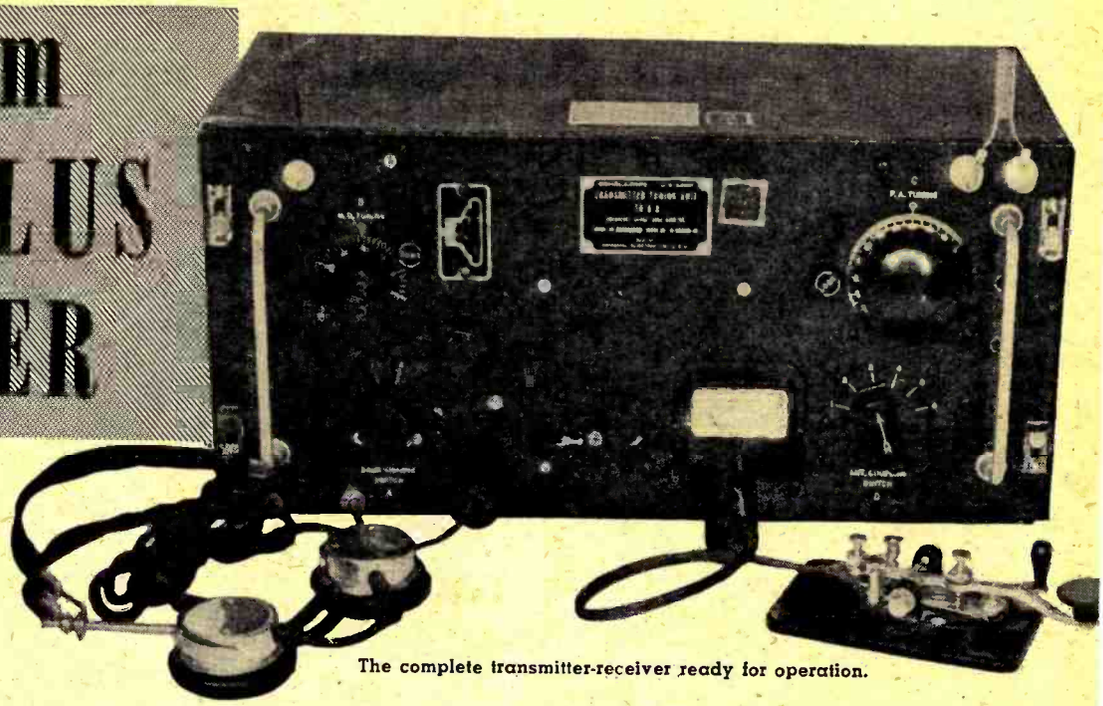
Table gives actual lengths for 300-ohm, 10 meter dipole antenna. Formula given may be used to calculate antenna lengths for operation on other amateur bands.

Fig. 1. Construction details for antenna designed for 10 meter operation.



TRANSMITTER-RECEIVER from SURPLUS TUNER

By
C. E. CLARK, W1KLS

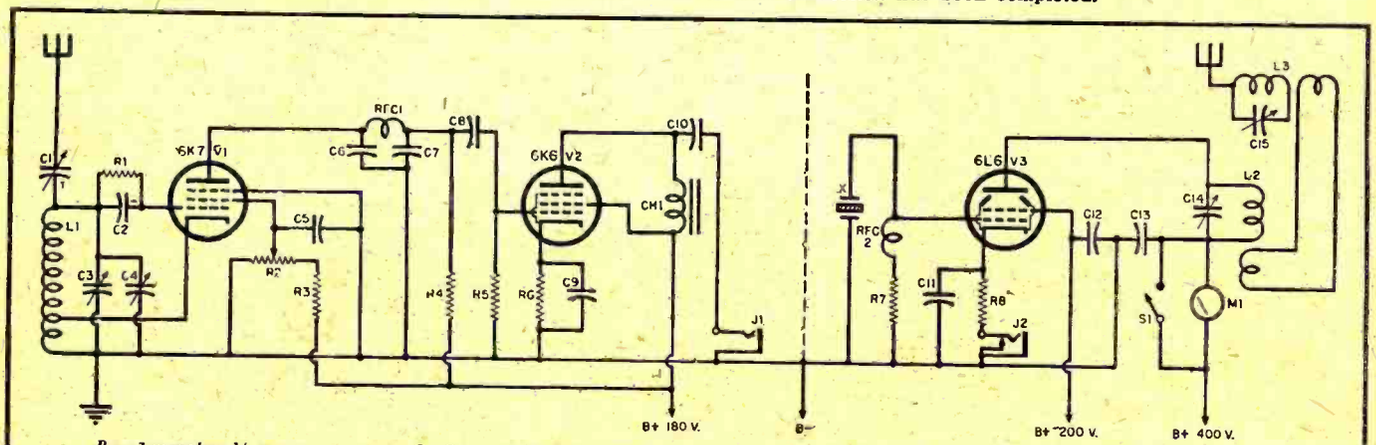


The complete transmitter-receiver ready for operation.

Ideal for the beginner—a low cost war surplus item that is easily converted for ham operation.

MANY of the war surplus items on the market offer intriguing possibilities for conversion to ham use. The compact transmitter-receiver discussed here is an interesting illustration. Here, a piece of equipment, officially known as TU6B, has been converted to a table top transmitter-receiver—a worthwhile project for either the beginning or advanced amateur. The former will find it an easy as well as economical means of getting on the air. The amateur who has a phone transmitter will find this little outfit the answer to an occasional urge to operate on the c.w. bands without the bother of retuning his phone rig. The c.w. men who are running 100 watts or more may use this rig for local contacts and will find that this shift to lower power is a favor to fellow hams. Beginner or old timer, those who enjoy the construction phases of amateur radio will find this project well within the scope of their ability and finances. A breakdown reveals, simply, a two-tube regenerative receiver and a one-tube crystal-controlled transmitter. Both

Schematic diagram of the transmitter-receiver after conversion has been completed.



R_1—3 megohm, ½ w. res.
R_2—50,000 ohm pot.
R_3—25,000 ohm, 1 w. res.
R_4—100,000 ohm, ½ w. res.
R_5—500,000 ohm, ½ w. res.
R_6—500 ohm, 2 w. res.
R_7—20,000 ohm, 1 w. res.
R_8—200 ohm, 2 w. res.
C_1—3-30 μμfd. trimmer cond.
C_2, C_6, C_7—100 μμfd. mica cond.
C_3—100 μμfd. var. cond.
C_4—2-plate var. cond.
C_5, C_{10}—.1 μfd., 400 v. cond.
C_8, C_{11}—.01 μfd., 400 v. cond.
C_9—10 μfd., 25 v. elec. cond.
C_{12}, C_{13}—.01 μfd., 600 v. cond.
C_{14}—P.A. tuning cond. (In surplus unit)
C_{15}—M.O. tuning cond. (In surplus unit)
J_1—Open circuit jack
J_2—Closed circuit jack
L_1—3.5 mc. coil, 28 t. #24 d.c.c., tapped 1¼ t. from gnd. end. 1½" diam. form, winding spaced out to 1½".
7 mc. coil, 14 t. #24 d.c.c. tapped ¾ t. from gnd. end. 1½" diam. form, winding spaced out to 1½".
L_2—P.A. coil (In surplus unit)
L_3—M.O. coil (In surplus unit)
Coupling links—3 t ea. pushback wire around "cold end" of L_2 and L_3
RFC_1, RFC_2—R.f. choke (In surplus unit)
CH_1—40 ma. midget filter choke
X—Crystal
M_1—0-200 d.c. milliammeter
V_1—6K7 tube V_2—6K6 tube V_3—6L6 tube

units were selected with the idea of simplicity and economy in mind. All usable parts in the original unit are employed, the balance of the required parts are either surplus components or are from the indispensable junk box. It is not necessary to adhere to the choice of tubes used here. Similar types at hand will do as well. Types 6J7GT/G, 6K7GT/G, 7V7, etc., may be used as the detector. In the audio stage, pentodes such as the 6V6, 7B5, 6M6G, may be used.

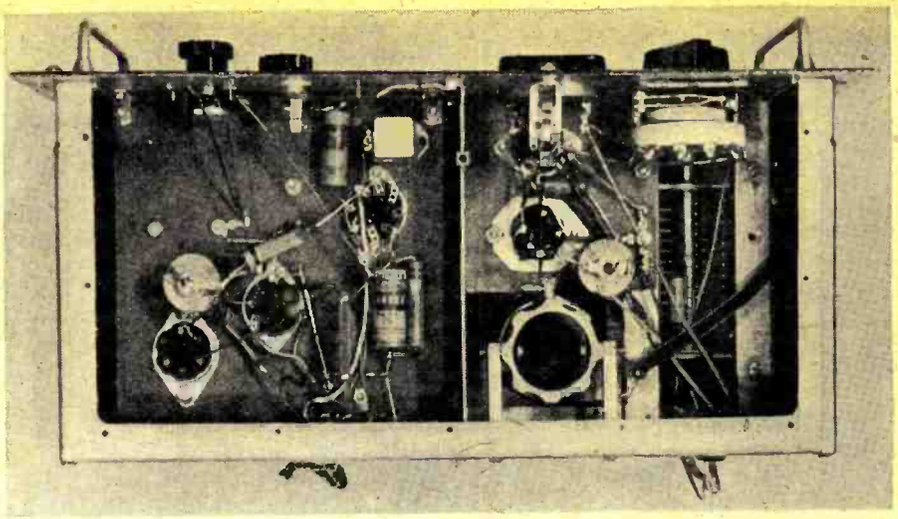
The plug-in coils for the receiver have only a single winding, thus simplifying what is sometimes an onerous task. In operation, the receiver will be found surprisingly stable, and capable of delivering a respectable amount of gain for good headphone reception. Condenser C_{10} in the audio output circuit eliminates the plate voltage in the phones, also leaves the phone cord free from stray r.f. currents which sometimes annoy. Finally, perfect shielding is provided by the aluminum cabinet.

The transmitter is conventional, which is to say, tried and true. Single-tube transmitters using the 6L6 tube are still heard on the air today, sufficient endorsement of their performance. When the transmitter-receiver is completed the builder will find he has a bonus in the form of a number of high quality parts which will, no doubt, eventually find their way into subsequent projects.

Since, obviously, the first step is to procure a tuning unit, a few lines regarding their availability will be helpful. Readers of RADIO NEWS will find these units advertised by several radio supply houses. Originally part of the BC-375-E transmitter, these units saw service in the bombers of the AAF. Some of them are brand new, some slightly used. The BC-375-E used seven of the units to provide rapid QSY, each one being calibrated and locked to a certain frequency. To conveniently hit the 80 and 40 meter amateur bands, the TU6B, which covers 3000-4500 kc., is the logical choice. With this unit no revamping of coils is necessary. Next choice in case the TU6B is unavailable, would be the TU5B. This unit has a range of 1500-3000 kc.

If the TU5B is used it will be necessary to remove a few windings from the transmitter tank coil, hitting the desired frequency by the cut and try method. The TU7B has a range of 4500-6200 kc., the TU8B, 6200-7700 kc. The latter may be revamped for use on the higher frequencies if so desired. The price of these units is usually less than $5.00, well below their original cost and far below their intrinsic value to the amateur experimenter.

The first step is to strip the TU of all parts not needed for the transmitter-receiver. This process will engender a large measure of respect for the rugged assembly methods which characterizes Signal Corps equipment, and to be honest, perhaps a certain amount of exasperation, The lives of



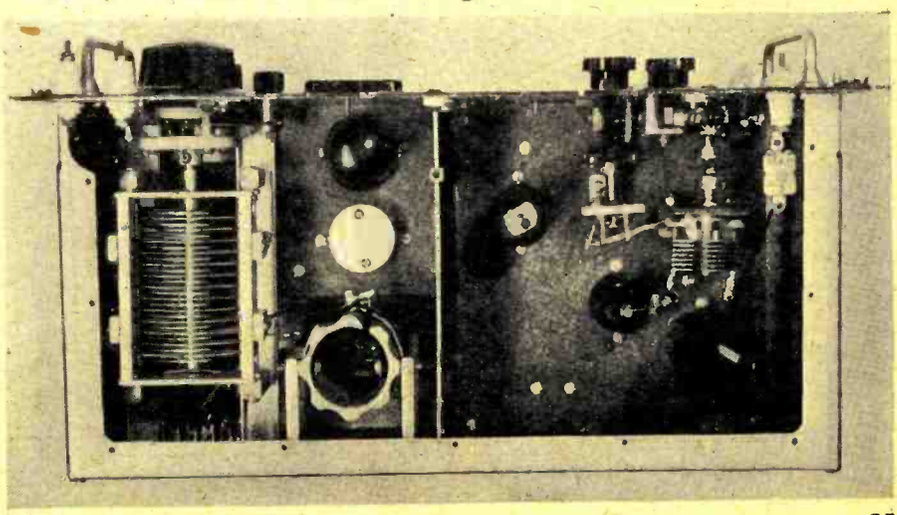
Under chassis view of war surplus TU6B tuning unit—part of BC-375-E transmitter.

men depended on the reliability of their communications equipment and it was built accordingly. Patience and the proper tools will, however, soon see the unit ready for conversion. In addition to the usual pliers and screwdrivers, a set of *Allen* screw wrenches is a must. These are essential because of the profusion of set screws which are not removable otherwise. Leave only the center partition, dials, the coil, condenser, and switch on what will be the transmitter portion of the finished product.

Construction is started in the receiver section by cutting a piece of Masonite to serve as a sub-panel. The size is approximately 6"x7", mounted 3¾" down to allow clearance for the tubes and coil. Lay out and drill the three socket holes. The sub-panel is next mounted using ½"x½" angle brackets. The tuning condenser C_3 and bandspread condenser C_4 are mounted next. These are brought out to their respective dials and knobs by use of ¼" diameter bakelite shafting and ¼" to ¼" solid or flexible couplings. Drill a hole through the panel for control of C_4. If a flexible coupling is employed, a ¼" panel bearing may be used to prevent wobble. Regeneration control R_2 is mounted behind the hole left by one of the original switches which brings it below the sub-panel. The front panel layout is completed by mounting the phone jack and the small feed-through insulator for the antenna lead. A four-lug terminal strip is mounted under the sub-panel to make a handy junction point for the power supply cable, which need not be attached until all interior wiring is finished. The original r.f. choke found on this side of the TU is used as RFC_1. With the remaining components connected and the coils wound, the receiver may now be connected to an external power supply, ready to be tested. Working properly, this receiver will prove itself to be a capable performer. "Conning" the crowded ham bands is a leisurely performance with a 50 to 1 ratio vernier dial. In practice, it will be found that the condenser C_4 is useful where it is desirable to speed up the action of the vernier dial. To elucidate, the slow action of the high ratio dial makes retuning to bring out a wanted signal a slow process. When the desired signal is ap-

(*Continued on page* 188)

Top view of converted unit. Transmitter is shown at left, receiver appears at right.



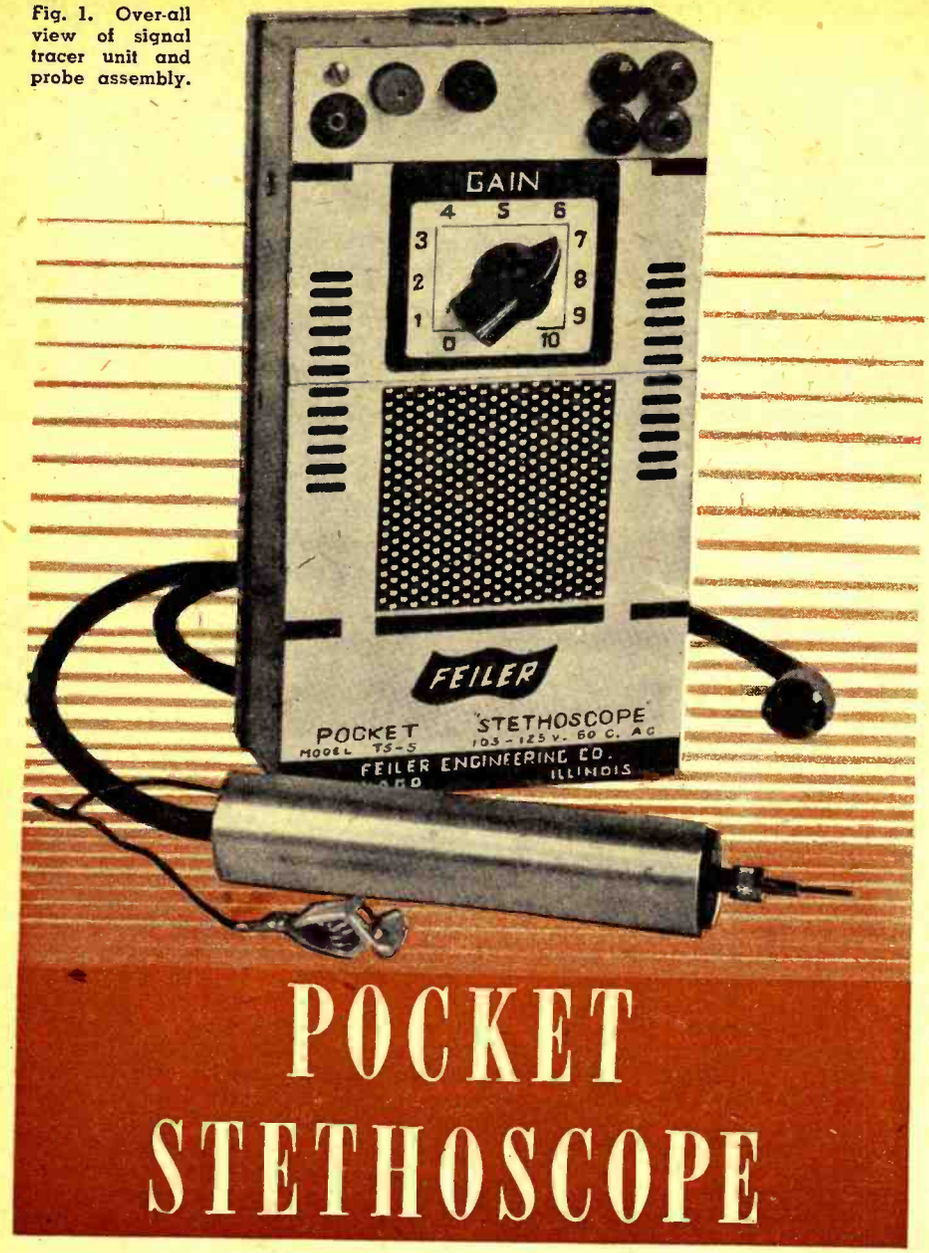


Fig. 1. Over-all view of signal tracer unit and probe assembly.

POCKET STETHOSCOPE

By **ROBERT L. FARNSWORTH**
Eng. Dept., Feiler Eng. Co.

Design characteristics of a compact, commercially manufactured, signal tracer type test instrument.

TOP-NOTCH servicemen and engineers have long demanded a high quality signal tracer type instrument in handy pocket form. Through practical experience, they have found that signal tracing is one of the newest and most basic methods yet devised to simplify repairs on radios and other electronic equipment. However, up until only recently there was no convenient way to make use of this technique outside of the shop or laboratory.

Because of the widespread application of electronic equipment and because this equipment often requires servicing, technicians and engineers have long felt the need for an instrument which could be carried anywhere —to homes, factories, offices, farms, boats, planes, etc. The importance of portability in a signal tracing instrument has been emphasized by the fact that electronic equipment is becoming more and more complex. It is no longer possible to determine the causes of trouble by means of the old-time "feel, see, and smell" method. The signal tracing method has been found to be one of the best answers to the need for an instrument which permits laboratory-type exactness outside the laboratory—right on the job.

When the design of this instrument was first under consideration, portability was deemed to be of primary importance. Consequently, it was first decided to design the smallest possible tracing instrument which would be consistent with practical production methods. Other requirements considered essential were that not only must the set be extremely small, but it must retain all of the time-tested features found so useful in its predecessors; it should also make audible all signals, r.f., i.f., and audio without the necessity for tuning, changing leads, or using switches and other special controls; it must be capable of detecting open or shorted resistors, condensers, coils, transformers, and defective speakers; it should facilitate the location of the causes of dead sets, weak sets, intermittents, fading, noise, hum, distortion, mistracking, etc. In addition, the instrument should also include; (A) provision for visual indication of r.f. voltages such as the output of an oscillator in superhets; (B) provision for an output meter for silent visual tracing; (C) provision for headphones to be used for work which requires maximum sensitivity; and (D) a.c. operation and complete isolation from the line. This last feature would permit the instrument's use on a.c.-d.c. equipment without danger and without the introduction of hum.

All of these requirements were met in the design of the "Pocket Stethoscope" which is illustrated in Figs. 1, 2, and 3. Other important features were also incorporated, including provision for use of the instrument as a compact high-gain amplifier, for use with crystal or dynamic microphones, or for use with phonograph pickups. This feature eliminates the necessity for having an amplifier in the laboratory or shop.

The probe, which is of the high-sensitivity shielded type, uses a 12BA6 tube and provides amplification at the signal point. Full shielding prevents hum pickup and hand capacity effects. The probe housing is a cylinder one inch in diameter and three and one-half inches long. The ends are sealed with bakelite inserts of special tapered design. The front end can be removed easily for inspection or tube replacement. The front insert contains the pressed-fit metal test prod, the point of which will fit the standard alligator clip designed to accommodate headphone tips. This type of alligator clip can be obtained from any radio supply house and provides a means of clipping the probe into the circuit. The insert in the other end is provided with openings to accommodate the probe cable and ground clip. The cable is of the long-lasting, flexible shielded type, wired to a three-contact plug to fit the socket on the front panel. The ground lead is 14 inches long and has an alligator clip attached for convenience in grounding to the equipment under test.

Front panel controls have been reduced to a minimum in order to keep the operation of the instrument as simple and efficient as possible. In Fig. 1, the gain control appears just above

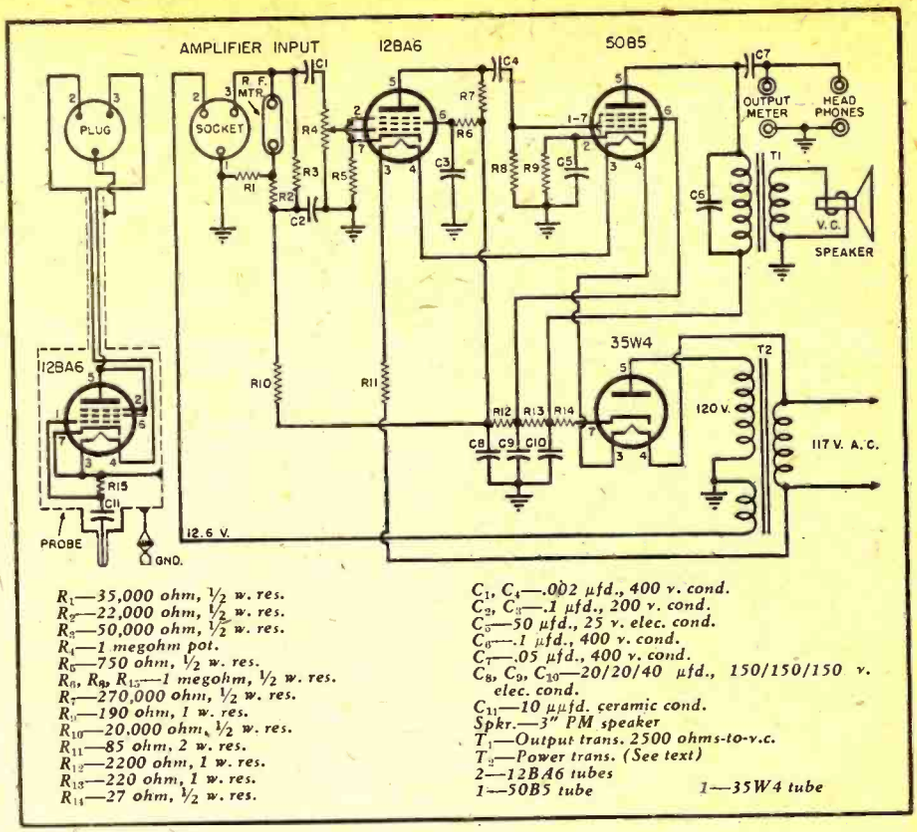
the speaker grille. The scale is calibrated from 0-10. This calibrated scale, in conjunction with the output meter, permits a relative comparison of signal strengths. Just to the left and above the gain control are the probe connection and r.f. meter jacks. Any 0-1 ma. d.c. milliammeter, when connected to these jacks, becomes an indicator of r.f. voltages. The r.f. meter is used primarily to check the output of the local oscillator in superheterodyne receivers. This output is non-modulated r.f. and cannot be read on the output meter which operates only on modulated r.f. or audio signals. The circuit is so arranged that the milliammeter becomes an indicator in a special bridge circuit which is formed by the probe tube and a balanced network of resistors and condensers.

To the right and directly across the front panel are located the output meter and headphone jacks. The output meter jacks will convert any rectifier type a.c. voltmeter, having a range of three volts or more, into a high impedance output meter. Nearly all standard volt-ohm-milliammeter sets are provided with a rectifier-type a.c. voltmeter which may be connected into the output meter jacks. With this arrangement an output meter can be connected at any point in a circuit with no effect on the operation of the circuit.

When the rear cover of the instrument is removed the unique mechanical design is fully revealed. No detail has been overlooked in providing durability and compactness. Above the speaker are located a 12BA6 tube used as a voltage amplifier, a 50B5 power output tube, and a 35W4 rectifier tube. These tubes are mounted as shown in Fig. 3. They are of the latest miniature type and have been selected for their rigid mechanical construction. Adequate ventilation for the tubes is provided by louvres in the front, side, and back of the case.

An eight-lug terminal strip is used for mounting the resistors and small condensers. Because of this strip, resistor and condenser leads are kept short, a feature which contributes to the long life of the instrument under the severe conditions imposed by portability. The only long wires necessary are those from the power and output transformers and the filter condenser. The power supply used is a ground-isolating transformer type with electrostatic shield. It operates from 105-120 volts, 60 cycle a.c. This type of power supply eliminates the possibility of short circuits, inherent with a.c.-d.c. supplies, when working with other a.c.-d.c. operated devices. It results in the elimination of all a.c. hum voltages due to common line connections as well.

The power transformer, T_2, is of special design, being a low-powered, midget type unit with two secondary windings supplying 120 volts and 12.6 volts. A transformer of this type is rather difficult to obtain on the open market. It is, however, possible to obtain two separate units, one being an isolation transformer with a 1:1 ratio, and the other a filament transformer with a 12.6 volt secondary winding. If desired, the filament transformer may also be made up of two 6.3 volt units connected so that their output voltages are additive.



R_1—35,000 ohm, ½ w. res.
R_2—22,000 ohm, ½ w. res.
R_3—50,000 ohm, ½ w. res.
R_4—1 megohm pot.
R_5—750 ohm, ½ w. res.
R_6, R_9, R_{13}—1 megohm, ½ w. res.
R_7—270,000 ohm, ½ w. res.
R_8—190 ohm, 1 w. res.
R_{10}—20,000 ohm, ½ w. res.
R_{11}—85 ohm, 2 w. res.
R_{12}—2200 ohm, 1 w. res.
R_{13}—220 ohm, 1 w. res.
R_{14}—27 ohm, ½ w. res.

C_1, C_4—.002 µfd., 400 v. cond.
C_2, C_3—.1 µfd., 200 v. cond.
C_5—50 µfd., 25 v. elec. cond.
C_6—.1 µfd., 400 v. cond.
C_7—.05 µfd., 400 v. cond.
C_8, C_9, C_{10}—20/20/40 µfd., 150/150/150 v. elec. cond.
C_{11}—10 µµfd. ceramic cond.
Spkr.—3" PM speaker
T_1—Output trans. 2500 ohms-to-v.c.
T_2—Power trans. (See text)
2—12BA6 tubes
1—50B5 tube
1—35W4 tube

Fig. 2. Complete schematic diagram of 4-tube, a.c. operated signal tracer.

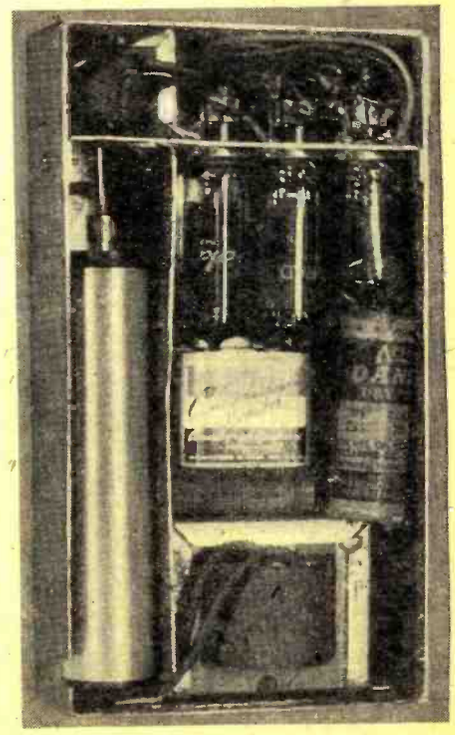
For maximum filtering of power supply hum a 3-section *RC* filter is used for the main power supply instead of the usual 2-section unit. The filter condenser is located just to the right of the speaker as shown in Fig. 3. The output transformer is located at the bottom of the probe compartment. The speaker used is a 3" PM unit with Alnico V magnet. The volume output of the instrument is high despite its small size.

The entire unit is self-contained in a sturdy metal case. The over-all case dimensions are 4⅛" wide, 8¾" high, and 2⅝" deep. This allows the unit to fit easily into the palm of the hand. The a.c. line cord and probe cable are wound on the inside back cover and the probe fits snugly into its special carrying compartment to the left of the speaker. This feature contributes compactness and assures complete portability.

The speaker grille, located just under the gain control, Fig. 1, is a stamped section of the front panel. This metal grille provides ample protection for the speaker and will resist marring and scuffing more readily than would grille cloth or other similar material. Louvres have been incorporated in the cabinet to insure sufficient air circulation for proper cooling. The unit is finished in brown with red and black borders and dials.

The new instrument will not only eliminate the necessity for lugging bulky equipment on outside jobs, but it can be used to cut down repair and development time in the shop and laboratory. Properly used, this "Pocket Stethoscope" can make service work simpler and faster. —30—

Fig. 3. Rear view, cover removed, shows placement of various component parts.



A POCKET V. T. V. M.

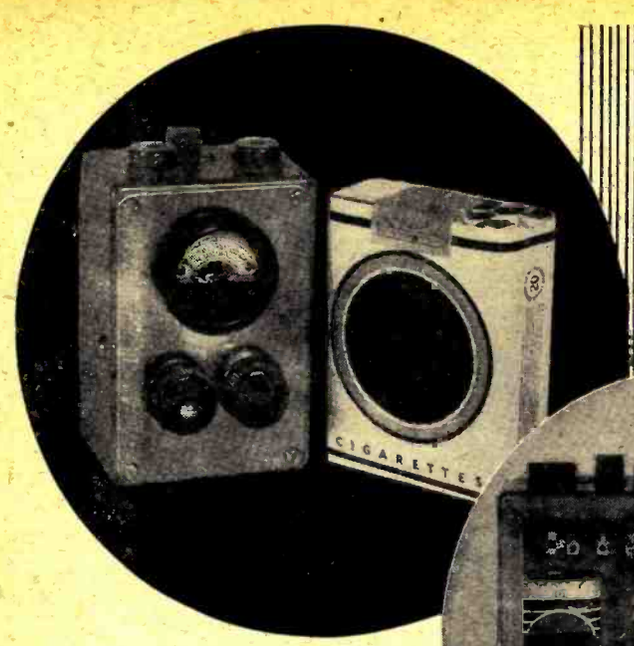


Fig. 1. External view of the completed vacuum-tube voltmeter. All components are self-contained.

Fig. 2. Partial assembly of the instrument before wiring. The meter, range switch, and zero-set rheostat are mounted on panel.

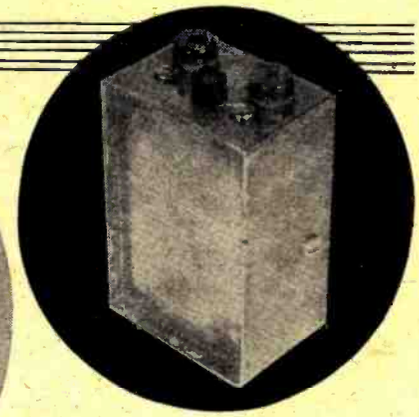


Fig. 3. Rear view of the instrument showing placement of power switch and the input terminals.

By

RUFUS P. TURNER,

W1AY

Complete construction data is given for a multi range d.c. vacuum-tube voltmeter weighing only 12 ounces and measuring 3 x 2 x 1½ inches.

THE tiny microammeter, tubes, batteries, selector switches, and rheostats now available make possible for the first time the construction of a truly pocket-sized vacuum-tube voltmeter. The completion of such an instrument, one that does not actually require a full-grown overcoat pocket, has been a will-o-the-wisp with experimenters for a long time. Since the time the author promised to describe a pocket v.t. v.m.,[1] our letter carrier has known very little peace of mind.

The v.t.v.m. to be described in this article fits easily into a coat pocket and may be held comfortably in one hand. It is just a little larger than a package of cigarettes, as may be seen from Fig. 1. Its outside dimensions are 3 inches high, 2 inches wide, and 1½ inch deep. The microammeter flange and adjusting knobs protrude slightly from the front panel (see Fig. 1), and the test lead tip jacks and the sliding button of the "on-off" switch protrude slightly from the top of the instrument case (See Figs. 1 and 3). The author's complete, self-contained instrument weighs only 12 ounces.

The instrument is entirely self-contained, the miniature "A" and "B" batteries being clipped in place inside the instrument case. The subminiature tube is mounted by its stiff wire leads which are soldered directly to circuit points.

This pocket v.t.v.m. was designed expressly for d.c. measurements, although a miniature external crystal diode probe will adapt it easily to a.c. and r.f. measurements as well. The meter ranges are 0-0.8, 0-8, 0-80, and 0-800 volts d.c. The range switching could have been set up for the more familiar 1, 10, 100, and 1000 volts, but insufficient space was available within the instrument for the series combinations of range resistors which would have been required. Input resistance of the present instrument is 10 megohms for all ranges.

Fig. 6 shows some of the important tiny parts used in the instrument, posed alongside a package of cigarettes for size comparison. Appearing from left to right, these components are; (1) *Eveready* miniature 22½-volt hearing aid "B" battery, (2) *Eveready* penlight cell, (3) 1-inch diameter microammeter made by *MB Instruments, Inc.*, (4) *Centralab* "dime-size" rheostat, (5) One of the new ¾-inch diameter rotary selector switches made by *Grayhill* of Chicago, and (6) *Mallory* sliding-bar type "on-off" switch. Item 7, the *Sylvania* 1W5 subminiature tube, is shown in front of the group.

Tube Used

The *Sylvania* type 1W5 tube is a subminiature pentode intended for hearing aid applications. In the pocket v.t.v.m. circuit (See Fig. 8), this tube is operated as a triode by connecting its plate and screen leads together. This small glass tube is less than one-half an inch in diameter and has an over-all length of about 1½ inches. It has no base, but stiff wire leads that take solder readily extend about an inch and a half through the bottom end of the tube. The leads may be identified easily by reference to Fig. 8. Tube characteristics are given in Table 1.

The 1W5 tube may be seen, with its spaghetti-covered leads soldered into the circuit, behind the front panel in Fig. 5. Even at the full lead length of 1½ inches, the leads are sufficiently rigid, especially when they are covered with thin spaghetti, to prevent whipping around of the tube.

Indicating Meter

The indicating meter is an *MB* Model 100, 0-200 d.c. microammeter. This is a readily available American-made miniature meter which has about the same diameter as a standard sweep-second wrist watch. Its front-face flange diameter is 1⅛ inches. The flange of this meter protrudes about 9/32 of an inch in front of the front panel, and the meter case

[1] "Putting the New Small Meter to Work," Turner, Rufus P., RADIO NEWS, January 1947. Page 52.

(including its rear terminals) extends about 1 1/16 of an inch back of the panel. Internal resistance of the 0-200 d.c. microammeter is approximately 510 ohms.

Adjustment Rheostats

Two rheostats are used in the circuit. One of these is the familiar *zero set,* used to set the meter initially to zero after the batteries have been switched on. This rheostat is R_9 in Fig. 8. The other is the *calibration control,* R_5 in Fig. 8.

Both rheostats are the new *Centralab* Model 1 "Radiohms," having less diameter than a dime and very little more thickness than that coin. These rheostats do not have conventional shafts, but are provided with very short studs having a fine-threaded (1-72) central hole. The smallest obtainable bakelite knob was fastened to a zero-set rheostat (lower left-hand corner of the front panel in Figs. 1 and 4) by means of a 1-72 screw, passed through a clearance hole drilled in the knob and into the rheostat stud. Since the calibration rheostat (R_5 in Fig. 8) does not need continual adjustment, no external knob was provided for this component. Instead, a short 1-72 screw has been inserted into its threaded stud and is accessible for occasional screwdriver adjustment through a small clearance hole near the top of one side of the instrument case (See Fig. 4).

These new rheostat-potentiometer's have twin sliding contacts and are rated at 1/10 watt.

Range Switch

The single-pole, 4-position, nonshorting, rotary selector switch (S_1 in Fig. 8) is a new development of *Grayhill* of Chicago. This is a phenolic-encased unit provided with a standard 1/4-inch-diameter shaft. The entire switch is only 3/4 inch in diameter and extends only about 1/2 inch behind the front panel. These features make it suitable for use in pocket equipment.

Circuit

The complete wiring diagram of the pocket v.t.v.m. is given in Fig. 8. This circuit will be recognized as straightforward and simple. It is a battery-operated triode circuit with a high-resistance input voltage divider for range switching, and a plate bridge circuit for zero setting.

Range Switch. Switch S_1 and resistors R_1 to R_4 comprise the input voltage divider (range switch). The total resistance of the input resistor string is 10 megohms.

Each of the four resistors in the input voltage divider must be selected with great care as to their ohmic value. However, it is not necessary that the *exact* values given in Fig. 8 be held to, if any error in one resistor is matched by an error of the same *percentage* and in the same direction in *each* of the three other resistors. The author experienced no difficulty at all in making a satisfactory selection of resistors from a store stock, using his own freshly-calibrated ohmmeter for the purpose.

Resistors R_1, R_2, and R_3 are soldered directly between contact lugs of selector switch S_1. Resistor R_4 is connected from the lower switch contact to ground (metal instrument case).

Condenser C_1 connected to the range switch and tube control grid, serves to bypass any a.c. component which may be introduced via the input terminals.

Input Terminals. The d.c. voltages to be measured are applied to the input terminal jacks, J_1 and J_2. The latter are insulated phone tip-type jacks which receive test leads having phone tips on their ends. These jacks are somewhat shorter than banana jacks. The positive polarity of the test voltage is applied to the grid jack (labelled "+" in Fig. 8); the negative polarity to the grounded jack.

Zero-Set Circuit. The balancing circuit is a conventional plate-circuit bridge, with rheostat R_9 as the actual zero-set control. The instrument has been found to be stable in operation, frequent resetting of zero not being required. The setting of rheostat R_5 will influence the zero-set position of rheostat R_9. Adjustment of these two rheostats will be described fully under *Adjustment and Calibration.*

Filament Polarity. For best operation of the circuit, it is imperative that the negative return, including R_3 and R_6, be connected to the *negative* filament terminal of the tube (lead 4 in Fig. 8). If the tube filament terminals are reversed, difficulty will be experienced in setting the meter to zero and of maintaining the zero setting as the impedance (resistance) of the test-voltage source varies.

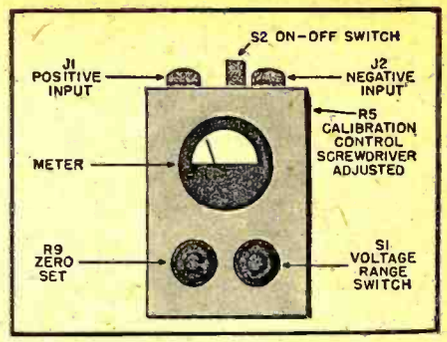


Fig. 4. Identification of components visible on the outside of the instrument case.

Battery Switch. S_2 is the ganged sections of the small-sized, double-pole "on-off" switch. A single movement of this switch bar connects or disconnects both "A" and "B" batteries simultaneously.

Electrical Wiring and Mechanical Construction

For compactness, as many of the components as possible are soldered directly to other components without using intervening leads. For example; the pigtails of resistors R_1 to R_4 are soldered directly to the contacts of switch S_1, resistor R_{10} is soldered directly to the center contact of rheostat R_9, and resistor R_6 to rheostat R_8. Both R_7 and R_8 are soldered directly to the negative terminal lug of the microammeter. This procedure greatly simplifies the problem of mechanically mounting the parts in an instrument which is so small as to outlaw the use of insulated terminal strips.

The lead from input jack J_1 to the top terminal of switch S_1 and the lead from the arm of S_1 to the tube grid are both shielded in the following manner. A tight jacket of shield braid is pulled on the insulated lead, and a length of spaghetti is pulled over the shield braid. The shield braid is grounded at each end. Covering the shield braid with spaghetti in this

Fig. 5. The completely assembled and wired instrument with the front panel removed to show construction. The subminiature tube is pointing upward near the center of the front panel.

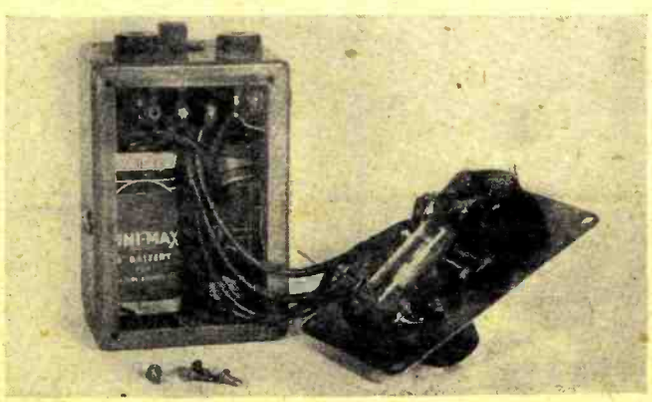


Fig. 6. Parts used in building the pocket v.t.v.m. Shown left to right: "B" battery, "A" battery, microammeter, rheostat, selector switch, "on-off" switch. The 1W5 tube is shown at front.

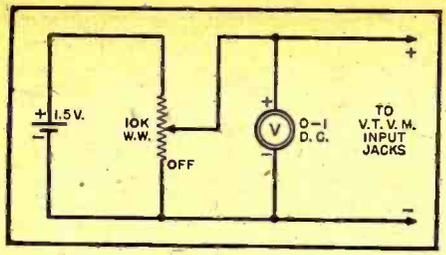


Fig. 7. Calibration circuit. Any type of voltmeter may be used in place of the 0-1 d.c. unit, however, it should be accurately readable to one-tenth of a volt.

Sharp Cut-off R. F. Pentode	
D. C. Fil. Voltage	1.25 v.
D. C. Fil. Current	40 ma.
D. C. Plate Voltage	30 v.
D. C. Screen Voltage	30 v.
D. C. Grid No. 1 Voltage	0 v.
D. C. Plate Current	420 μa.
D. C. Screen Current	160 μa.
Plate Res. (approx.)	.7 meg.
Transconductance	430 μmhos
Diameter	.400" max.
Over-all Length	1.5" max.
Mounting Position	Any

Table 1. Characteristics of 1W5 tube.

manner prevents accidental contact between the braid and various circuit components near which it passes.

For support, the tube leads, after being covered with thin spaghetti tubing, are soldered directly to points in the circuit. For example: Tube leads 7 and 8 are joined together and soldered to the positive terminal lug of the microammeter, lead 4 goes directly to one terminal of switch S_2, and lead 5 is connected to the positive terminal of the 1½-volt dry cell. Care must be exercised in soldering to the tube leads, especially if the latter have been clipped shorter, not to apply the soldering iron for any longer time than is necessary to obtain a good soldered joint.

Insulated wire leads were soldered directly to the terminals of each battery. However, the author later has learned that special "snap fastener" connectors now are available for the miniature "B" battery and may be attached to the ends of the leads.

In Fig. 5, several spaghetti-covered leads may be seen extending into the case proper from parts, including the tube, mounted on the front panel. These leads are tucked into the space between the "A" and "B" batteries when the front panel is placed into position on the instrument case.

The author's instrument is housed in a 3"x2"x1½" brass case. The removable brass front panel is a little under 2"x3" in size and is held to the case by means of four tiny self-tapping screws. A quarter-inch hole in the front panel was further reamed out carefully to admit the zero-set rheostat, R_9, which then was pressed into this hole for a nice, tight fit. This rheostat is clearly seen mounted in this manner in Fig. 2.

Rheostat R_8 is mounted by means of two small soldering lugs to one side of the instrument case and provided with a short 1-72 screw (with flat head) for screwdriver adjustment (See position in Fig. 4). A clearance hole in the wall of instrument case admits the blade of a pocket-size screwdriver for this adjustment. The 2-lug mounting is accomplished by slipping the small holes of each lug over the 1-72 mounting screw molded into the rheostat, replacing the 1-72 nuts, and passing 6-32 supporting screws through the large holes of the lugs.

If a non-metallic panel and case are employed to house the instrument, both rheostats may be mounted directly to the outside of the panel by means of their molded-in mounting screws, and clearance holes may be drilled for the three terminal lugs of each rheostat. The rheostat thickness is only about two-tenths of an inch, a very small projection beyond the front panel. *Centralab* supplies a special knurled disc, in lieu of a larger knob, for turning a rheostat mounted in this manner.

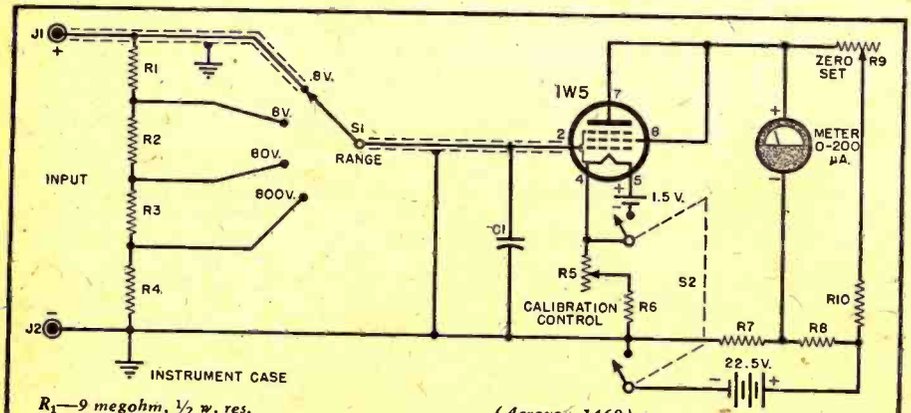
Also, in Fig. 2, which is a partial-assembly photograph, the phosphor bronze battery-holding clips are clearly visible. This simple method holds the batteries rigidly in place. When replacing batteries, the clip-retaining screws are removed from the sides of the instrument case, the spring clips removed, and the old batteries lifted out.

A rectangular hole, $1\frac{1}{32}$"x$1\frac{7}{32}$" is cut in the center rear portion of the top of the instrument case to clear the square bar knob of the "on-off" switch, S_2. This cutout, with switch in place, may be seen in Fig. 3. The sliding-type switch specified in Fig. 8 was the smallest such component that the author could find. Unfortunately, the double-pole switch is supplied only with the double-throw feature which is not needed in this voltmeter application. However, this in itself is not important, since it is easy to leave unused the two unneeded contacts at one end of the switch.

Clearance holes are drilled through the top of the instrument case, along the front portion, to accommodate the two insulated input jacks (See Figs. 1, 2, 3, and 5). The author found the insulating washers supplied with these jacks to be adequate insulation for the positive terminal at the 800 volts maximum input. However, the washers were wax impregnated for increased safety. If an instrument case of non-conducting material is used, insulating washers will not be required on the input jacks.

Individual builders may apply their own ingenuity where the instrument knobs are concerned. It is not necessary to follow our lead in this respect. As will be seen from Figs. 1 and 4, the author used the smallest available tapered, fingergrip knobs for the zero adjuster (R_9) and voltage range switch (S_1). Many other interesting possibilities will suggest themselves to a fellow who is handy with a lathe. For instance, modernistic disc-type knobs may be recessed into a thicker front panel, or handle-type adjusting levers might be employed.

Fig. 8. Complete circuit diagram of the pocket vacuum tube voltmeter.



R_1—9 megohm, ½ w. res.
R_2—900,000 ohm, ½ w. res.
R_3—90,000 ohm, ½ w. res.
R_4—10,000 ohm, ½ w. res.
R_5—500 ohm, "dime size" rheostat (Centralab Model 1 Radiohm)
R_6—500 ohm, ½ w. res.
R_7—20,000 ohm, 1 w. res.
R_8—2000 ohm, 1 w. res.
R_9—1000 ohm, "dime size" rheostat (Centralab Model 1 Radiohm)
R_{10}—7500 ohm, 1 w. res.
C_1—.002 μfd. midget silvered mica cond. (Aerovox 1469)
Meter—1" diam. 0-200 d.c. microammeter (MB Model 100)
S_1—S.p., 4-pos. non-shorting subminiature rotary selector sw. (Grayhill No. 5004)
S_2—D.p.d.t. miniature slide sw. (one side not used) (Mallory S3)
J_1, J_2—Insulated phone-tip jacks
1—1½ v. penlight-size cell (Eveready No. 915, Size AA)
1—22½ v. subminiature "B" battery (Eveready No. 412)
1—1W5 subminiature tube (Sylvania)

Adjustment and Calibration

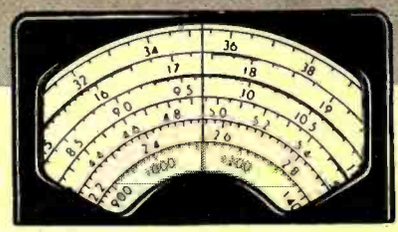
This v.t.v.m. does not read linearly, consequently the reader's instrument must be given its own calibration. But this is not a hard job if the following instructions are adhered to closely.

Preliminary Check. After the assembly and wiring have been completed and have passed inspection, make this initial check—*with no test leads connected to input jacks J_1 and J_2:*

(1) Set range switch S_1 to its .8-volt position. (2) Switch on batteries, noting that the meter is deflected immediately either above or below zero. (3) Adjust zero-set rheostat R_9 to bring microammeter pointer exactly

(*Continued on page* 112)

International SHORT-WAVE



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

IT IS a pleasure this month to dedicate the ISW Department to radio in Austria, and particularly to *Radio Wien,* Vienna.

For this material we are indebted to Paul Kary, Pennsylvania, and to Miss Hilda Hartner, secretary-general of *Radio Wien,* who sent these details to Mr. Kary:

On October 1, 1924, the *Osterreichische Radioverkehrs Ag. (Ravag)* presented its first official broadcast. It was a rather unpretentious beginning with temporary means—the studio being a mere garret. However, development was rapid. The first transmitter —Rosenhugel—was built within a few months. In December 1925, the transmitting stations at Klagenfurt and Innsbruck were established, and in June 1928, the radio stations at Linz, and a little later, the broadcasting stations at Salzburg and Vorarlberg followed.

Climax of technical development was construction of the big Bisamberg station, where the first self-radiating tower for mean waves (provided with a directional antenna beamed to the west) was used.

Broadcasting House was constructed in Vienna between 1935 and 1937 as a program and technical center. It involved considerable modern equipment and gained worldwide reputation as to performers and producers. At present it includes more than 80,000 cubic meters of walled-in space, administrative and technical bureaus, 16 studios for musical performances, conferences, and plays, and 14 additional operating and control rooms. A beautiful, big music hall serves for larger performances and for representative purposes.

Amplification is centralized in one single, large hall, made possible by an intricate automatic control system for the whole technical plant. By pressing only a few buttons and keys, the technical engineer can establish all connections necessary for one transmission. Thus, not only the amplifier chosen for the transmission, but also all the sound, control, signal, and telephone connections are put to work simultaneously. At the same time, circuits chosen are automatically blocked for all other studios. No less than seven transmissions can be accomplished at one time.

Broadcasting House is provided with a climatic plant so as to insure air conditioning appropriate for radio work.

In 1938 the Austrian Broadcasting System comprised these transmitting stations: Station Bisamberg, 100 kw., station Stubenring, 5 kw., short-wave station, 5 kw., Vienna; station St. Peter, 20 kw., Graz; station Freinberg, 20 kw., Linz; station Klagenfurt, 5 kw., Klagenfurt; station Monchsberg, 2 kw., Salzburg; station Aldrans, 2 kw., Innsbruck; and station Dornbirn, 5 kw., Dornbirn.

During the German occupation practically no changes took place. A transmitting station, however, was erected at Graz-Dobel, 100 kw., to beam transmissions southeast to the Balkans.

Listener statistics compiled by *Ravag* show that after 5 years of operation of the Austrian Broadcasting System, that is in 1929, there were 360,000 receiving sets in the country. In 1934 the number had risen to 510,000; at the time of the German annexation of Austria *(Anschluss),* in 1938, there were 630,000. In 1947 the number of receivers in Austria was estimated at about 900,000.

During World War II a great number of receiving sets was destroyed. As soon as the radio industry is able to get into normal production again, it is expected that the number of receiving sets in Austria will increase considerably. Today, Austria ranks first among the European countries as to per-cent of listeners, *Ravag* claims.

Ravag, Vienna, at present employs about 500 persons in addition to a large staff of artists and free lance personnel.

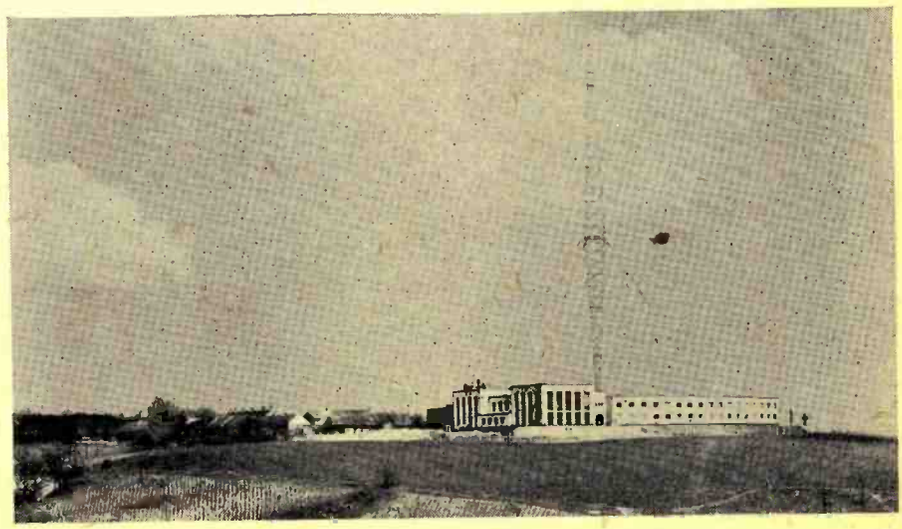
The program review, *Radio Wien,* appears weekly but because of current paper shortages is of rather modest size. Much improvement has been noted in this radio publication during the past year.

In the late war, when the Russian armies approached Vienna, the SS (Kampfsender Prinz Eugen, or military personnel of broadcasting forming Prinz Eugen) blew up the transmitting station at Bisamberg. Five bombs exploded within the area of Broadcasting House, destroying the studios used for recitals and plays; some 15 other bombs exploded in the gardens surrounding the building. Damage was quite heavy. While the struggle for Vienna went on, all movable equipment (reporting and transmitting cars, autos, and so on), with a large part of the technical outfit, was evacuated to the west or was lost in some other way.

On April 8, 1945, Russian troops entered Vienna. By April 29, *Radio Wien* was able to broadcast the inaugural address of the new government —everything being accomplished by means of temporary technical equipment of the poorest kind. Even today the antennas of one of the medium-wave transmitters and of four short-wave transmitters are atop Broadcasting House.

(*Continued on page* 128)

Broadcasting station "Bisamberg" near Vienna which was destroyed by the Germans in 1945 when they evacuated the city. The station is now being rebuilt.



Practical RADIO COURSE

New G.E. a.c.-d.c., 5½ pound, personal portable using four tubes and selenium rectifier.

By ALFRED A. GHIRARDI

Part 56. The design and operation of FM receiver type i.f. transformers.

THE intermediate-frequency amplifier in an FM receiver, as in an AM receiver, contributes a major part of the r.f. gain of the receiver and provides the selectivity that is desirable for avoiding interference from adjacent-channel FM transmitters.

From the standpoint of obtaining good selectivity and high gain per i.f. stage at low cost, use of a low intermediate frequency would be desirable. However, with the increasing popularity of FM, resulting in more and more FM transmitters in close proximity laying down strong local fields, the use of high [1] values of intermediate frequency in FM receivers has become mandatory in order to reduce the probability that spurious interfering responses (especially image-frequency [2] response) will occur, even though use of these higher values of i.f. makes the realization of satisfactory gains and stability more difficult and expensive to attain. Consequently, the industry has been forced to compromise on values of i.f. which result in acceptable gain and stability and yet sufficiently reduce spurious responses so that interference-free reception is obtained. This compromise has been aided considerably by the wartime development of greatly improved components for use at these higher intermediate frequencies.

Rules for Choice of Intermediate Frequency

There are several practical rules concerning the choice of a desirable i.f. value that it is well to know:

1. The i.f. should preferably be a value slightly *more* than one-half the range of the receiver tuning band so that all the possible image frequencies will lie *outside* of that band. Then, no transmitter engaged in the same class of service for which the receiver is designed will have an operating frequency that qualifies it as an *image* signal. Consequently image interference from such transmitters cannot occur.

2. However, the i.f. value chosen should not be such as will cause any of the possible image frequencies to lie in a band in which strong signals from some other radio transmission service are likely to be encountered, for these will then qualify as image signals and cause image interference.

3. Also, the i.f. value chosen should not be a frequency at which strong signals from some other radio transmission service are likely to be encountered, for such signals may find their way directly into the i.f. amplifier through any one of several paths and be accepted by its tuning circuits, resulting in direct-i.f. interference with the desired signal that is also there.

Let us now see how these rules were applied for selection of the values of i.f. that have been employed in FM broadcast receivers.

The earliest prewar FM broadcast band assigned the United States by the FCC extended from 42 to 45 mc., a bandwidth of only 45-42 = 3 mc. Half of this band is 3/2 = 1.5 mc. Use of an i.f. value slightly greater than this would be indicated by Rule 1. Actually, an i.f. of 2.1 mc. was used in early FM receivers designed for this signal frequency band. Later, i.f. values of 3.2 or 3.3 mc. were employed in them.

FM broadcast transmission was later reassigned to the wider frequency band from 42 to 50 mc. This is a band 50-42 = 8 mc. wide. Half this value is 8/2 = 4 mc. Rule 1 would indicate use of an i.f. value slightly greater than this. (Incidentally, use of an i.f. value of 4 mc. was not satisfactory since there was possibility of strong direct i.f. interference from strong signals in the 80 meter, 3.5 to 4 mc., amateur phone band.) A somewhat higher value of 4.3 mc. was chosen and

[1] See Alfred A. Ghirardi, Practical Radio Course, Part 53. (RADIO NEWS, May 1947)

[2] The *image frequency* is that frequency which differs from the desired signal frequency by *twice* the intermediate frequency, and which lies on the same side of the desired signal frequency as does the oscillator frequency. See Alfred A. Ghirardi, Practical Radio Course, Part 54, (RADIO NEWS, July 1947)

recommended by the RMA Engineering Department as an industry standard. It was used in most FM broadcast receivers manufactured during the prewar period. This was satisfactory because, since the oscillator frequency in these receivers was made *lower* [3] than the signal frequency, and the i.f. had to be made more than one-half of the total band, use of a 4.3 mc. i.f. made the image-frequency for the lowest-frequency signal (42 mc.) in the band occur at 42 − (4.3x2) = 33.4 mc. The image-frequency for the highest-frequency signal was 50 − (4.3x2) = 41.4 mc. Since this 33.4 to 41.4 mc. range of image frequencies lay well outside of (below) the prescribed 42-50 mc. FM broadcast band, image-frequency interference from other FM broadcast transmitters operating within this band would not occur.

Introduction of the 6SG7 type semi-remote cut-off, high-gain amplifier pentode tube and its use in i.f. amplifiers made possible considerable improvement in over-all stability since its plate-to-grid capacitance is very low and separate cathode base pins are provided for the grid and plate return circuits, thus reducing the coupling between these two circuits to a minimum. It aided in improving the performance of these 4.3 mc. i.f. amplifiers.

The postwar reassignment of FM broadcasting (including Educational, Commercial and Facsimile services) to the much wider band of higher frequencies between 88 and 108 mc. (a band 108-88 = 20 mc. wide) has made advisable another upward revision in the i.f. to be employed in FM receivers designed for this band. The RMA standard recommended i.f. value for use in such FM receivers is 10.7 mc. Here again, the same reasoning has been applied for selection of the i.f. value. One-half of this present FM band is 20/2 = 10 mc. Therefore, in order to throw the first image response outside of this band, the i.f. had to be made somewhat greater than 10 mc. Since postwar receivers employ an oscillator frequency *higher* than the signal frequency (by an amount always equal to the i.f.) selection of 10.7 mc. for the i.f. value places the image frequencies in the band between 88 + (10.7 x 2) = 109.4 mc. and 108 + (10.7 x 2) = 129.4 mc. The band over which the image frequencies lie is illustrated by the dotted rectangle in Fig. 1A. Observe that none of the image frequencies occur in the FM broadcast band; consequently no signal from an FM broadcast transmitter can qualify as being the image for the signal from any other FM broadcast transmitter. Therefore image-frequency interference from such a source cannot occur.

The possibility that there are transmitters for other types of services operating at frequencies in this image-frequency range must be checked. The only radio transmission services that have allocations in this image frequency range are as follows: 108-118 mc. Government; 118-122 mc. Airport Control; 122-132 mc. Aero. mobile (primarily non-government). Such transmitters are few in number, are of relatively low power and range and are not likely to cause interference with local FM broadcast service even if one happens to be located in the vicinity of an FM broadcast receiver.

It was stated that postwar FM receivers designed for the 88-108 mc.

[3] This is contrary to the practice commonly employed in AM broadcast receivers and in most present-day FM broadcast receivers. It was resorted to at the time mainly because it was desirable to reduce the frequencies at which the oscillator had to operate, since the art of constructing stable, low-cost v.h.f. oscillators for use in these receivers had not progressed sufficiently far at the time.

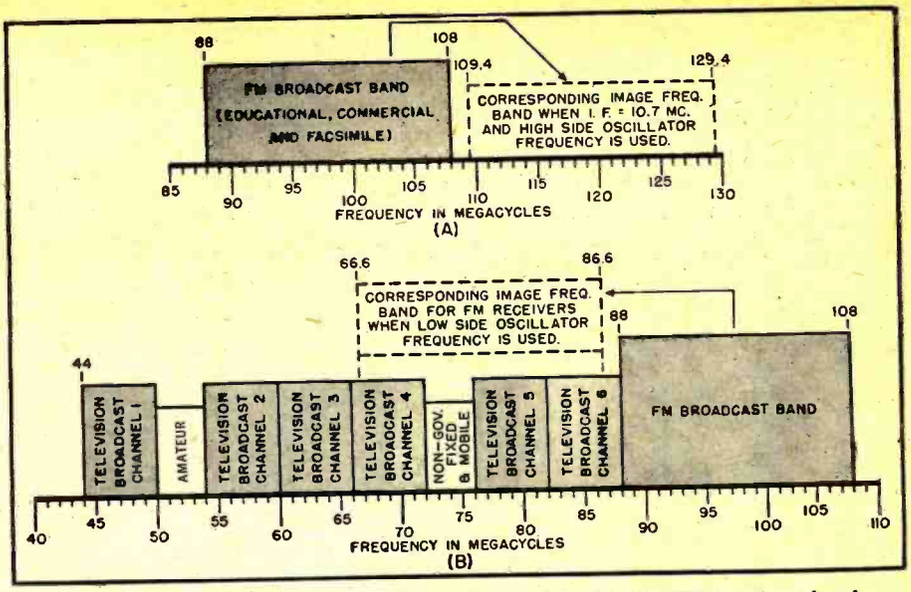


Fig. 1. (A) Observe that none of the image frequencies fall in the FM broadcast band when the oscillator frequency is higher than the signal frequency. (B) Oscillator frequency is always higher than signal frequency in 88-108 mc. FM receivers. If it were lower the image frequencies would fall in the television broadcasting band.

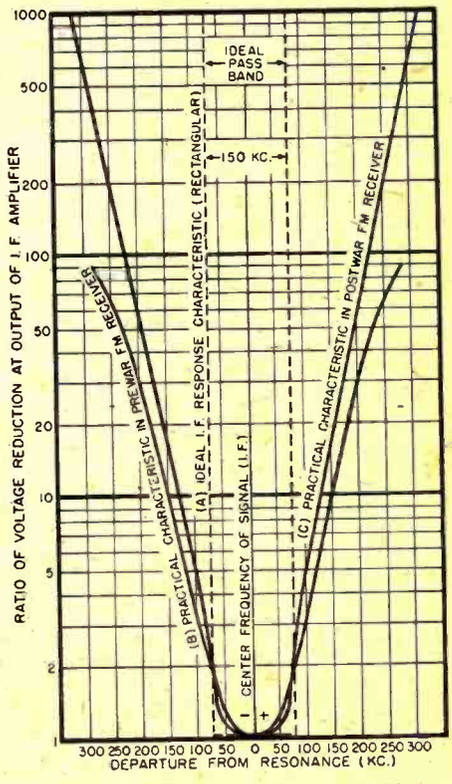
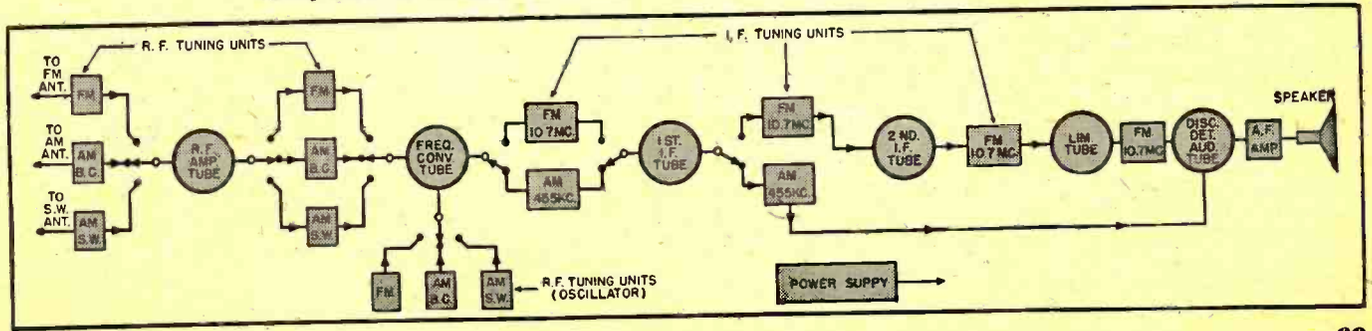


Fig. 2. Ideal and practical over-all i.f. selectivity characteristics for FM receivers.

Fig. 3. Elements of one type of combination FM-AM broadcast receiver in which different tuning units are switched into a basic superheterodyne circuit for FM, AM, and SW.



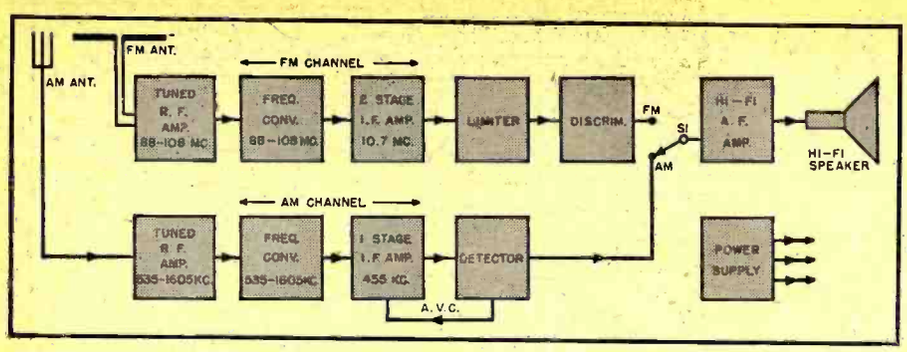


Fig. 4. Elements of type of combination FM-AM broadcast receiver in which completely separate FM and AM superheterodyne channels are used with a common high-fidelity audio amplifier and loudspeaker that may be switched to either channel for FM or AM.

FM band employ an oscillator frequency *higher* than that of the signal frequency (by an amount always equal to the i.f.). There is a good reason for this. If an oscillator frequency *lower* than that of the signal frequency were employed, the image-frequencies would lie in the frequency band between 88 − (10.7 x 2) = 66.6 mc., and 108 − (10.7 x 2) = 86.6 mc. As this lies directly in the frequency band assigned to television broadcast transmitters in Channels 4, 5 and 6, and to the 72-76 mc. channel assigned to non-government fixed and mobile services (as illustrated in Fig. 1B), there would be strong possibility of signals from such transmitters causing image interference in nearby FM broadcast receivers. Use of "high side" oscillator frequency in the FM receivers avoids this (see Fig. 1A), as already explained.

Direct i.f. interference at 10.7 mc., from transmitters operating at this frequency, is unlikely to occur, since the FCC frequency allocation for the band 10.2 — 11.3 mc. is for fixed-aero-fixed services. No transmitter in this band is assigned to a frequency of 10.7 mc.

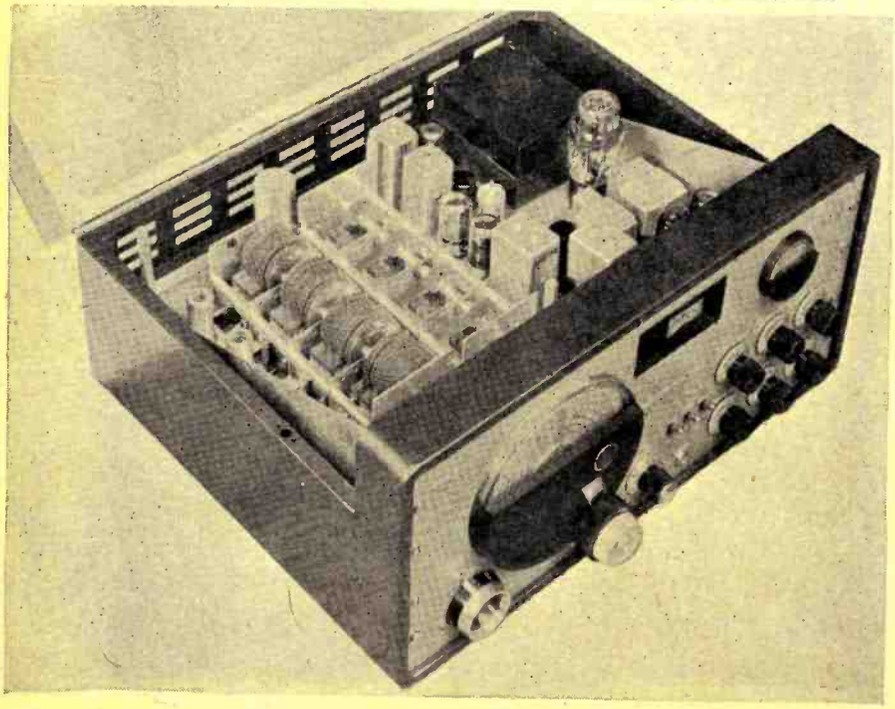
Before leaving this subject it should be mentioned that some manufacturers have used intermediate frequencies other than the RMA recommended standard value of 10.7 mc. in some of their postwar 88-108 mc. FM broadcast receivers, and many of these receivers are in operation. Intermediate frequency values of 8.25, 8.3 or 8.6 mc. have been most used in these receivers, primarily because they make possible the operation of the oscillator and i.f. circuits at frequencies a few megacycles lower than in the case when an i.f. of 10.7 mc. is employed. The bands in which the image frequencies lie when each of these off-standard i.f. values are employed in FM broadcast receivers are as follows:

I.F.	IMAGE FREQUENCIES
8.25 mc.	104.5—124.5 mc.
8.3 mc.	104.6—124.6 mc.
8.6 mc.	105.2—125.2 mc.

Reference to Fig. 1A indicates that in each case the image-frequency band for these receivers overlaps the extreme upper portion of the FM broadcast band. Although the 106-108 mc. portion of this band is now assigned to FM Facsimile broadcasting and few such transmitters are now in service, it is likely that there will be considerable activity in this field in the near future and such transmitters may cause image interference in these FM broadcast receivers unless wave traps are installed in them to reject the signals from particular interfering transmitters in this band.

Adherence to the RMA recommended 10.7 mc. i.f. value by all manufacturers of FM broadcast receivers would simplify the problems associated with the production, stocking, and replacement of i.f. transformer units employed in postwar receivers of this type, and also simplify the work of radio servicemen who are called upon to adjust, repair or replace them.

Fig. 5. A modern postwar communications receiver that provides AM or FM reception over a wide range of signal frequencies, and six i.f. selectivity characteristics to meet all reception requirements and conditions. Hallicrafter's Model SX-42.



I.F. Response Requirements of Hi-Fi FM Broadcast Receivers

As stated in the preceding article of this series, the maximum bandwidth is required for transmission of the FM signal when it is fully modulated at the highest audio modulating frequency. Since by FCC regulation, FM broadcast transmitters in the United States must confine their modulation effects to a band plus and minus 75 kc. from the assigned "center" frequency,[4] this regulation automatically defines the ideal i.f. amplifier selectivity characteristic desired in the FM broadcast receiver. Such an *ideal* i.f. amplifier would employ an i.f. of 10.7 mc. (postwar RMA recommended value), pass a band of frequencies 2 x 75 = 150 kc. in total width, and attenuate very rapidly thereafter so as to reject possible interfering side-band components of transmitters operating on adjacent broadcasting channels—especially those adjacent to the 88-108 mc. band. Fig. 2 illustrates an ideal broad-band, rectangular i.f. selectivity characteristic (drawn dotted) at *A*. Observe that it has a constant width or passband of 150 kc.

Because of the necessity for a design compromise between the opposing aims of obtaining maximum gain per stage and excellent suppression of adjacent-channel interference on the one hand, and of realizing uniform amplification of all transmitted sideband components on the other, most prewar FM broadcast receivers employed i.f. amplifiers having a response characteristic that is about one-half the peak at 75 kc. above and below the intermediate frequency, and having the general shape illustrated at *B* of Fig. 2. This characteristic has been drawn superimposed over the *ideal* characteristic for direct comparison. Observe that all sideband components having a frequency higher than about 50 kc. removed from the center frequency of the FM signal will be attenuated by the selectivity of this i.f.

[4] Alfred Ghirardi, Practical Radio Course, Part 55 (RADIO NEWS, October 1947)

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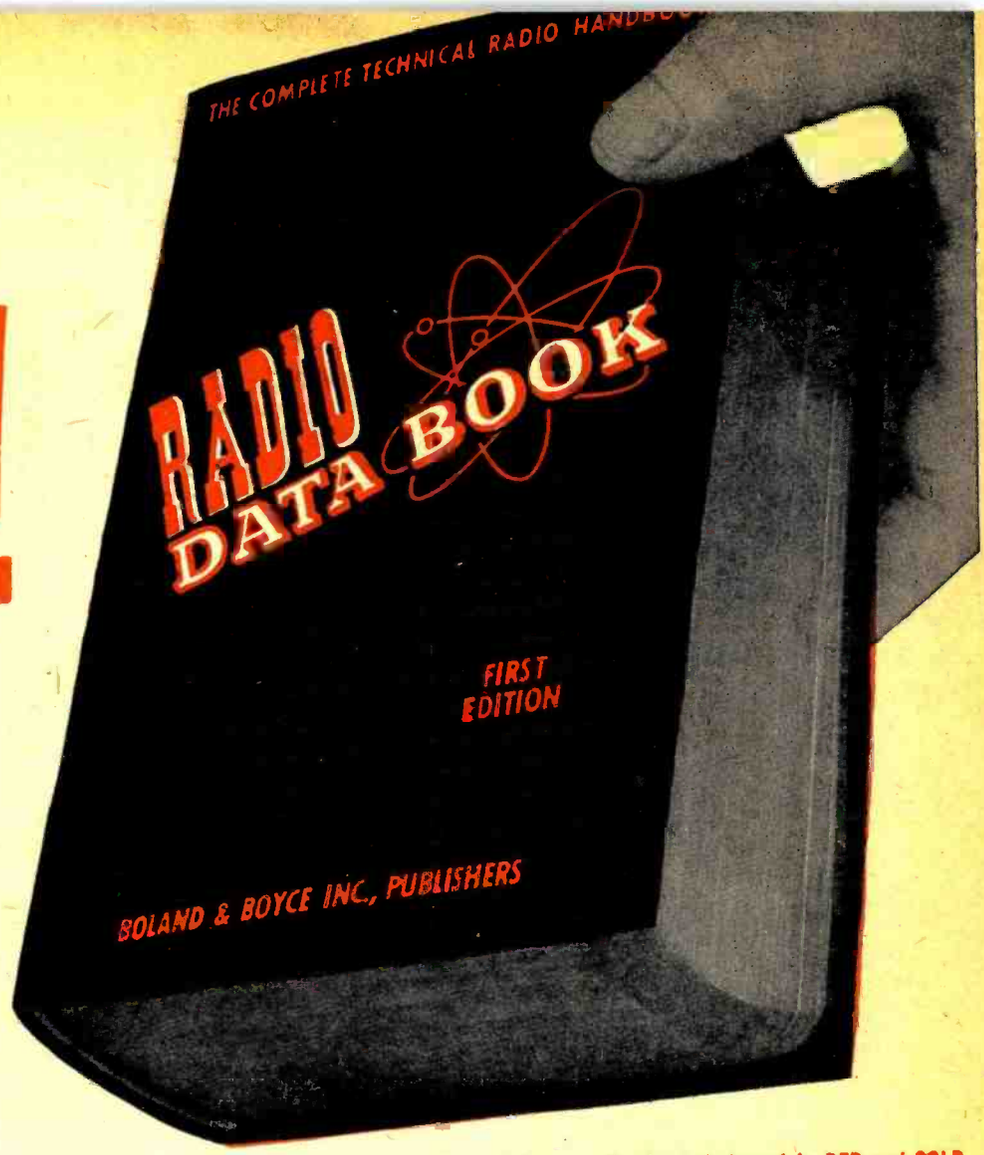

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amplifier. Those having frequencies that place them near the extremes of the ± 75 kc. signal band will be attenuated rather seriously. For example, sideband components having a frequency approximately ± 75 kc. removed from the center-frequency of the signal will experience a voltage reduction ratio of almost 2 to 1 (equivalent to almost 6 db. down).

Characteristic *C* in Fig. 2 is an improvement since it has a somewhat broader base and therefore causes less attenuation of the higher frequency components of the order of ± 75 kc. from the center-frequency of the signal. It is narrower than characteristic *B* for all frequencies beyond the theoretical ideal 150 kc. passband, so it provides better adjacent-channel selectivity.

If the highest degree of fidelity is to be obtained over the entire audio range in order to realize the full high fidelity advantages offered by the wide-band signal transmitted in FM broadcasting, an i.f. selectivity characteristic in which the signal is down only 1 or 2 db. at 75 kc. deviation is favored, even though it is more difficult to obtain high r.f. gain per i.f. stage when such a selectivity characteristic is employed. A characteristic of this type, whose end closely approaches that of the ideal rectangular characteristic *A*, also allows signals whose level is somewhat below limiting to be received without distortion, thus increasing the usable sensitivity of the receiver in locations where the noise level is very low. Its attainment makes the design of the i.f. amplifier in a high fidelity FM receiver more difficult, and its construction more expensive, than in the case for the narrow-band i.f. amplifier employed in narrow-band AM broadcast receivers.

I.F. Amplifier Requirements in Combination FM-AM Broadcast Receivers

To satisfy the widest demand, an FM broadcast receiver designed for home use should also provide for reception of AM broadcast stations over the 535-1605 kc. AM broadcast band, and those on one or more of the AM short-wave bands. The i.f. value and response characteristics desirable for receivers designed for reception of the AM broadcast stations was discussed in detail in the previous article of this series. It will be remembered that an i.f. value of the order of 455 kc. is now the RMA standard, and a passband characteristic approximately 10 kc. wide is required for this service. These values are also satisfactory for the reception of short-wave AM broadcast signals. For the FM broadcast reception an i.f. of 10.7 mc. is now the RMA standard, and a 150 kc. passband is required. How are both characteristics to be made available, at will, in one receiver?

The problem has been attacked in three different ways. In some combination receivers of this type, the receiver is designed primarily as a conventional 88-108 mc. FM broadcast re-

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ceiver containing an 88-108 mc. tuned r.f. stage, frequency converter, two stages of broad-band i.f. amplification (in which an i.f. of 10.7 mc., or 8.3 mc., is employed), a limiter, discriminator (detector), high fidelity audio amplifier, high fidelity loudspeaker, and power supply as illustrated in Fig. 3. The receiver is used this way for FM broadcast reception.

For AM broadcast reception, the r.f., oscillator and i.f. tuning units employed for FM reception are switched out of the circuit, and in their places are switched corresponding tuning units designed especially for AM broadcast band reception—a 455 kc. i.f. and 10 kc. passband being employed. For short-wave AM reception, a different set of r.f. and oscillator tuning units only, designed for the particular short-wave band to be received, is switched into the circuit. The same i.f. amplifier tuning units that are used for AM broadcast band reception are also used for AM short-wave reception.

For AM reception, the secondary winding of the third 455 kc. i.f. transformer is fed directly to a diode detector element in the combination tube that acts as discriminator, detector, a.v.c., and first audio tube. The limiter and discriminator are thereby bypassed. The same high fidelity audio amplifier and speaker are used for both FM and AM reception.

As we shall learn later, this general arrangement is widely used in other types of combination receivers that are designed to provide two or more different types of reception facilities. Combination FM-AM communications type receivers provide one example of this.

In another i.f. amplifier arrangement that has become popular, each i.f. transformer contains primary and secondary windings for both 455 kc. (AM) and 10.7 mc. (FM), and the changeover is accomplished automatically between the AM and FM bands. This type of transformer will be described more fully in a later article of this series.

In another version of the combination FM-AM receiver two completely separate channels are used up to the audio amplifier. One is designed especially for AM and the other especially for FM reception. This arrangement is illustrated in Fig. 4. The FM section comprises a superheterodyne circuit having one 88-108 mc. wide-band tuned r.f. amplifier, frequency converter, two wide-band 10.7 mc. (or 8.3 mc.) i.f. amplifier stages, limiter, and discriminator, feeding its audio output to the common high fidelity audio amplifier and loudspeaker that is switched to it. The AM section comprises a superheterodyne circuit having one 455 kc. i.f. stage with a 10 kc. bandpass characteristic, and a diode detector that provides audio output and a.v.c. voltage. The audio output is fed to the common high fidelity audio amplifier and loudspeaker that is switched to it.

(*Continued on page* 144)

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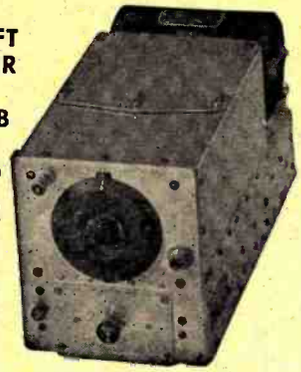
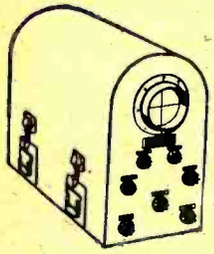
ARMY AIRCRAFT RECEIVER Model BC-946-B



Broadcast band from 520 to 1500 Kc; sensitive 6 tube receiver for the broadcast band with calibrated dial. Has one RF and two IF stages with iron core coils and air trimmers. "Perfect" for car radio, home radio, portable or P.A. tuner. BRAND NEW . . . complete with six tubes and instruction manual in sealed carton, less dynamotor. Each.....**$12.95**

BC-612



Modified BC-412, 5" Radar Oscilloscope; ideal for first class laboratory instruments; 110V 60 cycles, complete with tubes and power supply brand new in original cartons.

Each...**$49.95**

RADIO RECEIVERS

BC-453-A; 190-550 kc, complete with tubes; BRAND NEW IN ORIGINAL CARTONS**$7.95**
used.....$4.95

BC-454-A; 3-6 mc; complete with tubes; BRAND NEW IN ORIGINAL CARTONS**$5.95**
used..... 3.95

BC-455-A; 6-9 mc, complete with tubes; BRAND NEW IN ORIGINAL CARTONS**$5.95**
used..... 3.95

TRANSMITTERS (274N Series)

All Brand New in Original Cartons
Complete with Tubes and Crystal

BC-696—3-4 Mc.....**$7.95**
BC-457—4-5.3 Mc..... 5.95
BC-458—5.3-7 Mc..... 5.95
BC-459—7-9.1 Mc..... 5.95

DYNAMOTOR

DM 32A. Each 95c, 3 for.....**$2.00**

AN18/APT-10

Pre-amplifier model K-1, designed to raise output level of magnetic type microphone, complete with 2 tubes 6SL7GT and 28D7 and hand switch. brand new in original cartons.

Each **$1.95**, 3 for **$5.00**

REMOTE CONTROL BOX

BC-450-A.....**$1.95**

ARB AIRCRAFT RADIO RECEIVER

The ARB is a six tube, four band, superheterodyne Aircraft Radio Receiver with built-in dynamotor, designed for the reception of MCW (tone or voice) or CW within the frequency range 195 Kc to 9.05 megacycles.
Used.....**$16.95**

ART-13 TRANSMITTER

Used, in good condition, complete with tubes and calibrating crystal, freq. range 2,000 Kc to 18 mc; A-1, A-2, A-3 type transmission; power output 100 watts
Each.....**$67.95**

BC-929-A

Contains power supply 110 V, 400 cycles, has 7 tubes such as 3CP1, brand new, complete with tubes.
Each....$17.95
Used, ea 14.95

APS-15

Has 45 tubes, one 5" scope tube, one 2" scope tube, has 3 meters, 4 power supply units 110V 400 cycles, complete with tubes. Each.....**$39.50**

T-17B HAND MIKE

BRAND NEW . . . perfect carbon hand mikes, light wt., 200 ohms, single button, press to talk switch, 5 ft. rubber cord, plug, dust cover.
ONLY.....**69c**

VHF RECEIVER BC-701

Frequency range 170-180 Mc; IF 30.5 Mc; complete with 11 tubes; self-contained power supply, brand new in beautiful wooden carrying case.....**$9.95**

RAX-1 RANGE AND BROADCAST BAND RECEIVER

4 bands, tunes from 200-1500 Kc; MCW and CW signals; complete with tubes and 24V dynamotor, used in A-1 condition.
A REAL BUY.....**$14.95**

NAVY GLIDE PATH RECEIVER

Bolt type, complete with 3 6C6 tubes and tunes from 90 to 95 Mc, operates from 12 or 24V.....Brand new **$2.95**

RANGER MODEL 114-C AIRCRAFT RECEIVER

Combination Interphone, Amplifier and 6-Tube Superheterodyne Receiver designed to operate directly from a 24V aircraft battery. Tuning range 200 kc to 550 kc. complete with mounting rack, jackbox and cords. This unit is used as range receiver and interphone amplifier.
Brand new.....**$9.95**

GF12 and RU 17 NAVY RECEIVER and TRANSMITTER

Complete with receiving and transmitting coils, junction box, control boxes, plugs, power supply, instruction manual and spare parts which include tubes. Freq. Range: 200 Kc to 14 Mc. Brand new in original carton.
A real buy.....**$24.95**

GO-9

Navy type low and high frequency transmitter with power supply and tubes. Operates from 200 Kc to 18,100 Kc; requires 115V, 800 cycles.
Used, complete with tubes.....**$39.50**

HAND-TYPE MICROPHONE RS-38

Carbon type, with PL-68 plug, brand new...$1.95
Used..... 1.00

MICROPHONE AND RECEIVER P-60

Dynamic type, 50-ohm impedance; mike and phones interminate in 5-wire male plugs. 3-ft. cord.....**$1.49**

OXYGEN MASK MICROPHONE T44C

Used with SCR-522, magnetic type complete with JK-26 and PL-179. Used, A-1 condition.....**95c**

Wholesalers, dealers, institutions and other quantity purchasers . . . Write, Wire, Phone for Quantity Prices. All Shipments F.O.B. Chicago—20% Deposit Required on all orders. Minimum order accepted $5.00.

WRITE FOR OUR COMPLETE CATALOG

DEPT. C

RCA AVT-112A Aircraft Transmitter

For radio-telephone communication; for 6, 12 or 24 volt source freq. range from 2,500 to 6,500 Kc. Small in size and wt. (wt. 6 lbs.). Complete with 6 tubes, oscillator circuit, power amplifier modulators, dual tuning indicator and amplifier, with instruction manual, less crystal . . .
BRAND NEW IN ORIGINAL CARTONS—ONLY..... **$12.95** each

RCA AVR20 Aircraft Receiver

Companion for above..... **$12.95**

RECEIVER-POWER SUPPLY UNIT

For the APN-4 indicator; complete with 16 tubes; 110 V, 400 cycles;
BRAND NEW.....**$10.95**
Used.....**$7.95**

SETCHELL CARLSON RADIO RECEIVER

BC-1206-C

Designed to receive A-N beam signals. 24-28 vdc 21.6 watts. Tube complement: 14H7 or 14A7, RF amplifier; 14H7 or 14J7, mixer; 14A7 or 14H7, IF amplifier; 14R7, detector and 1st audio amplifier; 28D7, output amplifier. 195 to 420 kc. 4" high x 4" wide x 6⅝" long—wt. 3 lbs., 4 oz.
Used A-1 cond.....**$4.95**
BRAND NEW
in original carton..... **6.95**

RADIO TRANSMITTER and RECEIVER APS-13

Light weight air-borne radar system, radio transmitter and receiver APS-13; tube complement: 5—6J6, 9—6AG5, 1—VR105, 2—D21; unit is brand new, complete with tubes, the tubes alone are worth more than this LOW PRICE OF
ONLY.....**$10.95**

GLIDE PATH RECEIVER R-89/ARN-5

Glide Path Receiver used in the Instrument Landing System covering the frequency range 332 to 335 mc; complete with the following tubes: 7—6AJ5, 1—12SR7, 2—12SN7, 1—28D7, and including three crystals 6497KC, 6522KC, 6547KC . . . units are in A-1 condition for
ONLY.....**$8.45**

BC-733 D LOCALIZER RECEIVER

Freq. 108-110 Mc; Tube complement: 10 tubes—1—12SQ7, 2—12SR7, 1—12A6, 1—AH7GT, 2—12SG7, 3—717A;
NOW ONLY.....**$6.95**

SCR-522 TRANSMITTER and RECEIVER

The standard very-high frequency airborne receiver transmitter. 100 to 156 megacycles. 4 channels selected from remote control box. Used, as is—"Complete with Tubes"
ONLY.....**$14.95**
Excellent Condition $19.95

BC-625

VHF transmitter, frequency range 100-156 Mc; four channels. Part of the SCR-522. Complete with tubes less crystals.
Used, good condition.....ea. **$8.95**

BC-624

VHF Companion receiver for above transmitter. Complete with tubes less crystals. Used, good condition. Diagram with either unit included.....ea. **$8.95**

VEEDER-ROOT METER AND CASE

Counts up to 1000.
Each.....**95c**

WESTON OUTPUT METER No. 687

3 scales 0-50.
A-1 Condition
ONLY.....**$5.95**

ARROW SALES, INC.

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Don't Delay...ORDER TODAY!

BC-645 TRANSMITTER-RECEIVER

BRAND NEW . . . 15 tubes interrogator-transmitter designed for airborne use, 435 to 500MC frequency range, 5 tube tuned line transmitter with 30 Watts peak-impulse power output on either two channels. With some modifications the set can be used for 2-way communication, voice or code, on the following bands: ham band: 420-450mc; fixed and mobile: 450-460mc; citizens radio band: 460-470mc; television experimental: 470-500mc; complete with all tubes, including WE Doorknob tube. Size 10½"x13½"x4¾". Net wt only 25 lbs. Your cost.....only **$9.95**

TWO FOR ONLY $19.00

DYNAMOTOR FOR ABOVE Model PE-101-C.....$2.95

Large model, 5 inch diameter, only..... **$2.95**

SELSYN INDICATORS

For use with beam rotators for indication of direction of beam. Operate from 15-24V. 60-cycle AC supply.

Small model, 3 inch diameter, only..... **$2.45**

ANTENNA RELAY UNIT BC-442

With antenna current meter, antenna transfer relay with 3 stand-off lead-in terminals. A-1 condition. Only..... **95c**

TRANSFORMER

High voltage scope transformer, 90V 60 cps. primary; 6400 V secondary; 4 stand-off terminals.....each **$2.95**

ANTENNA TRANSFER SWITCH SW-225

Triple-pole, double-throw, mounted on bakelite base with nine 2" porcelain stand-off mounts, BRAND NEW..... **59c**

BC 732 CONTROL BOX

With 6 position, selective switch, volume control and toggle switch.....each **59c**

COAXIAL CABLE

26 ft. of Coaxial Cable RGU8, 52 ohm..... **89c**

OUTPUT TRANSFORMERS

50L6.....39c 6V6.....39c

FILTER CHOKES

All Fully Enclosed

3.7 H. @ 145 MA. DC., 125 ohms DC. Res. 4 MTG. Studs, each..... **59c**

100 mil 10H..... **59c**

I-70-D TUNING METER

Milliammeter for indicating resonance of tuned station, NEW.....ea **49c**

400 CYCLE AUTOSYN MOTOR

Ideal for indicating direction of antenna systems—BRAND NEW.....ea. **95c**

HEADPHONES

Signal Corps, 8000 ohms and 200 ohms, each.....used **79c**

RADIO PARTS

100 Resistors ⅓ to 1 watt..... **95c**

100 Tubular bypass condensers, assorted. 01 to .1, all 600 Volt..... **$4.69**

Electrolytic condensers 50-30, 150 Volt.....ea. **29c**

½ Meg. Volume Controls 2" shaft with switch. 10 for..... **$3.00**

½ Meg. Volume Controls 2" shaft without switch. 10 for..... **$1.95**

Crystal Pick-up, new light wt.....ea. **$1.79**

BATTERY FOR "GE" PORTABLES

2-volt Willard type 27/2 the exact replacement in Pre-War Model LB 530 "GE" Portable Radios. Plastic case, size 3³¹⁄₃₂x3½x5½" high. Shipped dry. Uses standard battery electrolyte List value $8.75. BRAND NEW! Your Cost..... **$1.95**

McELROY RADIO TELEGRAPH SIGNAL RECORDER MODEL RR2-900-42

Complete with three tubes: one—117Z6-GT; two — 117P7-GT; like brand new, complete with beautiful maple finish wooden case. Each only..... **$5.95**

NEW BC 223 AX TRANSMITTER

801 Oscillator and 801 Power Amplifiers, 2—46 modulators and 1—46 speech amplifier; 4 Xtal Frequencies and Master Oscillator on selector switch. 10 to 30 watts output. Tone voice or C.W. Mod. Ideal for Ham Use. Black wrinkle case. Tubes included, packed in original cases, less crystals, only..... **$14.95**

Shipping wt. 125 lbs.

ARC 4 TRANSMITTER and RECEIVER

For operation VHF frequencies in range of 140-144 mc. Four channel crystal controlled, manufactured by Western Electric—12 or 24 V. operation. Complete with crystal and dynamotor. Used. Good condition..... **$24.95**

GE METER

0-10 amps., DC.....ea. **$2.29**

INTERPHONE AMPLIFIER

Comes in an aluminum cabinet 9¾x4¾ x5½". DC output at 60MA, less tubes. Yours for only..... **95c**

LP-21 ADF LOOP

Low impedance loop, good for direction finder. one Selsyn motor, one Selsyn transmitter, freq. range of loop 100 Kc to 1750 Kc: BRAND NEW in original cartons, each..... **$6.95**

PE-117 UNIVERSAL POWER SUPPLY

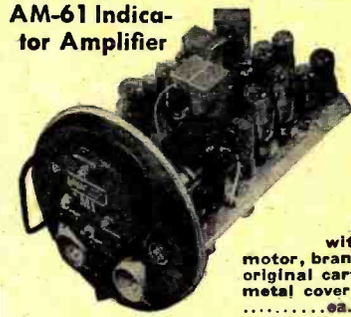
6 or 12 volt input; output 145 volts and 90 volts; less vibrator, voltage regulator and rectifier tube; ideal mobile power supply unit; excellent condition, each..... **$4.95**

MONTHLY SPECIAL! AC-DC TEST SET

For testing resistors, condensers, chokes, open and short circuits; complete with instruction manual and test leads. BRAND NEW in metal carrying case, each.

$2.95 each

AM-61 Indicator Amplifier



15 tubes including two VR105; 6L7GT; 6SN7GT; with blower motor, brand new in original carton, with metal cover .....ea. **$9.95**

TUBES

6V6	12BE6		
6X5	6SQ7		
6AG7	12A6		
35W4	12C8		
12AT6	6SJ7		
12SR7	12SL7GT		
1625	6A6		
Amperite 10T1			
12J5	10AC Neon		
6AT6	12K8		
6SF7	VR-105	6H6	
5R4	6SN7	36	6G6G

49¢

SCOPE TUBES				
	3AP1	$1.19	3FP7	$1.19
	5FP7	2.49	7BP7	2.98

SPRAGUE PULSE FORMING NETWORKS

Used in small radar modulators, available in 3 sizes, 67 ohms impedance, 7.5 Kilowatt rating.

H-603, one micro second, 200 pulses per second..... **$1.95**

H-601, 3 micro seconds, 200 pulses per second..... **$2.95**

H-602, 16 micro seconds, 60 pulses per second..... **$3.95**

ALL THREE ABOVE FOR ONLY.....$7.50

Transmitting MICA CONDENSERS

.0008 at 5000 VDC..24c .00005 at 3000 VDC.19c

Assorted—100 mica condensers..... **$1.19**

OIL-FILLED CONDENSERS

.25 MFD at 1500 VDC.....59c

.25 MFD at 15,000 VDC..... **$6.95**

1 MFD at 1000 VDC.....59c

.1 MFD at 3000 VDC.....59c

4 MFD at 600 VDC.....29c

.4 MFD at 220 VAC.....29c

.2 MFD at 600 VDC.....19c

WAVE METERS

Freq. range: 22 to 30 meg..... **$24.95**

Freq. range: 37 to 53 meg..... **24.95**

Freq. range: 155 to 230 meg..... **24.95**

AC operated, complete with carrying case and magic eye for tuning indicator, veneer tuning dial

CRYSTALS

10 crystals from 2 meg. to 8 meg..... **$2.95**

Power Converter Unit PE-104A for BC-654. each only..... **$4.95**

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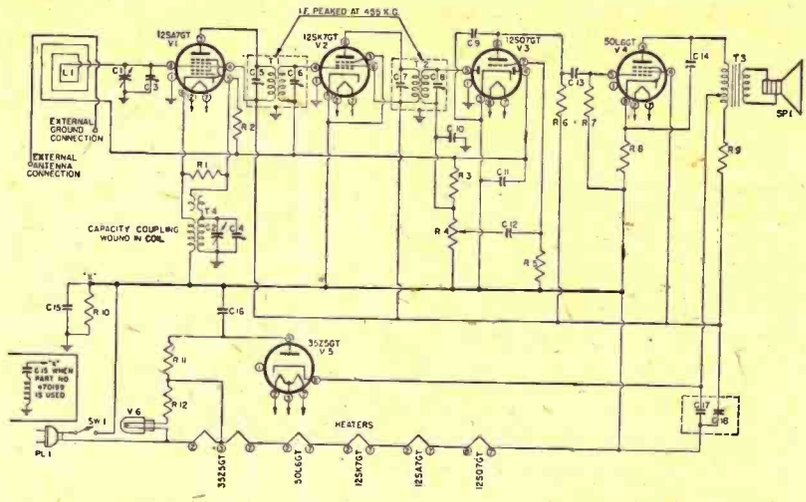
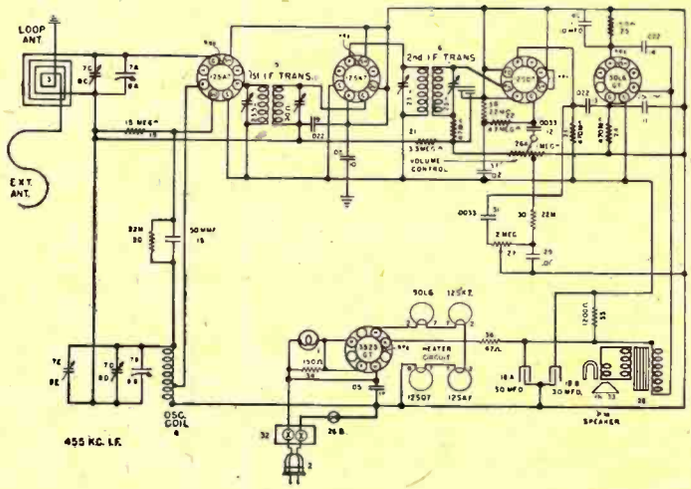
the RN CIRCUIT PAGE

(FOR PARTS LIST SEE PAGE 98)

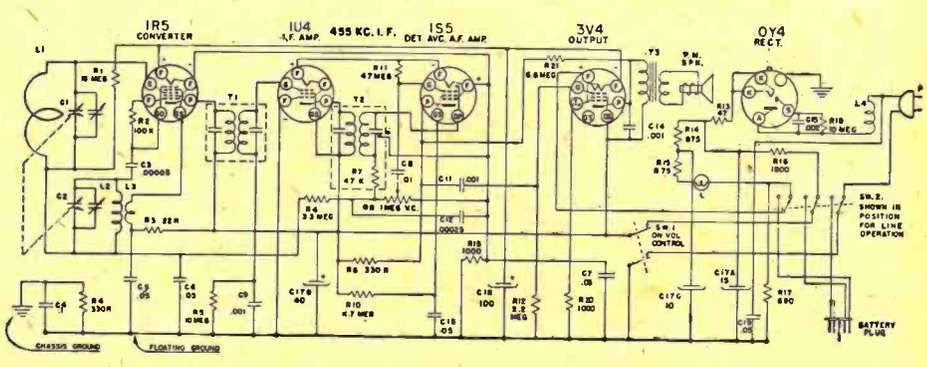
RADIO NEWS, NOVEMBER, 1947 — EMERSON MODELS 501, 502, 504



RADIO NEWS, NOVEMBER, 1947 — CROSLEY MODEL 56TD-W

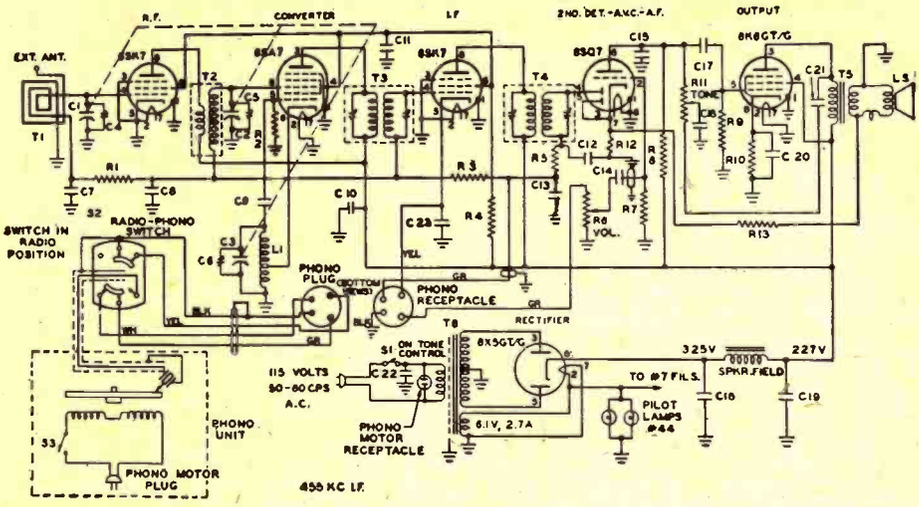


RADIO NEWS, NOVEMBER, 1947 — ARVIN MODEL 140P

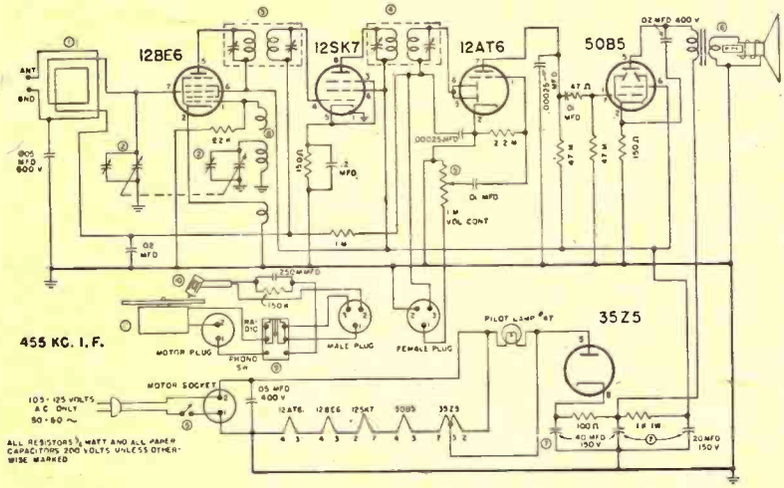


Here, and on following pages, are circuit diagrams and parts lists of many new postwar radio receivers. Radio News will bring to you other circuits as quickly as possible after we receive them from manufacturers.

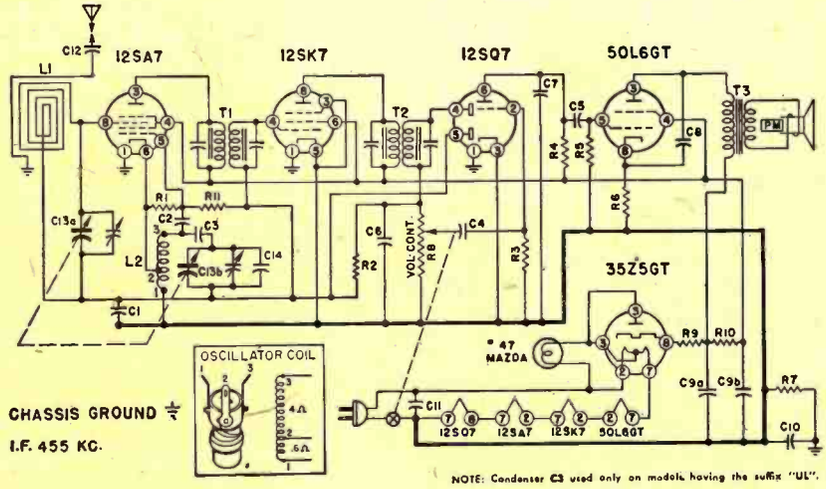
RADIO NEWS, NOVEMBER, 1947 — **HOFFMAN MODEL A401**



RADIO NEWS, NOVEMBER, 1947 — **GAROD MODEL 5AP1-Y**



RADIO NEWS, NOVEMBER, 1947 — **ADMIRAL MODELS 7T01, 7T04**



NOTE: Condenser C3 used only on models having the suffix "UL".

BUILD THIS 8-TUBE RADIO-AMPLIFIER • COMPLETE KIT—ONLY $29.95

DELUXE CONSOLE CABINET, $39.95

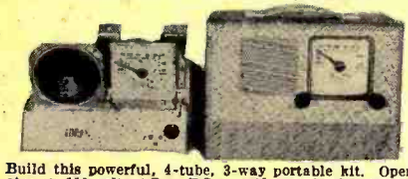
- SLIDE AWAY CHANGER COMP.
- RECORD ALBUM COMPARTMENT
- BEAUTIFUL, ALL WALNUT CONSTRUCTION

This is the first time we have been able to offer a beautiful floor model console, RADIO-PHONO cabinet. Finest all walnut construction; hand rubbed finish. 34" long, 33" high, 16" deep. Holds 12" speaker, large record compartment. Slide away changer compartment will accommodate changer of the Webster 56 class and smaller. Receiver compartment is 15x14½x7½ inches. Will accommodate our Model PRK-10 kit; advertised here. Dealers, here is your chance to buy good cabinets at the right price. Convert those low-priced sets into radio-phono combinations. Weight 50 lbs. Net, **$39.95.** Price with Webster 56 changer. **$59.90**
IF DESIRED, WE CAN FURNISH THIS IN BLOND MAHOGANY AT $10.00 EXTRA.

PERSONAL PORTABLE KIT, $10.95

PERSONAL PORTABLE KIT MODEL K-PX. Small size leatherette covered case 8x6x7. Easy to build. Operates on self contained B and A batteries. Rec. Broadcast 550 to 1600 K.C. Incorporates a standard superhet circuit with avc. Has 3 inch Alnico five PM speaker. Priced complete with batteries, pictorial diagram and tubes 1R5, 1S5, 1T4 and 3S4. Not AC DC, but straight battery operated. Has 2 gang cond. Everyone should have one of these personal portables. Everything furnished. Kit K-PX .....Net **$10.95**

3-WAY PORTABLE KIT, $17.95



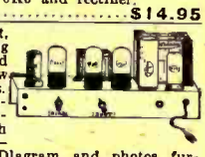
Build this powerful, 4-tube, 3-way portable kit. Operates on 110 volts AC or DC or self contained batteries. Receives broadcast 550 to 1650 K.C. Incorporates a standard superhet circuit with AVC and loop Ant. Has Alnico 5 PM Speaker, 2 gang condenser. All Parts and batteries are furnished including tubes Disc Rectifier, IR5, 1T4, 1S5 and 3S4. Has attractive leatherette portable cabinet size 7x9x9. Weight 14 lbs. Kit model 3-ZA .....Net **$17.95**

RECORD PLAYER $9.95

POWERFUL SINGLE RECORD PLAYER KIT Z-26. Housed in an attractive leatherette covered cabinet. Latest 78 RPM rim drive motor and light weight pick-up. Ready wired and tested 70L7 type tube amplifier. Tone and volume control. 5" PM speaker (Alnico V). This kit easily slips together. Priced complete with tubes and hook-up instructions. Kit Z-26.....Net **$9.95**

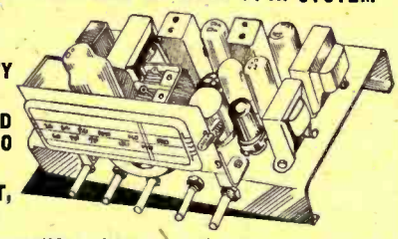
KIT K-7A. Easily assembled into a fine working, attractive, transformer type AC, broadcast receiver; 550 to 1700 KC. Has push-pull audio, tone control and 6½" Alnico 5 PM speaker. Beautifully made 14" walnut cabinet. Incorporates a standard superhet circuit, with AVC and loop antenna. All parts, schematic and tubes 6SA7, 6SK7, 6H6, 6SN7, 2—6V6's and 5Y3 furnished. Has full 90 mil. power trans. Weight 17 lbs. Dealers Net **$19.95**

Deluxe AC Kit, $14.95. Model JD5 AC. Has beautifully made 12" walnut cabinet. All parts furnished to build a powerful broadcast 5 tube AC, power transformer type, superhet. Rec. 440 to 1700 KC. Slide rule dial, 2 gang tuning cond. Loop aerial. Heavy duty Alnico V. PM speaker. Everything furnished including photos, diagram and tubes. 6SA7, 6SD7, 6SQ7, 6K6 and rectifier. Kit JD5 AC. Net.....**$14.95**



12 WATT Amplifier Kit, **$10.95.** For recording and utility use. Matched component parts assure low hum level and good bass. One control, fades from record to microphone; tone control. Priced complete with all parts and tubes: 2—6V6, 6SN7, 6SH7, 7Y4. Diagram and photos furnished. 12" Alnico V PM speaker **$6.95** extra. Crystal desk mike **$4.95** extra. Kit AC-12. Net.....**$10.95**

- A COMBINED BROADCAST SUPERHET RADIO CHASSIS AND 15 WATT P. A. SYSTEM
- HEAVY DUTY 12" P.M. SPEAKER
- CROW 8" SLIDE RULE DIAL. 2 GANG COND.
- REC. BROAD. 550 TO 1700 KC. HI-FIDELITY PUSH PULL 6V6—TWIN TONE CONTROLS
- INPUTS FOR CRYSTAL OR DYN. MIKES AND PHONO-PICKUP. WE FURNISH EVERYTHING TO BUILD THIS DELUXE CHASSIS
- WHY NOT ORDER THE CONSOLE ON THE LEFT, WITH YOUR PRK-10

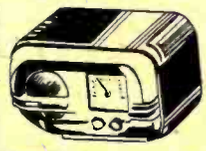


Here is something new in radio. A real 15 watt power amplifier with bass and treble controls. Has extra gain stage for crystal or dynamic mikes. And on the same chassis, a standard superhet radio receiver. We furnish all parts, knobs, escutcheon plate and tubes: 6SA7, 6SK7, 6SR7, 6SN7, 6SJ7, two 6V6 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. With tubes....Net **$29.95**

PRK-10X Radio-Amp. Kit with tubes and $30.00 value 15" Cinaudagraph speaker.....Net **$42.95**

5-TUBE AC-DC KIT, $9.95



Kit Model P-85. We have finally been able to achieve our goal. Here it is. A good 5-tube broadcast AC DC superhet radio receiver for less than ten dollars. The beautiful 10 inch plastic cabinet is made of the finest material. The chassis is of the standard accepted superhet design. 456 KC ifs AVC and 5 inch Alnico 5 PM speaker. Attractive vernier dial. Two gang tuning condenser. Loop ant. We defy anyone to offer a better working AC DC receiver kit. Priced complete with diagram, photos and tubes 12BE6, 12BA6, 12AT6, 50B5 and 35W4. Nothing else to buy. You can't go wrong on this value. Kit Model P-85 .....Net **$9.95**

SUPERHET. 4-Tube, 1½—90 Volt FARM RADIO KIT complete, less 1000-hour battery; similar cab. to Model P-85. Model PB-48.....Net **$9.95**

NEW SUPER MIDGET KIT, $12.95 MODEL KP-T

Build this new super Midget Broadcast 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.

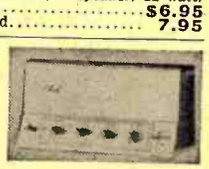
20-WATT UTILITY AMP. KIT, $17.95

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" 12 watt Alnico 5 PM speaker, $6.95 extra. Astatic crystal mike and desk stand, $7.95 extra.

6-110 VOLT UTILITY AMP. KIT, $29.95

Model 20-LX6 20 watts output. Similar in appearance to the model 20-LX except on slightly larger chassis. Has same tube line up and input circuits. Has power supply that will work on 6 Volt DC, or 110 Volts AC. Equipped with super heavy duty vibrator. Has output voltage to run a reg. AC phono motor when used as a 6 volt unit. All parts tubes and easy to follow diagram furnished.
Model 20-LX6 amp. kit. Net $29.95. Ship. weight 30 lbs. Latest 12 in. P.M. Alnico, V speaker, 12 watt. Net **$6.95**
Crystal mike and desk stand.....**7.95**

JUKE BOX QUALITY AMPLIFIER KIT, $29.95



This is the finest in audio amplifiers. Four 6V6 tubes in push-pull parallel and hooked up as cathode followers to drive any P.M. speaker. Gain stage for crystal or dynamic mike as well as any phono pick up. Has variable tone control and fader control. We furnish all parts, nothing else to buy. Has a streamlined spatter finished chassis with cover (ready punched). Complete with diagram, photos and tubes 6SH7, two 6SN7, four 6V6 and 5U4. Will give 18 watts of the sweetest audio you have ever heard. Wt. 25 lbs. Kit model JB-18 net **$29.95**

DELUXE REC. CHASSIS, $22.95

DeLuxe broadcast receiver chassis kit model AB-4, this kit is offered those who want a good receiver to install in their cabinet. The design is of the accepted type; standard superhet. Has power transformer push-pull 6V6's output tubes; tone control; 2 gang condenser and 8 inch deluxe slide rule dial; similar in appearance to our PRK-10 kit; shown above; except it has no provision for mike. Offered with a 12" 15 watt Alnico 5 PM speaker. Priced complete with diagrams, photos and tubes 6SA7, 6SQ7, 6SN7, 2 6V6 and 5Y3. Wt. 22 lbs.
Kit model AB-4.....Net **$22.95**

COMBO-RADIO-PHONO WL3-R

Offered with walnut cabinet with hinged lid. Latest rim drive phono motor, crystal pick-up and complete kit of parts to build a conventional five-tube AC-DC superhet with loop and condenser gang. Receives broadcast 55- to 1630 KC. We furnish everything including tubes, 12BA6, 12BE6, 12AT6, 50B5, 35W4. WL3-R..Net $19.95

WL-3. Same as WL3-R except is record player only. No radio. Has wired and tested amplifier and speaker. Slips together in a few minutes. WL-3. Net $14.95

RADIO-PHONO COMB. KIT, $24.95

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 **$24.95**

RECORD PLAYER SCOOP, $14.95

Assemble this single record player. Only a few minutes required to mount pick up, motor and ready wired and tested amplifier. Everything furnished including tubes 12SR7, 50L6 and 35Z5. Has heavy duty Alnico V PM speaker, tone and volume controls. Has latest crystal pick up and 78 RPM phono motor. The attractive Alligator covered case is small and ruggedly constructed. (15x6½x11.) This is our leader in a portable record player. Weight 18 lbs. Kit J-20. Net.....**$14.95**

PORTABLE RADIO RECORDER KIT $54.95

$90.00 value for only $54.95. We furnish every part to build a powerful radio and dual speed recorder. The attractive leatherette case houses the sensitive superhet broadcast radio and General Industries R90L 33⅓ and 78 RPM dual speed recorder; play back mechanism. The 6 tube receiver and amplifier is all on one chassis; 12SA7, 12SQ7, 12SK7, 12SL7, mike gain; two 35L6 push-pull output; plus disc rectifier. Has plenty of gain for crystal or dynamic mike. Has 6" heavy duty PM speaker and tone control. Kit G-31, everything complete, with tubes and diagram. **$54.95.** Crystal mike and desk stand **$4.95** extra. This is without a doubt one of the best values in kits we have ever offered. Wt. 40 lbs.

McGEE RADIO COMPANY WRITE FOR CATALOG

SEND 25% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

CATHODE RAY TUBES BRAND NEW

3BP1.....Net	$2.95
3AP1.....Net	2.95
5CP1.....Net	3.95
5BP1.....Net	3.95
5FP7.....Net	3.95
7BP7.....Net	4.95
9LP7.....Net	4.95

75% of All the Tubes You Use at 49c Ea.

Guaranteed Standard Brands. Cartoned and Uncartoned

1B4	6SA7	12H6	25L6GT	78
1B5	6SC7	12J5GT	25Z6GT	80
1S5	6SD7GT	12SA7	26	1L4
1T4	6SF5	12SG7	27	50L6
3Q4	6SK7	12SH7	35L6GT	50L6
3S4	6SG7	12SJ7	35W4	12A6
5U4G	6SH7	12SK7	35Z3	14B6
5Y3GT	6SJ7	12SL7GT	35Z4GT	
6AC7/ 1852	6SK7	12SN7GT	35Z5GT	
6C5	6SL7GT	12SQ7GT	39/44	
6C6	6SN7GT	12SR7	41	
6D6	6SQ7GT	14A7/ 12B7	42	
6F6GT	6SH7	14B6	43	
6H6	6V6GT	14C7	45	
6J5	6X5GT	14H7	50B5	
6K6GT	12AT6	14J7	56	
6K7	12BA6	14Q7	75	
6L7	12BE6	14R7	76	
	12C8	14S7	77	
7A6	7C6	30	6A7	
7A7	7E7	32	6A8	
7A8	7F7	33	1N5GT	
7B4	7H7	34	1A7	
7B5	7N7	35/51	7B8	
7B6	7Q7	35A5	3Q5	
7B7	7Y4	0Z4	50A5	
7C5	7Z4	1H5GT		
1LA4	1LC5	1LE3	6L6	
1LA6	1LC6	1LH4		
1LB4	1LD5	1LN5		

49c

69c

99c

Scoop Civilian type high imp. head phones (9500 ohms.) Brand new factory cartoned. Have full length regular type leads. Net $1.29 each; 10 for.....**$10.95**

Broadcast crystal radio receiver, with crystal. $0.99, 10 for **$8.90**

HOT SPECIALS IN P.M. SPEAKERS

12" P.M. 7 oz of A.V. 18 watt only.....$6.95

All are guaranteed.

12" 5 oz. Alnico 5 Pm Speaker.....12 watt Net $5.95
10" 5 oz. Alnico 5 Pm Speaker.....10 watt Net 4.95
8" 3.15 oz. Alnico 5 Pm Speaker... 8 watt Net 3.49
8" 2.15 oz. Alnico 5 Pm Speaker... 6 watt Net 2.95
6" 2.15 oz. Alnico 5 Pm Speaker... 6 watt Net 1.95
RED HOT SPECIAL—6" 5 oz. Alnico 3 Square Pm Speaker $1.49; 10 for.....**$13.50**

GENERAL ELECTRIC 5½" P.M. $1.95

5½" G-E 1.5 oz. Alnico 5 Pm Speaker with output transformer for 50L6 $1.95 (mount for either 6 or 6½" speaker.) Scoop price $1.95; 10 for....**$17.50**

CHOICE OF 3½", 4" or 5" P.M. $0.99

3½", 4", or 5" Pm Speaker with 1 oz. Alnico 5 magnet. Your choice 99c each. Order all you need. May never again be sold at this price. All brand new and guaranteed perfect. Choice of 3½", 4", or 5" 1 oz. Alnico 5 Pm Speaker. Scoop Price..**99c** each

DYNAMIC SPEAKERS

6½"	1000 ohm	Field Speaker.....	$2.49
5"	3000 ohm	Field Speaker.....	1.89
5"	1000 ohm	Field Speaker.....	1.89
5"	450 ohm	Field Speaker.....	1.89
4"	450 ohm	Field Speaker.....	1.89
4x6"	450 ohm	Field Speaker.....	1.89

SPECIALS IN TUBULAR CONDENSERS

Cornell Dubilier .05 Mfd. 600 volt condenser. Scoop Price $0.09 each. 100 for.....**$7.50**

Solar Sealtites .05 Mfd. 400 volt condensers or .01 400 volt $0.07 each. 100 for.....**$5.00**

600 VOLT TUBULARS, MANUFACTURERS TYPE

Guaranteed all good brands condensers; .001, .005, .01, .02, .05, all 600 volt. Any size $0.08 each. 100 assorted for **$6.50**

POPULAR F.P. ELECTROLYTICS

In Alum. Cans. Easy Twist. Mounting all small size.

10 x 10 x 10 Mfd. 450 volt	$0.49	20 x 40 Mfd. 400 volt	$0.49
30 Mfd. 450 volt..	.49	40 x 40 Mfd. 250 volt	.39
20 Mfd. 450 volt..	.39		
20 Mfd. 300 volt, 10 Mfd 350 volt, 20 Mfd. 25 volt	.39	40 x 20 Mfd. 150 volt 20 Mfd. 25 volt	.39

TUBULAR ELECTROLYTICS

In paper tubes with pig tail leads

Cornell-Dubilier, 8 Mfd. 450 volt $0.39 each. 100 for	$32.50
Cornell-Dubilier, 16 Mfd. 450 $0.59 each. 10 for	5.25
Aerovox, 8 x 8 Mfd. 450 volt. $0.49 each. 10 for	4.50
Aerovox, 20 x 20 Mfd. 150 volt. $0.39 each. 10 for	3.50
Sprague, 50 x 30 Mfd. 150 volt. $0.49 each. 10 for	4.25
Solar 50 x 30 Mfd. 20 Mfd. 25 volt $0.59 each, 10 for	4.90

G.I. RECORDER MECHANISMS

Latest 1947 General Industries recording assemblies with 4 ohm magnetic cutters and crystal play back.
Model R70-L—78 RPM. Net.....**$24.50**
Model R90-33 and 78 RPM. Net.....**28.95**
Model R130-L—Automatic changer with cutter. 78 RPM. Net.....**40.10**

LAST MINUTE SPECIALS

Red hot PM speaker values. All have 20 oz. of alnico 3 magnet. Latest production. Ideal for amplifiers and radio set replacement. Fully guaranteed.
12 in. 20 oz. alnico V. 20 watts.....Net $5.49
10 in. 20 oz. alnico V. 20 watts.....Net 4.49
8 in. 20 oz. alnico V. 15 watts.....Net 3.98

Thordarson power transformer scoop T 70R62 or T 44915 for 60 cycle 115 AC. 700 volts C.T. at 145 mills. 6.3 v. 4.5amps. and 5 v. 3amps. Scoop price 3.49

Spring wound phono motor with all hardware turntable crank etc. reg. $6.50 value. Scoop price 2.98

Thordarson filter choke. 200 mil. 10 henry; fully shielded. Most beautifully made choke you ever saw. Weight 5 pounds. Scoop price $1.99. 3 for 5.50

R-32 Victor etc., replacement power transformer. Made by Utah. Upright mounting. Has all windings 1½, 2½, 5 etc. .....Net 4.95

100 assorted ¼ (⅓) watt carbon resistors; non-insulated type .....Net 1.19

G-E Plastic AC cord; with molded cap 6½ foot 19c
8 foot 24c

Utah VPR-1 50 mil strap mounting choke; 30 henrys. This is the standard size as used by 4, 5 and 6 tube radios.....Net Price .49

Auto aerial closeouts.
4 section. Top Cowl less lead.....$0.69
3 sect. 66" side cowl, 30" lead.....1.79
4 sect. 96" side cowl, 30" lead.....2.79
72" ICA Uni-mount with lead.....1.79

MALLORY Standard size 4 prong vib. Has 8 points yet is a non-sync. For those heavy drain auto sets. Scoop Price $1.09 each; 10 for.....**$9.90**

DELCO off set 4 prong vib. net $1.49; 100 mill 6.3 volt flush mounting power trans. $2.49; 55 mill upright 6.3 power trans. net $2.49; Astatic pickup arm with L40 crystal, made for automatic changers and does not have mounting sleeve, net $1.29; 10 for.....**$11.95**

WIRE RECORDER—RADIO—P.A.

ALL IN ONE PORTABLE CASE

McGEE'S 1948 ADD-A-UNIT 10" P.M. SPEAKER 3 NEW MODELS

ADD-A-UNIT PORTABLE PA SYSTEM RECORDER-RADIO. This unit is offered as a slip-together kit. All components need only be mounted together to make a high quality sound system, Radio-Disc or Wire Recorder. The broadcast radio tuner may be added to any model. The portable case is leatherette covered and snaps together for easy carrying. The 12 watt AC amplifier (Model AC-12W) is wired and tested ready to play. Priced complete with tubes: 2—6V6, 6SN7, 6SH7, and 7Y4. Has tone control and fader control, gain for either dynamic or crystal mike. Has heavy duty 10" PM speaker. This amplifier is ideal for a public address system and record player; or for recording.

Model SK-1 PA SYSTEM, RECORD PLAYER: Includes portable case, wired and tested 12 watt amplifier (Model AC-12W), 10" PM speaker and latest single post record changer. Model SK-1 Net $45.95; Crystal Mike $4.95; Broadcast Radio Tuner **$7.95**

Model SK-2 PA SYSTEM AND DISC RECORDER: Includes portable case, 12 watt amplifier (Model AC-12W), 10" PM speaker and General Industries RF90-L dual speed recorder and play-back mechanism. Model SK-2 Net $54.50; Crystal Mike $4.95; Broadcast Radio Tuner **$7.95**

Model SK-3 PA SYSTEM AND WIRE RECORDER: Includes portable case and 12 watt amplifier (Model AC-12W), 10" PM speaker and Webster Model 79 wire recorder mechanism with 15 minute spool of recording wire. This is the last word in public address and recording machines. Model SK-3 Net $79.50; Crystal Mike $4.95; Broadcast Radio Tuner.....**$7.95**

WEBSTER 79 WIRE RECORDING MECHANISM $52.92

WEBSTER 79 WIRE RECORDER, PLAY BACK MECHANISM. Wiring diagram of necessary amplifier included with kit. The entire mechanism is a completely assembled unit. Weight 10 pounds. Includes one fifteen minute spool of recording wire. This is the hottest new item in the electronic field. Webster 79 recording mechanism. Net $52.92; Extra recording wire, fifteen minute $2.40; thirty minutes $3.60; one hour...$6.45

SCOOP! MAGUIRE CHANGER $11.95

Latest Maguire 2 post rapid action record changer. Shuts off on last record; has high fidelity crystal. A $25.00 value in a changer for only $11.95. Pictured to the right. Made to fit base.....**$2.49**

Maguire changer record player. Has walnut finished base with 3 tube, 50L6 type amplifier and 3" PM speaker. Similar to one shown, only with deeper base; with speaker grill cutout. Priced complete; ready to play. Model MG-L. Scoop Price.....**$19.95**

General Instrument Single Post Automatic Changer. This is a fine quality changer; yet small enough to fit space that any other changer will fit. Scoop Price....**$14.95**

10 STATION INTERCOM $29.95

This 10 station push-button inter-com. originally cost the dealer over $40.00. Attractive walnut finished cabinet; made by East coast manufacturer. With tubes 14F7, 50L6 and 35Z5. Master and one sub-station. net **$29.95.** Extra sub **$5.95** each.

3-WAY REGAL SUPER-MITE $22.95

No Taller Than a Pen

Regal Model 747—3-way personal radio. Receives broadcasts 550 to 1650 KC. Small in size; only 4x5x 8 inches. However uses full size parts with 2 gang condenser and loop. Priced complete with 4 miniature tubes and disc rectifier. Net $22.95 each. In lots of 3 **$21.95**
Kit of batteries $2.05 extra.

REGAL 5-TUBE AC-DC $15.95

A scoop value. Full-fledged; 5 tube superhet broadcast (550 to 1650 KC). Loop antenna. 5" dynamic speaker, attractive 10" plastic cabinet and slide rule dial. Order now for Christmas sales. $15.95 each. In lots of 3.....**$14.95**

MECK PEE WEE SUPER $11.95

Meck. 5 tube superhet; using miniature tubes. Small plastic cabinet (7x4x5"). 2 gang condenser, loop antenna. Alnico 5 PM speaker. This is a red hot value in a small radio receiver; broadcast 550 to 1650 KC. Priced with tubes; ready to play.
Model 800B. Black plastic cabinet.....$11.95
Lots of 3.....**$10.95**
Model 800W, White plastic cabinet.....$12.95
Lots of 3.....**$11.95**
Weight 5 lbs.

MECK FM CONVERTER $14.95

It's sensational. Makes any regular AM (ordinary radio) radio receive FM Signals (88 to 108 MC). Just announced by John Meck Industries. Order your sample today. Dealers Net $15.95. Same cabinet as Pee Wee shown above.
Lots of three.....**$14.95**

MECK FARM RADIO $16.95

JOHN MECK INDUSTRIES BATTERY RADIO. Full 5 tube superhet circuit; covering broadcast band: 550 to 1650 KC. Full size Alnico 5 PM speaker and beautiful cabinet 17x8x 9". Large enough to hold 1000 hour farm battery pack. Priced complete with tubes, less battery pack: 1R5, 2-1T4, 1S5, and 3S4. Has loop antenna with provision for external antenna. Net price $16.95. In lots of 10.....**$15.95**
1000 hour battery pack.....$4.98

1948 MODELS OF KARADIOS

"For Your Car"

Karadio Model 80-A—The greatest radio ever offered to the ham; covers broadcast 80, 40, 20 and 10 meter bands. Here is your chance to get a communications type car radio easy to mount under dash. Has R.F. stage; separate PM speaker. Designed for 6 volts D.C. input. Band 1—530 to 1700 KC; Band 2—3 to 7.3 MC; Band 3—14 to 30 MC. Net Price.....**$79.50**

Karadio Model 80-B (airport model). Similar in appearance to model 80-A; except covers different frequency. Band 1—190 to 450 KC; Band 2—535 to 1700 KC; Band 3—2.4 to 6.8 MC. Input six volts DC. Net **$62.50**

Karadio Model 1200—A fine broadcast (535 to 1700 KC) car radio. Compact size makes for easy installation (5½x2¾x8 inches). Input six volts D.C. Has tuned R.F. stage; separate 6" PM speaker and conventional high gain superhet circuit. Similar in appearance to Model 80; shown above. Net Price **$38.95**

PHONO MOTOR SCOOP $1.95

Yes that is the right price only $1.95. Latest type rim drive 110 volt 60 cycle AC phono motor. Best type of construction. Only 2000 to sell while they last only .....Each **$1.95**
Latest type light weight crystal pick up arm. Has standard output crystal. Scoop price.....**$1.69**

JAN-6V6GT 49c; 100 for.....**$39.00**

McGEE RADIO COMPANY

WRITE FOR CATALOG

SEND 25% DEPOSIT—BALANCE C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

80 METER TRANSMITTER ARMY BC-223 $12.95

Brand New Factory cartoned BC 223 AX transmitter. Has 801 OSC and power amp. 2-46 modulators and 46 speech amplifier. Four xtal frequencies and Master oscillator. Up to 40 watts output on CW, tone or voice. Ideal for the 80 meter band. Comes with 3 coils. 2 to 3 MC. 3 to 5 MC. 3.5 to 5.25 MC. Less xtal with tubes and frequency chart. Weight 120 lbs.

MALLORY SYNC. VIBRATOR $.99

This is a standard type 6 volt vib. unit. Has long leads. Easily installed in the old case. A red hot item if we ever had one.

ARC-4 140-152 MC. $24.95

for operation on VFH frequencies from 140 to 152 MC. Four channels crystal controlled transmitter and receiver. Designed for 12 or 24 volt DC operation. Scoop Price.....**$24.95**
Weight 35 lbs.

BRAND NEW RADIO COMPASS $69.50

SCR-269-F Brand New Radio Compass; Automatic direction finder. Complete with all component parts; $69.50. This unit was designed for Army Navy as a primary navigation compass. Constant reception is possible so that fixes can be made at any time; to establish a ship or plane's position. Plotting fixes is accomplished by selecting two or more stations and plotting these on the navigation map. The point of intersection indicates the position of the ship or plane. This equipment comes complete with 17 tubes; superhet receiver which is tunable from 200 to 1750 KC in three bands. A complete instruction manual for operation and maintenance accompanies each unit.

RU-19 REC. $7.95

2-Band Aircraft Receiver RU-19

Priced complete with six tubes, 3 78's and 2 77's plus twin output tube. Guaranteed to be in good condition.

RU-19 type A receives 200 to 400 KC and 4130 to 7700 KC **$7.95**

RU-19 type B receives 200 to 400 KC and 2500 to 4700 KC.....**$7.95**

RU-19X FOR SALVAGE $2.95

RU-19X or ARMY equal. SALVAGE PARTS SCOOP. Has many usable parts, condensers, resistors, etc. Less tubes and plug in coils. All are in good condition. RU-19X Salvage Scoop $2.95 ea.; two for $5.00.

RCA—AIRCRAFT TRANS.—REC.

RCA AVT-12A Transmitter; pictured to the left; Brand new RCA aircraft transmitter. Crystal controlled, 2500 to 6500 KC. Designed for 6, 12 and 24 volt DC and 350 volt DC input. 6 tubes; 6AF6 dual tuning indicator, 6V6 Pierce oscillator, 6V6 P.A., 2—6V6, as plate modulators and 6SL7 tuning indicator amplifier. This is the nicest piece of equipment you have ever seen. 6x6x5½ inches and weighs 6 pounds. Every ham or ham to be should have one of these. All brand new with tubes (less crystal) and complete instruction book. This unit covers 80 meters and 3105 and 6210 aircraft bands. Your Net.....**$12.95**

RCA AVR-20A Aircraft Receiver; pictured to the right; small light weight, companion unit to the AVT-12A. A full 3 gang superhet, covering 2300 to 6500 KC, with tubes 6K6, 6S7, 6F7, and 6B8. Brand new, factory cartoned. This is a beautiful, compact piece of receiving equipment. RCA AVR-20A Receiver. Net..**$12.95**
RCA AVT-12A Transmitter and RCA AVR-20A Receiver. Both for only.....**$24.95**

RCA SALVAGE SCOOP $2.95

RCA Radio Salvage SCOOP. We have a few hundred of the AVR-20A receivers described above, in used condition. They have been stored in a damp place and are slightly molded. However, they have all of the tubes and parts and are not mutilated. Ideal for salvage. Service men: the 6K8, 6S7, 6F7 and 6B8 are worth more than the price of the whole unit. With the tubes, you can't go wrong. AVR-20A Salvage only. Net..$2.95
Two for 5.49

VHF T.R. SALVAGE SCOOP $6.95

V.H.F. SUPER SALVAGE SCOOP $6.95 General Electric; very high transmitter-receiver. Brand new factory cartoned. Has fixed frequency, tuned line transmitter and superhet receiver; a multitude of good, very high frequency parts. Compact, aluminum case. Weight 25 pounds packed; shipped less the 16 tubes. Never before have we offered a salvage scoop of this caliber. Relays, I.F.'s more value than you ever saw for.....**$6.95**
V.H.F. SUPER SCOOP $6.95; 2 for.....**$12.95**

1948 MODEL—MIKE-BROADCASTER ONLY $7.95

Broadcasts 800 to 1500 KC from either a phonograph pick-up or a crystal or dynamic mike. Makes any radio receiver a P.A. system, record player or recording amplifier. Gives broadcast quality. Has fader control from mike to record, simulating a regular broadcast station. This is a powerful model; using 2-35L6, 12SJ7 and 35Z5 tubes. Priced with tubes and connecting instructions. Works on 110 volts AC-DC. Crystal mike and desk stand $4.95 extra. Model DE-5 truly a de-luxe mike-phono oscillator.

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

3-TUBE PHONO. OSC. ONLY $3.95

Model DE-4—Phonograph oscillator. Broadcasts from 800 to 1500 KC. Gain for any crystal pick up. A new powerful circuit is used to assure plenty of power. Has variable gain control for proper modulation. Priced with tubes ready to operate, two 50B5 and 34W4.
Model DE-4 Net.....**$3.95**

ELECTRIC DRILLS $19.50 UP

Jones Motorola Pistol Grip Electric Drills. Finest type of construction. Jacobs Chucks. For 110 volt AC operation.

¼ in. 3000 RPM .....net **$19.50**
⅜ in. 800 RPM .....net **27.00**
½ in. 400 RPM .....net **29.50**

SUPERHET BROADCAST TUNER for connection to phono amp. or P.A. system. Compact chassis 5x3½x3 inches. May be mounted inside the record player cabinet. Requires only three connections to amplifier. Uses 6SA7 or 12SA7; 6SK7 or 12SK7 and crystal diode. Complete with tubes, loop antenna, dial and instructions for connecting to any amplifier. Net **$7.95.** Specify if tuner is to be used with AC or AC-DC type amplifier.

SCR-522 AS-IS $12.95—Two for $25.00

SCR-522 You are all familiar with this 100 to 156 MC Transmitter, receiver. These 522's that we have are in rough looking cases and some of the outside connectors have been damaged. However, separate the transmitter and receiver and remove the case, you will have usuable merchandise. There are not many more of these units available; we have just 100 to sell.

AM-26 $1.49

AM 26 interphone amplifier. This unit is nice for parts salvage and the aluminum case is usable for receiver building etc. Size 9½x4½x5". Has two transformers, four tube sockets, three filter condensers, three position panel switch, toggle switch, and many small parts. All are in perfect condition.
$1.49; 2 for $2.49

VIBRATOR SCOOP $1.99

Heavy Duty Vibrator—Made for 6-110 volt amplifiers. Freq. 60 CPS. Scoop price.....**$1.99**

135 ma 6-110 volt conventional power transformer, with all windings; will run phono motor.
$5.95

(Use with above vibrator.)

VEEDER ROOT METER

Counts number of feet of trailing wire antennae; number turns when winding on coil; applicable for many uses; beautiful bakelite case, jewelled dialite, pilot light enclosed, 3 position switch, counts up to 1000.
Each **95c**

NAVY GLIDE PATH SCOOP $3.95

Navy model ZA Glide path receiver. Has 3—6C6 tubes; several controls, transformer and handy case; size 6x7x12 inches. Ideal for salvage, near new condition **$3.95**; 2 for.....**$6.95**

PACKARD BELL PRE-AMP. $1.99

Housed in a handy aluminum case 5x4x5, priced complete with tubes 6SL7, 28D7, has many usable parts. Relay and control PL68 plug and patch cord.

BC-412 $49.95

BC-412-612 Oscilloscope. Brand new factory cartoned, weight 200 lbs. This unit is the most ideal war surplus scope. Works on 110v 60 cycle AC. Only simple changes (conversion in many radio magazines) necessary to convert to a laboratory test scope. Has twin heavy duty plate supplies and tubes 5BP4 5" scope tube, 6—6L6, 2X2, 5T4, 2—6SJ7, 6SC7, 6H6, etc. Schematic diagram with each unit. This may be the last time we have a scope in a scope like this.
Net **$49.95**

SCR 274 COMMAND SET $24.95

SCR-274 Command set. Removed from planes; guaranteed to be in good condition. Here is what you get: 3 Receivers—BC-453-B (200 to 500 KC) BC-454-B (3 to 6 MC), BC-455-B (6 to 9 MC)—Triple remote tuning head, with three flexible shafts and triple shock mounting rack. Two transmitters BC-457-A (4-5.5 MC), BC-458-A (5.3-7 MC) and twin shock mounting rack. Antenna current meter, modulator and dynamotors. Each receiver has its own dynamotor. Scoop Price $24.95, complete.

SELSYN INDICATORS $2.95

Selsyn Indicators. 5" diameter. Will operate on from 15 to 24 volts 60 cycle AC. Model I-82A can be used as either selsyn transmitter or selsyn receiver. Scoop Price, $2.95, 2 for **$5.49**

FM CONVERTER $21.95

Superior FM converter. 5 tubes 88 to 108 MC. Plugs in to the phono. jack of your present radio. Has own power supply. Our testing lab. shows this to be the converter of the year. Net **$21.95** each in lots of three **$20.95**

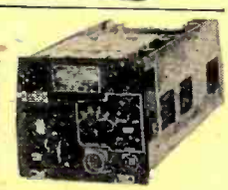
Left to Right

New Remote Control Head and volume control CW, MCW, sw. for BC-455-B 6 to 9 MC receiver.
Scoop Price..**$0.99**
BC-631-13 Jack Box, NEW. Has 10M gain control and Jones 6 screw terminal block. Salvage Price.....**$0.29**
Salvage Scoop BC-732-A Radio Control Box. Toggle switch, volume control and 6 position single pole cam-operated switch; phone jack. Scoop Price.**$0.49**

NEW BC-1206 $7.95

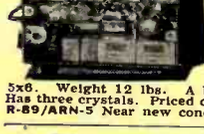
Designed to receive A-N beam signals. 24-28 vdc. Tube complement: 14H7, 14A7, RF. 14H7, 14J7, 14A7, 14H7, IF amplifier; 14R7, detector and 1st audio; 28D7, output. 195 to 420 KC 4" high x 4" wide x 6⅝" long. Weight 4 lbs.

NAVY ARB $19.95



You can convert this over easily to a good ham receiver. It's one of the hottest values in surplus receivers. 28 volts DC input. Covers 4 bands. 195 kc to 9 mc. This is a deluxe type superhet receiver, note that the frequency coverage includes the standard broadcast band. Has 4 gang tuning condenser; can be converted to a 110 volt AC receiver. Priced complete with tubes: 12SF7, 12SA7, 3-12SF7 and 12A6. Has dial built on front of chassis. Electric driven or manual band change switch. Weight 28 lbs. Size 6x7x15 inches.
ARB Near new condition, with tubes and dynamotor.
Net **$19.95**

R-89 $6.95



R-89/ARN-5 Glide Path Receiver 11 tube superhet. Formerly used for blind landing. Adaptable for many uses. Receives 326 to 335 MC. Contains six relays. 11 tubes 7—6AJ5, 12SR7, 2—12SN7, 25D7. Size 13x5x8. Weight 12 lbs. A beautiful piece of equipment. Has three crystals. Priced complete with xtals and tubes.
R-89/ARN-5 Near new condition. Net.....**$6.95**

SWITCH POT SALVAGE

99¢ 3 for $2.50

McGEE RADIO COMPANY

WRITE FOR CATALOG

SEND 25% DEPOSIT — BALANCE C. O. D.
1225 McGEE ST., KANSAS CITY, MISSOURI

ORDER YOUR AIRCRAFT COMMAND RECEIVERS FROM McGEE

BRAND NEW BC-453, 200 TO 500 K.C., WITH TUBES.....$6.95
BRAND NEW BC-454, 3 TO 6 M.C., WITH TUBES.....$4.95
NEAR NEW BC-454, 3 TO 6 M.C., WITH TUBES.....$3.95
BRAND NEW BC-455, 6 TO 9 M.C., WITH TUBES.....$4.95
NEAR NEW BC-455, 6 TO 9 M.C., WITH TUBES.....$3.95
BRAND NEW BC-946 (broadcast), 550 TO 1500 K.C., WITH TUBES & INST.....$12.95

These command receivers have proven to be one of the best values in war surplus. We continue to get repeat orders. Hams and experimenters buy them to convert to other frequencies and for use as they are made. Designed for 28 volts DC input and easily converted to AC-DC operation, etc. For your convenience, we will include with each receiver a diagram of the Bc 454. As all of command receivers are similar, this will assist you in becoming familiar with them. Weight 8 lbs. Priced with tubes, three 12SK7, 12SR7, 12K8, 12K6.

28 Volt Dynamotor for 453, etc.....$0.95
Triple remote control head for SCR-274 (BC-453, BC-454, BC-455).....$1.95
Flexible cable for tuning SCR-274..... .79
Mounting Rack for three receivers..... 1.95

SUPER VALUES IN AIRCRAFT COMMAND TRANSMITTERS!

NEAR NEW BC-696, 3 TO 4 M.C., WITH TUBES.....$3.95
BRAND NEW BC-457, 4 TO 5.3 M.C., WITH TUBES.....$5.95
NEAR NEW BC-457, 4 TO 5.3 M.C., WITH TUBES.....$3.95
BRAND NEW BC-458, 5 TO 7 M.C., WITH TUBES.....$5.95
NEAR NEW BC-458, 5 TO 7 M.C., WITH TUBES.....$3.95
BRAND NEW BC-459, 7 TO 9.1 M.C., WITH TUBES.....$5.95

ORDER YOURS WHILE THEY ARE STILL AVAILABLE

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. Priced with tubes and crystal. For your convenience a diagram of the BC-457 will be sent you. All of the command transmitters are essentially the same hook-up.

BC-654 TRANSMITTER RECEIVER $12.95

GUARANTEED TO BE IN GOOD CONDITION

7-Tube Superhet Receiver and 6-Tube Trans. with 25 Watts Power.

Order Now at this Scoop Price. Covers 3800 Kc. to 5800 Kc.

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; furnished with all tubes necessary for the operation of the trans. and rec. Less power supplies. These units are used but in good condition. Shipping weight 50 lbs.....$12.95; 2 for $25.00
Send your order to our Kansas City store. This unit will be shipped from our Chicago warehouse. Immediate delivery. You can hardly tell they are used.
BC-654 Less all tubes and crystal.....$7.95

654 VIBRATOR POWER PACK 6 OR 12 V.D.C. INPUT $4.95 EXTRA.

G.E. SERVO-AMP. SALVAGE

$1.95 EACH

Two for $3.50

G.E. Servo amp Salvage Scoop. This item is ideal to tear up for the pieces, General Electric Servo amplifier, has 14 octal tube sockets, 5 small neon lamps. Lots of condensers, resistors and controls. Salvage value more than the purchase price of this unit. Weight 15 lbs. Brand new. Priced less tubes $1.95; 2 for.....$3.50

ARMY PARTS SALVAGE SCOOP!—$2.49 EACH

TWO FOR $4.49

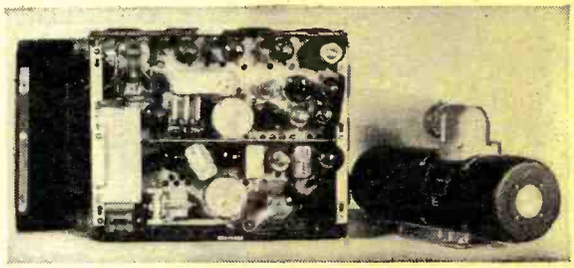
Another red hot value in salvage. All kinds of good useable parts in this unit. Con. Res. Relays, Modulation trans. and tubes VR150, 12J5 and 1625. Brand new and in factory carton. Originally designed to modulate the BC 457 W.E. Transmitter. You can find many uses for this. BC-456 Modulator scoop, price.....$2.49

BOTTOM VIEW

BC-645 450 MEGACYCLE TRANSMITTER-RECEIVER

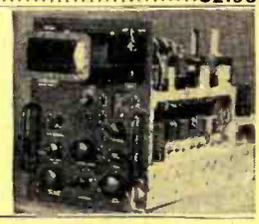
★ *BRAND NEW* ★ *FACTORY CARTONED*

$9.95 EACH **TWO FOR $19.00**



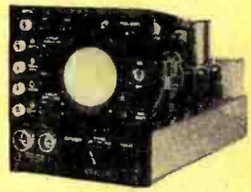
ARMY BC-645 I.F.F. UNIT. Early in the war when radar picked up a plane, there was no way of knowing whether it was friendly or not. That was before BC-645 was invented. BC-645 sent out a signal that identified the plane as American. It probably saved more lives than any other piece of electronic equipment made. With some modifications the set can be used for 2-way communication, voice or code, on the following bands: ham band 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.....$2.95

R65 SCOPE, $29.95



Another receiver indicator unit; with gobs of material. Complete with 28 tubes such as: 6SA7, 6SK7, 6H6, 2X2, 5Y3, etc., plus 3BP1 scope tube. A multitude of controls, RF coils, switches, etc. All are in perfect condition; just removed from aircraft. Case size, 9x12x16". Ideal to convert to test scope and beautiful for general salvage. Weight 35 lbs.
Scoop Price.....$29.95

BC929 RADAR, $14.95



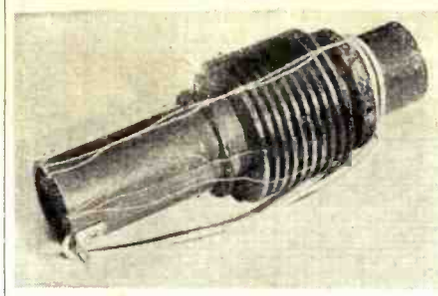
BC-929 A Radar Indicator Scoop. This unit could be rebuilt into a fine test scope. It is an ideal size. 8x9x14 priced with tubes 2—6SN7, 2—6H6, 6G5, 6X5 and 2X2. This is a red hot buy. However you will have to change the power trans. for 60 cycle use. Guaranteed to be in good condition.
Scoop Price.....$14.95
Weight 20 lbs. Has 3 in. Cr Tube.
We have a few BC-929 Radar Scoops. Brand new in factory cartons at $19.95 each.

McGEE RADIO COMPANY *WRITE FOR CATALOG* *SEND 25% DEPOSIT—BALANCE C.O.D.* *1225 McGEE ST., KANSAS CITY, MISSOURI*

What's New in Radio

R.F. POWER SUPPLY COIL

Electronic Engineering Service of Ridgewood, New Jersey, has recently announced a line of r.f. power supply transformers for use in television receivers, cathode-ray oscilloscopes, and



other equipment requiring a safe, low-current, high-voltage source of power.

Available sizes include 1, 2.5, 4.5, and 10 kv. units. All of these components are conservatively rated at 250 microamperes and each includes primary, secondary, feedback, and rectifier filament windings. All coils are "Q-Max" treated. A circuit diagram is included with each coil.

Further information on this line may be secured by writing *Electronic Engineering Service,* P.O. Box 72, Ridgewood, New Jersey.

ALTEC LANSING AMPLIFIER

The new *Altec Lansing* A-323B amplifier which features built-in equalization, a treble tone control, and a hum-balancing potentiometer is now available for distribution.

The unit has two high impedance inputs, one for phonograph pickup and the other for radio. It carries a nominal rating of 15 watts and will deliver this rated power within 1 db. from 35 cycles to 12,000 cycles, according to the manufacturer. The frequency response is flat from 20 to 20,000 cycles.

The built-in equalization is designed to operate direct from the new *General Electric* Variable Reluctance or *Pickering* Magnetic Pickup Cartridges.

The treble tone control consists of a true low-pass filter which is adjustable by steps to give a very sharp cut-off of noise frequencies and yet allow full reproduction of all usable high frequencies on phonograph records. The hum-balancing potentiometer eliminates the necessity of careful selection of present day tubes for quiet, noiseless operation.

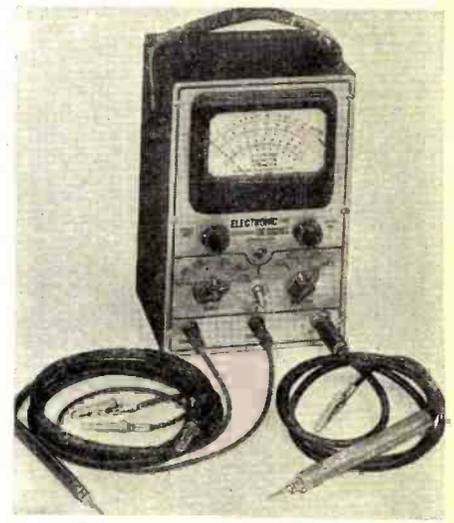
Altec Service Corp., 250 West 57th Street, New York 19, New York, will furnish additional details on the A-323B amplifier upon request.

NEW V.T.V.M.

Electronic Designs, Inc., is currently marketing a new vacuum tube voltmeter-ohmmeter, the Model ED 100.

Designed to provide visual dynamic signal tracing in the laboratory and service shop, this unit measures r.f. with the same ease as measuring d.c.

The instrument provides d.c. ranges from 0 to 3-10-30-100-300 and 1000 volts. All ranges have a constant input resistance of 11 megohms. Accuracy is ± 3%. The a.c. ranges are 0 to 10-30-100-300 and 1000 volts with a sensitivity of 1000 ohms per volt. Accuracy



is ± 5%. The ohmmeter ranges are from 0-1000, 0-10,000, 0-100,000, 0-1 megohm, 0-10 megohms, and 0-1000 megohms. R.f. voltage ranges are from 0 to 3-10-30-50, with 50 volts being measured on the 100 volt range.

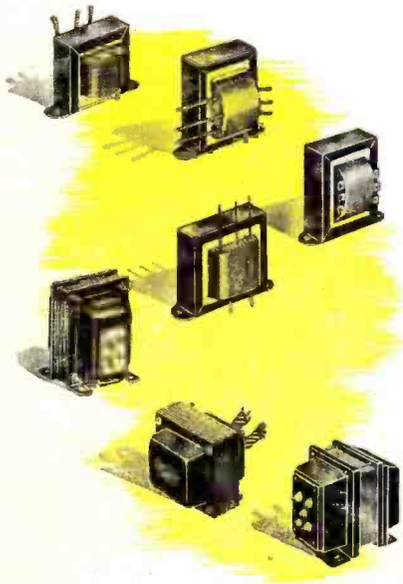
Full details on the Model ED 100 are available from *Electronic Designs, Inc.,* Irvington on Hudson, New York.

CRYSTAL-CONTROLLED OSCILLATOR

Bliley Electric Company of Erie, Pennsylvania, has announced the availability of a new crystal-controlled oscillator, the CCO Model 2A. This new unit for 2-6-10 and 11 meters provides a complete packaged nucleus for new construction or conversion of existing equipment.

With this basic oscillator, employing a 6AG7 tube, the advantages of v.h.f. crystal control are easily achieved. The CCO-2A has direct output on 6, 10, and 11 meters and ample output to drive a tripler stage in 2 meters. Single tuning control, bandswitch, and crystal socket are mounted on the outside of the painted metal subchassis,

when stamped STANCOR you get "plus-value" PERFORMANCE!



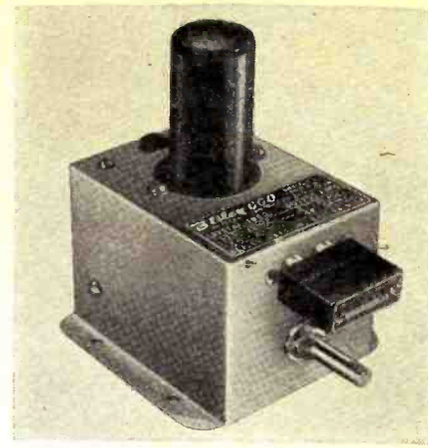
When it comes to merchandise nothing means more to any customer than the best service possible from the equipment he has purchased . . . Similarly, nothing means more to the service man than the good will and increased patronage of satisfied customers...STANCOR has long recognized this truth and has zealously guarded its good reputation for quality transformers by manufacturing the best possible merchandise from the best material obtainable—and with that extra "Plus" in effort . . . Remember, the Stancor identification on a transformer is your assurance of "PLUS-VALUE" for lasting satisfactory service.

standardize on **STANCOR TRANSFORMERS**

STANDARD TRANSFORMER CORPORATION · ELSTON, KEDZIE AND ADDISON · CHICAGO 18, ILL.

with the power and output terminals at the back.

The oscillator uses *Bliley* AX2 20 meter crystals for output on 10 and 11



meters and the new *Bliley* AX3 crystals for 6 and 2 meter operation.

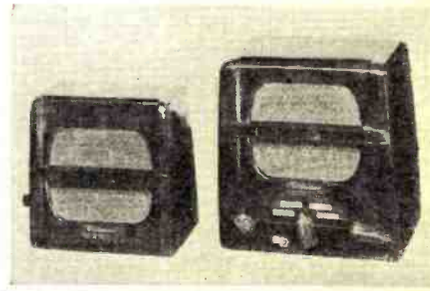
Full details are given in Bulletin No. 34 which will be sent upon request to *Bliley Electric Company,* Erie, Pennsylvania.

"TELEHOME"

A recently introduced item of interest to dealers is the *Webster Electric Company's* intercom for home installation, the "Telehome."

Designed as a step-saver for the homemaker, this new unit permits instantaneous communication with the kitchen, basement, garage, or supervision of the nursery.

The new unit consists of a master station which can originate and receive responses from as many as three speaker stations, which may be conveniently located to save steps.



The "Telehome" retails in the moderate price class and *Webster Electric Company* of Racine, Wisconsin, will furnish complete details on request.

"PACKAGED" TOWER UNIT

Rostan Corporation of New York is currently in production on the company's new "Trig Tower" which has been designed as an all-purpose unit for AM, FM, and television broadcast stations, amateurs, and the communications field.

The new tower is fabricated entirely of 61S T aluminum alloy and comes in three sizes, 30 foot, 20 foot, in ten foot sections, as well as a complete 10 foot unit.

Lightweight construction cuts shipping, erection, and footing costs. Because aluminum alloy is used, the

(*Continued on page* 114)

HOT RADIO VALUES at SUN RADIO!

HAM AND POLICE SUPERHET TUNER

Brand New. Complete with 7V7 (1 Stage T.R.F.) 7Q7 (1st IF & Osc.) 7V7 (2nd IF) 7F7 (Audio) and 7V7 (BFO). Frequency 2.4 to 16.3 mc. Filament voltage required 6.3 AC or DC—2.1 amp. Plate voltage required 135V DC—30 MA. Only 4 ½x9 ½x3 ¾", and weighs only 6 ½ lbs. deal for Ham and Police.... **$14.95**

WAVEMETER

We're closing out the last few of these precision wavemeters which tune from 150-210 mc and which contain a high quality resonant cavity wavemeter oscillator heterodyne amplifier electric tuning eye complete with 19 tubes, 110 v AC power supply. The tubes alone far exceed your close-out costs of only... **$17.95**

V.H.F. TRANSMITTER

Here is one of the greatest offerings in war surplus! Hundreds sold at $20 and now closed out at an amazingly low price. Brand new. Battery operated (67 ½ v B and 1 ½ v A.) Frequency 80 to 105 mc. Complete with 2—1G4 tubes and full instruction manual. Ready to go on the air. Less Batteries... **$6.95**

SPERRY AMPLIFIER

Brand new servo amplifier containing two beam power output tubes (1632) similar to 25L6, two twin triodes (1633 and 1634) similar to 6SC7, two mica condensers, dozens of color coded half watt resistors, two dual and four section bathtub condensers, three transformers, two wafer switches, one volume control, four octal sockets. Easily convertible.... **$3.95**

BC 684 F.M. 35 WATT TRANSMITTER

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

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**

BC645 UHF RECEIVER TRANSMITTER

"The citizen's Radio" covers 420-450 mc. Consists of complete transmitter, modulator system and receiver, 15 tubes, and simple complete conversion instructions for 420 mc operation. Brand new **$14.95**

WALKIE TALKIES

EACH **$69.95**

Set **$129.90**

SCR195 Walkie Talkies, brand new, weight 27 ½ pounds including knapsack. Range up to 25 miles in open country. Frequency 52.8 to 65.8 MC. Transmitter and receiver with regular hand set. Complete ready to operate with spare parts.

VM RECORD CHANGER

Brand new. Mixes 10" and 12" records.. **$16.95**

Wood Base fo above.....$3.49

100 WATT BENDIX TRANSMITTER TA12

CHECK THESE VALUES: 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 11 x 12 x 15 inches, weighing 35 ¼ lbs. Complete, simple instructions for conversion furnished. Complete with tubes..... **$49.95**

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 Output and Noise Suppressor 80 Rectifier. Dimensions— 3 ½ x 19 x 11 ½ inches. Comes complete, brand new, with one set of coils and two sets of tubes... **$16.95**

Extra set of coils.....$2.95

Portable Amplifying MEGAPHONE

U.S. Army Signal Corps Surplus! Complete in portable carrying case with electric megaphone and microphone, pistol grip and trigger switch. Additional hand microphone and switch. Portable tripod stand. Combination amplifier and battery case. Projects voice up to ¼ mile..... **$59.95**

WESTON OHM METER No. 689

A beautiful instrument for accurate work. Scale 0-10 ohm and 0-100 ohm scaled to read 1/20 of an ohm with ease. This 2 ¼" round meter is housed in a black bakelite case 1 ¾"x2 ¾"x5". Complete with heavy duty felt lined leather case and lock. Special.. **$14.95**

5-GANG TUNING CONDENSER

Brand new . . . 5 gang, 365 mmfd. per section . . . a truly precision built condenser with ceramic insulation. A. $13.50 value in the greatest offering ever made in tuning condensers for only..... **$2.95**

TS13 HANDSET

Combining a 200 ohm carbon mike and 2500 ohm earphone with butterfly switch for listen and talk. Has 6' flexible rubber cord with 1—P155 and PL68 plugs attached . . . **$2.95**

Brand New..

A. C. VOLT-METER **$3.49**

Brand new G.E. 3" square panel meter 0-150 v ideal for checking primary voltage.

D.C. MILLIAMMETER

Brand new General Electric 2" round panel meter 0-300..... **$2.97**

RADAR RECEIVER BC—1068A

Guaranteed excellent condition. It is a Hot receiver for Ham and Television experimenters, tunes 174 to 210 mc, contains 2 R.F. and 5 I.F. stages. Complete with 110 volt AC power supply and 14 tubes.... **$39.95**

BC-221 FREQUENCY METER

A heterodyne frequency meter complete with tubes, crystal, calibration chart and guaranteed accuracy of .01% or 500 cycles, whichever is greater. Better than two dial division per kc. Fundamental ranges are 125-250 and 200-400 kc. Can be used with 110 volts AC power pack, batteries or vibrapack. Makes a fine signal generator or converts to VFO. These are slightly used but Guaranteed A1..... **$37.50**

With Modulation.....$54.50

•All items F.O.B., Washington, D. C. All orders $30.00 or less cash with order. Above $30.00 25 per cent with order balance C.O.D. Foreign orders cash with all orders, plus exchange rate.

SUN RADIO

OF WASHINGTON, D. C. ●

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

THE ICONOSCOPE

By MILTON S. KIVER

Although the orthicon is of more recent design and has greater sensitivity, the iconoscope is still widely used because of its many unique advantages.

MANY persons in this country have undoubtedly witnessed a radio broadcast, at least once, by this time. Even those who have not bothered to do so (and anyone can obtain admittance to a large number of these shows) are quite familiar with the routine followed. Besides the script and rehearsals, no extensive preparations are necessary and many of the smaller stations do all their broadcasting from one or two studios.

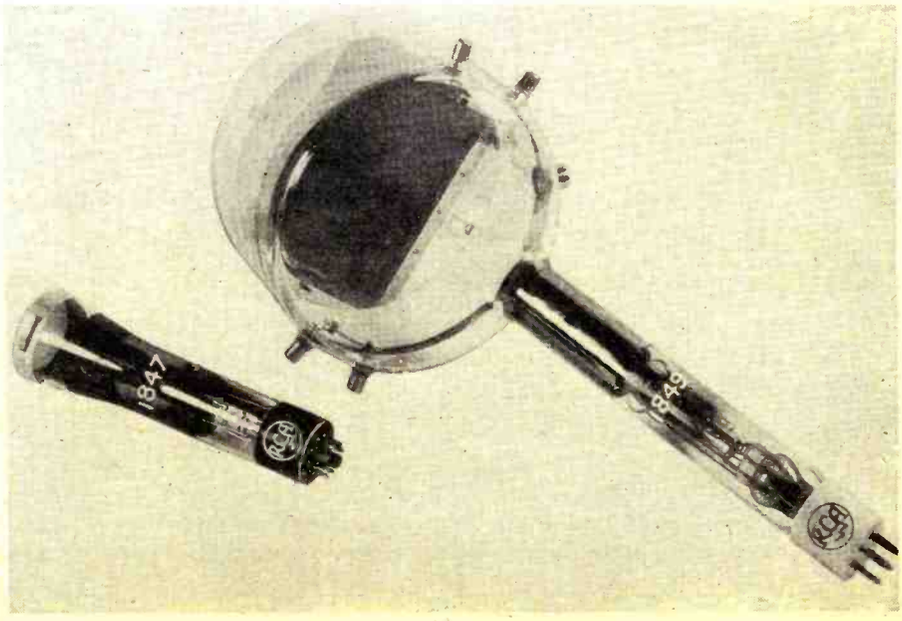
Not so familiar to most people is the television broadcast. Present facilities generally eliminate audiences, but these will undoubtedly be provided for when television broadcasting hits its stride.

However, when television studios are operating on a full-time basis, it will probably be found that the greater percentage of broadcast audiences will find more enjoyment in viewing television programs than the ordinary sound program. The reason can quite simply be found in the added requirements of visual radio. Not only must the actors speak their parts, but they must also look and act them. This will call for acting ability above and beyond the mere speaking voice, and each television program will appear as a miniature Hollywood movie set. Precise calculations of the various settings, the movements of actors and cameras throughout the entire production will have to be charted far in advance of the actual broadcast.

The complications of running a television studio will involve, in addition to the usual program planning, script writing, and rehearsals, such added features as design and production of scenery, arrangement of sets, make-up of performers, and exact placement of cameras. The camera operator, viewing the scene through his camera, the overhanging microphone and the strong illuminating lights suspended from the ceiling are all just as important as the scene itself.

Probably the one piece of apparatus that has been the recipient of the greatest amount of technical research has been the camera, and within it, the camera tube. When television was first conceived, mechanical devices were employed to transform light rays into electrical impulses, but in recent years, the trend has definitely been toward electronic scanning tubes and these are the only types now extensively employed. Since these camera tubes are responsible for the present

Fig. 1. Two types of iconoscope tubes. The 1847, the smaller of the two shown, is limited in its application. It is most frequently used for amateur or experimental work. The 1849 is widely used in television broadcast work. It is particularly applicable to studio pickup.



MODEL 205

Engineered by specialists in the development of broadcast receivers, built in our own modern laboratory. Four times the power of pre-war radio sets. Handsomer in appearance and more efficient in operation. Visual slide rule tuning dial with built-in Regaloop, and super Alnico No. 5 permanent magnetic speaker, with automatic volume control.

FEATURES

- Five Tubes—including Rectifier
- Single Band Super-Heterodyne
- Broadcast Band 540 to 1650 K.C.
- Automatic Volume Control
- Super Sensitive Iron Core Transformers
- 5" Alnico Wonder Speaker
- Illuminated Slide Rule Dial
- Built in Regaloop

$19.95 LIST PRICE

● ALSO AVAILABLE IN IVORY

Size: 4" wide 5" high 8" long

MODEL 747

The REGAL Super-Mite! AC, DC or BATTERY. Small enough to be packed in a suitcase, yet uses standard full size components! Parts interchangeable anywhere! The only set of its size with 5 "A" batteries and 1 "B" battery. Average life—100 hours!

FEATURES

- 4½" Alnico No. 5 speaker with a heavy duty slug weighing 1.47 oz.
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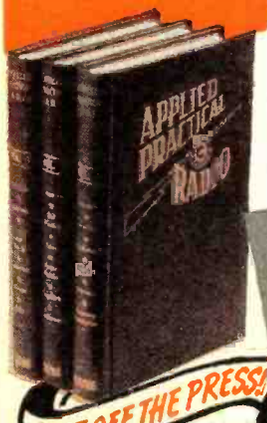

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state of engineering achievement in the television field, let us study the construction and operation of the more popular ones. With these as a start, some of the other components found in television broadcasting stations will not appear so completely different and unfamiliar.

The camera tube holds a position in television comparable to the microphone in audio broadcasting. Through its action, the light rays from the scene being televised are transformed into equivalent electrical currents. The comparison between the camera tube and the microphone, while useful in bringing out the over-all function of camera tubes, must not, however, be followed too far. The operation of the camera tube is much more complex than the relatively simple microphone and the manner in which the signal is taken from the tube will vary in accordance with the type of transmission used. This will be explained in greater detail in the following paragraphs.

If it were desired to break a picture up into some orderly sequence and send the various parts to some distant point, a variety of ways could be employed. We might, for example, cut the photo into a number of vertical strips, starting at the left-hand side of the picture. Another method could involve cutting the picture into horizontal strips, while a third might resort to starting at the center of the photograph and cut an everwidening circular or spiral path.

At the receiving end, these strips into which the photograph was dissected at the transmitter are pieced together in the exact same manner in which they were taken apart. The result, the same photograph. In television, it has been universally decided upon to utilize horizontal scanning and each televised scene is broken up into 525 lines or strips. These are sent in a definite sequence and pieced together at the receiver by a synchronized scanning beam in the cathode-ray viewing tube. The time taken to send the entire 525 lines amounts to $\frac{1}{30}$ of a second, or thirty complete images are transmitted every second. This rate has proved suitable for depicting most ordinary scenes and the figure chosen ties in very nicely with the 60-cycle alternating current used to power all television equipment in this country. The filtering problem is found to be less critical by this arrangement.

The Iconoscope

With the foregoing brief description in mind, let us examine the action of a popular camera tube, the iconoscope. A photograph of this tube is given in Fig. 1.

The surface on which the light rays are focused is known as the mosaic plate. On one side of the plate, the side facing the incoming light rays, many small photosensitive globules of cesium oxide, silver oxide, and silver have been deposited. Each globule

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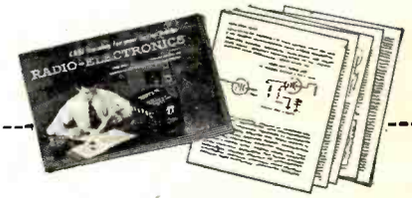

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(or small group of globules) is isolated. On the back side of the mica mosaic sheet is a continuous layer of conducting graphite. The amount of electrons given off from any one globule is proportional to the intensity of the impinging light rays. This construction results in a varying distribution of positive charge throughout the mosaic which is directly related to the distribution of light at the scene being televised. This represents the first step in converting the light rays into equivalent electrical charges.

As the globule distribution represents essentially many small condensers that are charged, some method must be used to discharge them. The electron beam is used for this purpose. Through elaborate electrical timing circuits, the electron beam is made to swing horizontally across the mosaic plate, rapidly neutralizing the deficiency of electrons on each globule. The deficiency arose when the light rays caused the globules to emit the electrons. These were then collected by the collector ring. The electron beam now returns these emitted electrons and in so doing, discharges each globule condenser. With the discharge, a pulse of current flows from the opposite side of the mosaic and through the series resistor. The voltage drop across this resistor is applied to the grid of the attached tube and amplified. The succeeding operations are similar to sound transmission methods.

The rapidly moving electron beam scans the mosaic plate with 525 interlaced lines. Each globule stores up charge during the time interval that the beam is at some other portion of the mosaic.

The advantages of the iconoscope are to be found in the ease with which it functions, its relatively small size and its good sensitivity, and fidelity of reproduction. The sensitivity is derived in large measure from the storage of electric charge by the photosensitive globules.

On the other side of the ledger we find poor efficiency and the disturbing presence of background shading in the reproduced image that was not present in the original scene. Poor efficiency, somewhere in the vicinity of 5 per-cent, is due, in part, to the inability of all the emitted electrons to reach the collector ring. The arrangement of the elements in this tube are such as to place the mosaic plate at only a few volts difference from the collector ring. Both are highly positive with respect to the cathode, but only a few volts apart between themselves. The emitted electrons, in trying to reach the collector anode, must overcome the positive charge of the mosaic plate itself and so many of these photoelectrons are drawn back to the mosaic surface. Naturally this lowers the efficiency.

The other reason for poor efficiency is tied in with the spurious background shading present in the reproduced image. It was found that the

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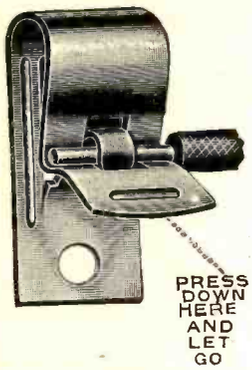

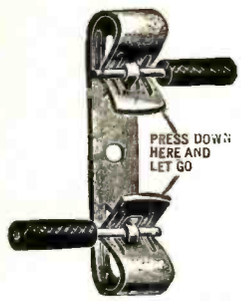

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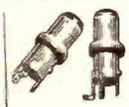

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electron beam, when impinging upon the mosaic plate (in the process of scanning), caused secondary electrons to be emitted. This is not surprising when it is considered that a fast-moving stream of electrons is impinging upon a surface that yields electrons quite easily to energy-giving sources. This process here is comparable to the emission of secondary electrons in tetrode tubes. These secondary electrons, once clear of the mosaic surface, may do one of two things; they may either be attracted to the collector anode or else they may return to the mosaic plate. It is this latter action that is responsible for all the trouble.

In returning to the mosaic plate, they do not all return to the particular globule from which they were knocked off by the electron beam. Rather they descend onto the plate more or less in the form of a shower. In so doing the original distribution of charge, as caused by the light rays, is altered and this results in distortion. It has been found that this distortion occurs even when no light rays are focused onto the mosaic plate, and there is merely the electron beam moving back and forth.

The distortion caused by these secondary electrons falling back on the mosaic plate appears on the reproducing screen in the form of uneven shading of the background of the image. To correct this, at least partially, a shading correction generator is inserted into the transmitting circuits. The voltages produced by this generator tend to combine with the unwanted distortion signals at a 180° phase shift. The result is the elimination of much of this uneven shading, despite the fact that these spurious voltages cannot be predicted in advance. One common method of minimizing the production of these secondary electrons is to reduce the intensity of the scanning electron beam. It is obvious that the operator's skill in operating the shading correction generator will largely determine the amount of spurious signal that will be eliminated.

While the iconoscope is used chiefly for indoor studio work, many outdoor programs will be planned. —30—

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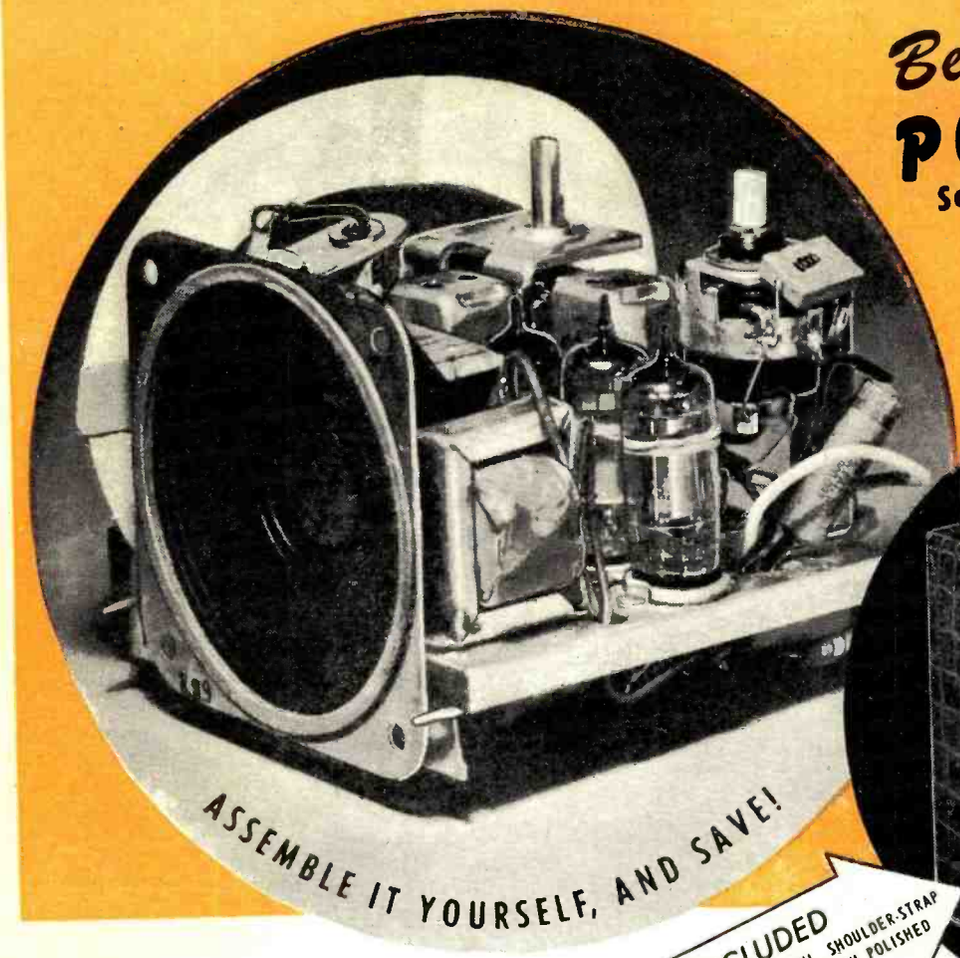

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Parts Lists

(FOR CIRCUIT DIAGRAMS APPEARING ON PAGES 78 AND 79)

HOFFMAN MODEL A401

Part No.	Code and Description
4500	R_1, R_8—.22 megohm, ½ w. res.
4501	R_2—22,000 ohm, ½ w. res.
4502	R_3—.22 megohm, ½ w. res.
4503	R_4—10,000 ohm, 2 w. res.
4504	R_5—47,000 ohm, ½ w. res.
4804	R_6—.5 megohm pot.
4505	R_7—10 megohm, ½ w. res.
4506	R_9—.47 megohm, ½ w. res.
4507	R_{10}—560 ohm, ½ w. res.
4805	R_{11}—.25 megohm pot. (with sw.)
4508	R_{12}—47 ohm, ½ w. res.
4509	R_{13}—330 ohm, ½ w. res.
4400	C_1, C_2, C_3—388/388/180 μμfd. 3-sec. var. cond.
	C_4, C_5, C_6—Part of var. cond.
4100	C_7, C_8—.05 μfd., 200 v. cond.
4000	C_9, C_{12}, C_{13}, C_{15}—100 μμfd. mica cond.
4101	C_{10}, C_{11}, C_{23}—.05 μfd., 400 v. cond.
4102	C_{14}, C_{16}—.005 μfd., 600 v. cond.
4103	C_{17}—.01 μfd., 400 v. cond.
4200	C_{18}, C_{19}, C_{20}—20/20/20 μfd., 450/450/25 v. elec. cond.
4104	C_{21}—.001 μfd., 600 v. cond.
4105	C_{22}—.01 μfd., 600 v. cond. (metal can)
5200	L_1—Osc. coil
9000	LS—Loudspeaker (1500 ohm field)
	S_1—On-off sw. (on tone control)
6001	S_2—Radio-phono sw.
	S_3—Phono motor sw.
5223	T_1—Ant. loop
5202	T_2—Shielded r.f. coil
5203	T_3—Input i.f. trans.
5204	T_4—Output i.f. trans.
5100	T_5—Audio output trans.
5000	T_6—Power trans.

ARVIN MODEL 140P

Part No.	Code and Description
C20060-156	R_1—15 megohm, ¼ w. res.
C20060-104	R_2—100,000 ohm, ¼ w. res.
C20060-223	R_3—22,000 ohm, ¼ w. res.
C20060-334	R_4, R_9—330,000 ohm, ¼ w. res.
C20060-106	R_5, R_{18}—10 megohm, ¼ w. res.
C20060-335	R_6—3.3 megohm, ¼ w. res.
C20060-473	R_7—47,000 ohm, ¼ w. res.
C21050	R_8—1 megohm vol. control & sw.
C20060-475	R_{10}, R_{11}—4.7 megohm, ¼ w. res.
C20060-225	R_{12}—2.2 megohm, ¼ w. res.
C20070-470	R_{13}—47 ohm, 1 w. res.
A21348	R_{14}, R_{15}—1750 ohm, 10 w. res.
C20070-182	R_{16}—1800 ohm, 1 w. res.
C20060-681	R_{17}—680 ohm, ¼ w. res.
C20060-102	R_{19}, R_{20}—1000 ohm, ¼ w. res.
C20060-685	R_{21}—6.8 megohm, ¼ w. res.
C19822	C_1, C_2—2-gang var. cond. including 1 A20077-3 grommet and 1 spacer eyelet
or C21153	C_1, C_2—2-gang var. cond. including 2-A 19328-2 grommet
C20065-500	C_3—.00005 μfd., 500 v. mica cond.
C20068-104	C_4—.1 μfd., 400 v. cond.
C20068-503	C_5, C_6, C_7, C_{13}, C_{19}—.05 μfd., 400 v. cond.
C20069-103	C_8—.01 μfd., 400 v. cond.
C20065-102	C_9, C_{11}, C_{14}—.001 μfd., 500 v. mica cond.
C20065-251	C_{12}—.00025 μfd., 500 v. mica cond.
C20069-202	C_{15}—.002 μfd., 600 v. cond.
A21163	C_{17A}, C_{17B}, C_{17C}—15/40/10 μfd., 150/150/150 v. elec. cond.
A21164	C_{18}—100 μfd., 10 v. elec. cond.
AC21054-1	L_1—Antenna loop assembly
AC21055-1	L_2, L_3—Osc. coil assembly
AC21152-1	L_4—Hash filter
AC21052-1	T_1—First i.f. coil
AC21053-1	T_2—Second i.f. coil
AC21057-1	T_3—Output trans.

ADMIRAL MODELS 7T01, 7T04

Part No.	Code and Description
60B8-223	R_1—22,000 ohm, ½ w. res.
60B8-105	R_2—1 megohm, ½ w. res.
60B8-475	R_3—4.7 megohm, ½ w. res.
60B8-474	R_4, R_5—470,000 ohm ½ w. res.
60B8-151	R_6—150 ohm, ½ w. res.
60B8-154	R_7—150,000 ohm, ½ w. res.
75B1-6	R_8—1 megohm vol. control & sw.
60B28-3	R_9—33 ohm, 1 w. res.
60B28-2	R_{10}—1000 ohm, 1 w. res.
60B2-106	R_{11}—10 megohm, ¼ w. res.
64B1-30	C_1—.1 μfd., 200 v. cond.
65B6-4	C_2—50 μμfd. ceramic cond.
64B1-24	C_3—.02 μfd., 400 v. cond.
64B1-25	C_4, C_5—.01 μfd., 400 v. cond.
65B6-5	C_6—250 μμfd. ceramic cond.
65B6-6	C_7—500 μμfd. ceramic cond.
64B1-24	C_8—.02 μfd., 400 v. cond.
67A3	C_{9a}, C_{9b}—50/30 μμfd., 150/150 v. elec. cond.
64B1-20	C_{10}—.1 μfd., 400 v. cond.
64B1-22	C_{11}—.05 μfd., 400 v. cond.
64B1-12	C_{12}—.005 μfd., 600 v. cond.
A1364	C_{13a}, C_{13b}—0-420/0-162 μμfd. gang
65B6-18	C_{14}—15 μμfd. ceramic cond.
69B4	L_1—Antenna loop (includes C_{12})
69A14	L_2—Osc. coil
72B31	T_1—First i.f. trans.
72B32	T_2—Second i.f. trans.
98A4	T_3—Output trans.

EMERSON MODELS 501, 502, 504

Part No.	Code and Description
397000	R_1, R_9—15 megohm, ¼ w. res.
321330	R_2—3.3 megohm, ¼ w. res.
390010	R_3—.5 megohm vol. control
321130	R_4, R_5—470,000 ohm, ¼ res.
340290	R_6—150 ohm, ½ w. res.
370490	R_7—1000 ohm, 1 w. res.
310810	R_8—22,000 ohm, ¼ w. res.
340010	R_{10}—10 ohm, ½ w. res.
397040	R_{11}—15 ohm, 1 w. wirewound res.
321050	R_{12}—220,000 ohm, ¼ w. res.
900170	C_1, C_2—Two-gang var. cond. (120000 chassis)
900290 or 900160	C_1, C_2—Two-gang var. cond. (120029 chassis)
	C_3—Trimmer (Part of var. cond.)
	C_4—Trimmer (Part of var. cond.)
	C_5, C_6—Trimmers (Part of first i.f. trans.)
	C_7, C_8—Trimmers (Part of second i.f. trans.)
920010	C_9, C_{15}—.002 μfd., 600 v. cond.
920170	C_{10}—.001 μfd., 600 v. cond.
920020	C_{11}, C_{12}—.02 μfd., 400 v. cond.
910000	C_{13}—.00022 μfd. mica cond.
920040	C_{14}—.1 μfd., 200 v. cond.
920030	C_{16}—.05 μfd., 400 v. cond.
925000	C_{17}, C_{18}—30/50 μfd., 150/150 v. elec. cond.
920050	C_{19}—.2 μfd., 200 v. cond.
700000 or 700200	L_1—Loop antenna
720000	T_1—First i.f. trans.
720100	T_2—Second i.f. trans.
734000	T_3—Output trans.
716010	T_4—Osc. coil

CROSLEY MODEL 56TD-W

Part No.	Code and Description
W-48858	1—6.3 v., 15 amp. dial bulb
C132300-1	2—Cable & plug
AC-136091	3—Ant. loop & back assembly
AW-136058	4—Osc. coil assembly
AW-137656	5—First i.f. trans.
AW-137657	6—Second i.f. trans.
B-136810	7A, 7B—Two-section var. cond.
	7C—Trimmer (Part of 7A)
	7D, 7E—Trimmer (Part of 7B)
39001-80	9—.02 μfd., 600 v. cond.
39001-17	10—.05 μfd., 600 v. cond.
39001-73	11—250 μμfd., 600 v. cond.
39001-76	12—.003 μfd., 600 v. cond.
39001-80	13, 14—.02 μfd., 600 v. cond.
B-226638-53	15—50 μμfd., 500 v. ceramic cond.
B-136767	16—Speaker
39001-17	17—.05 μfd., 600 v. cond.
B-136771	18A, 18B, 18C—50/30/10 μfd., 150/150/25 v. elec. cond.
39294-38	19—15 megohm, ½ w. res.
39294-21	20—22,000 ohm, ½ w. res.
39294-34	21—3.3 megohm, ½ w. res.
39294-35	22—4.7 megohm, ½ w. res.
39294-29	23, 24—470,000 ohm, ½ w. res.
39294-9	25—150 ohm, ½ w. res.
B-135383	26A, 26B—1 megohm vol. control & sw.
B-135892	27—2 megohm control
B-135388	28—Output trans.
39001-13	29—.01 μfd., 600 v. cond.
39294-21	30—22,000 ohm, ½ w. res.

BLEEDER RESISTOR
50,000 ohm 100 watt..... 89c

R·H·S
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VERNIER TUNING GEAR BOX
18:1 and 36:1 Ratio. Ideal for osc. tuning section of SCR-522..... $2.49

SELENIUM RECTIFIERS
Full Wave Bridge Type

INPUT		OUTPUT		
up to	18v A.C.	up to 12v D.C	1 Amp.	$1.95
up to	18v A.C.	up to 12v D.C	5 Amp.	4.45
up to	18v A.C.	up to 12v D.C	10 Amp.	7.45
up to	18v A.C.	up to 12v D.C	15 Amp.	9.95
up to	18v A.C.	up to 12v D.C	30 Amp.	14.95
up to	36v A.C.	up to 28v D.C	1 Amp.	3.45
up to	36v A.C.	up to 28v D.C	5 Amp.	7.45
up to	36v A.C.	up to 28v D.C	10 Amp.	12.45
up to	36v A.C.	up to 28v D.C	15 Amp.	18.95
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

HALF WAVE TYPE

up to 196v A.C.	up to 158v D.C	.075 Amp.	$1.95
up to 396v A.C.	up to 330v D.C	.075 Amp.	2.95
up to 396v A.C.	up to 330v D.C	.110 Amp.	3.95

OIL CONDENSERS:
G.E., AEROVOX, CD., ETC.
All Ratings, D.C.

1mfd.	600v	$0.35	2mfd.	2000v	$1.75
2mfd.	600v	.35	3mfd.	2000v	2.75
4mfd.	600v	.60	4mfd.	2000v	3.75
8mfd.	600v	1.10	15mfd.	2000v	4.95
10mfd.	600v	1.15	.1mfd.	2500v	1.25
1mfd.	1000v	.60	.25mfd.	2500v	1.45
2mfd.	1000v	.70	.5mfd.	2500v	1.75
4mfd.	1000v	.95	.05mfd.	3000v	1.95
8mfd.	1000v	1.95	.1mfd.	3000v	2.25
10mfd.	1000v	2.10	.25mfd.	3000v	2.65
15mfd.	1000v	2.25	.5mfd.	3000v	2.85
20mfd.	1000v	2.95	1mfd.	3000v	3.50
24mfd.	1500v	6.95	12mfd.	3000v	6.95
.25mfd.	2000v	1.05	2mfd.	4000v	5.95
.5mfd.	2000v	1.15	1mfd.	5000v	4.95
1mfd.	2000v	.95	.1mfd.	7000v	2.95

SPECIAL! 2 mfd. 3000v..... $4.45

HIGH CAPACITY CONDENSERS
All Ratings, D.C.

4000 mfd.—18WVDC	$1.95
4000 mfd.—30WVDC	2.95
1000 mfd.—15WVDC	.99
2000 mfd.—50WVDC	1.95

ART/13 MODULATION KIT
Consists of driver, speech amplifier, sidetone amplifier assembly and modulation transformer. With complete diagram for the famous ART/13 transmitter.
SUPER BUY at..... $8.95

GIBSON GIRL TRANSMITTER
(SCR-578B)
Emergency life transmitter. 100% complete; includes balloon, hydrogen generator, kite, signal lamp, antenna and instruction manual. Self-powered merely by turning crank. Automatically transmits S.O.S. on 500 cycles.
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PORTABLE F M TRANSMITTER
(SONOBUOY)
Operates on standard 67½v Minimac and 1½v Flashlight cells. Frequency 72 mc (easily doubled to 144 mc). Complete with 5 tubes and diagram. (Less batteries.)
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DYNAMOTORS
(Ideal for Mobile)
Input: 6 or 12 volts.
Output: 500 VDC at 160 ma.
Voltage Regulated and Filtered.
PE-103 (slightly used)..... $5.95

Input: 24-28 volts. Output: 150 VDC at 260 ma. 150 VDC at 10 ma. 14.5 VDC at 5 amp.
Voltage Regulated and Filtered
DA-3a (slightly used).... $4.95

RCA-158 OSCILLOSCOPE
Brand New—110v 60 cyc. 5 inch tube. Complete ready to operate. Regular price much higher. Limited Quantity $99.50

TUBES (*Brand New*)
Army-Navy Inspected

1B24	$ 4.95	311	$ 1.98
2AP1	2.25	371B	5.95
2C40	1.19	450TH	39.95
2D21	.89	703A	7.95
2V3G	1.25	705A	3.95
2X2	.84	715B	29.50
3AP1	3.00	721A	4.35
3BP1	2.95	726/AC	7.50
3E29	2.95	801	1.49
5BP1	3.95	202	1.98
5BP4	4.95	803	8.95
5CP1	3.95	804	9.95
5JP1	11.95	805	4.95
5LP1	8.95	806	14.95
5R4GY	.98	807	.95
5Y3	.41	808	2.95
6AB7	.99	809	1.50
6AC7	.99	810	4.95
6AG5	.99	811	1.95
6AG7	.99	812	3.15
6AJ5	.99	812H	6.90
6AK5	.90	813	8.95
6AL5	.99	814	4.45
6AR6	1.29	815	3.95
6B4G	1.29	826	2.25
6C4	.69	829-A-B	3.00
6C5	.49	832	2.25
6F6	.89	833A	39.50
6F6G	.59	834	2.95
6J4	.89	835	2.95
6J5	.69	836	1.75
6J6	.89	837	2.50
6L6	.81	838	3.95
6L7	1.25	841	1.20
6N7	1.59	861	69.50
6SH7	3.95	866	.75
6SL7	.98	872A	2.50
6SN7	1.50	884	.98
6SR7	1.50	885	.98
7A4	1.75	902	2.25
7F7	1.50	913	3.00
7L7	.55	954	.75
9JP1	.89	955	.75
10Y	1.23	956	.75
12X3	.98	957	.75
15E	1.02	958	.75
HK24	.59	959	.75
28D7	.98	1005	.69
30	.75	1616	2.95
35T/TG	3.50	1619	.75
VR90	.75	1624	.90
VR105	.75	1625	.75
VR150	.75	1626	.75
100TH	7.95	8001	6.49
100TS	3.00	8003	9.95
211	1.25	8005	4.95
75T	2.95	8011	1.95
250TH	14.95	8016	1.65
257B	6.49	8025A	4.95
304TH	9.95	1654	1.98

SCR-522 100-156 MC.
RECEIVER AND TRANSMITTER
Licensed for Railway and Taxicab Use
The ideal all-purpose transmitter-receiver for work in the 100-156 mc. spectrum. Four channel push-button operation, crystal-controlled, AM, phone, mobile or fixed station service. Ideal for amateur, aircraft, marine, railroad, taxicabs, police and experimental. Amplitude modulated—High transmitter output. Receiver has 10 tubes and transmitter has 7 tubes including two 832's. 60 cycle operation. Complete conversion instructions and schematic furnished with each unit. Tube complement 2—832; 3—12A6; 1—6G6; 2—6557; 1—12J5GT; 1—12C8; 1—9002; 3—9003; 1—12AH7 GT and 3—12SG7. Complete with tubes..... $14.95

BC-348 RECEIVER
Built for continuous duty, this band switching, six band receiver with a freq. range of 200 to 500 kc. and complete 1500 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 each band. Complete with built-in dynamotor for 28v DC; 8 tubes. Conversion instructions and schematics. Wonderful buy at..... $49.50
Conversion kit for 110v-60 cyc. operation. complete $7.50

TRANSFORMERS—115 V 60 CYC.
HI-VOLTAGE INSULATION

1600v at 4ma; 700v at 150ma; 6.3v at 8A	$8.50
3710v at 4ma; 2x2.5v at 3A	9.95
2500v at 10ma	6.50
2150v at 15ma	6.50
1750v at 4ma; 6.3v at 3A	7.95
1540v at 4ma; 340-0-340 at 240ma	7.50
550-0-550v at 150ma; 5v at 3A; 2x6.3 at 3 amp	7.95
500-0-500v at 100ma; 5v ct at 3A	4.95
442-0-442v at 1000ma	9.95
425-0-425v at 150ma; 6.3v at 7.5A; 6.3v at 3A; 5v at 3A	5.95
400-0-400v at 200ma; 5v at 3A	4.95
350-0-350v at 150ma; 6.3v at 6A; 5v at 3A; 78v at 1A	4.95
350-0-350v at 35ma-XLNT for VOLT-DBLR	1.49
300-0-300v at 65ma; 2X 5v at 2A; 6.3v at 2½A; 6.3v at 1A	3.49
325-0-325v at 120ma; 10v at 5A; 6.3v at 7A	3.49
350-0-350v at 85ma; 2X 5v at 2A; 6.3v at .6A; 6.3v at 3.75A	7.50
250-0-250v at 100ma; 2X 6.3 at 4A; 6.3v at 5A; 6.3v at 1A	4.95
2.5v at 2A; 5v at 3A	2.95
2.5v at 10A	3.25
5v at 115A	9.95
5v at 190A	17.50
6.3v at 6.6A	3.25
6.3v at 3.1A	1.95
6.3v at 21.5A; 6.3v at 2A; 2.5v at 2A	6.95
1600v @ 2 ma; 2.5v @ 1.75A; 6.3 @ .6A	9.95

FILTER CHOKES
HI-VOLTAGE INSULATION

4 Hy at 250ma	$1.98	12 Hy at 300ma	$3.95
10 Hy at 250ma	2.49	15 Hy at 100ma	2.95
10 Hy at 400ma	4.95	15 Hy at 125ma	3.25
12 Hy at 100ma	2.95	30 Hy at 70ma	1.95
4 Hy at 600ma	5.95	.1 Hy at 5 Amps	6.95
10 Hy at 200ma	1.98	15 Hy at 75ma	1.49
200 Hy at 12ma	1.39	10/20 Hy at 85ma	1.95

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 2¾x3¼". Many uses.
Super buy at..... $5.95

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Let us quote on components and equipment that you require. We have too many items to be listed on this page. Place your name on our mailing list now for new catalog.

39001-76	31—.003 μfd., 600 v. cond.
W-135355	32—Interlock sw.
39294-8	34—150 ohm, ½ w. res.
39015-26	35—1200 ohm, 1 w. res.
W-137367	36—47 ohm, 1. w. res.
39001-80	37—.02 μfd., 600 v. cond.
39294-21	38—22,000 ohm, ½ w. res.

GAROD MODEL 5AP1-Y

Part No.	Code and Description
1.410	1—Loop assembly
2.200	2—2-gang var. cond.
1.259	3—First i.f. trans.
1.259	4—Second i.f. trans.
8.201-2	5—Vol. control & sw.
30.301	6—4" PM speaker & output trans.
5.400-8	7—40/40/20 μfd. elec. cond.
1.402-2	8—Osc. coil
11.207	9—D.p.d.t. sw.
36.104	10—Phono pickup
36.108	11—Phono motor and turntable

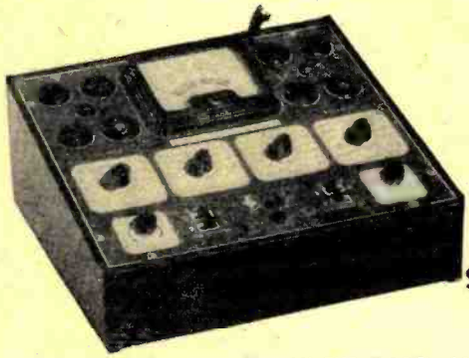
Spot Radio News

(*Continued from page* 18)

that the refusal of Mr. Petrillo to permit the duplication of musical programs on FM will serve as a serious delay in the development of a broadcast art which the FCC has termed the 'finest'." He added: "We feel that the issue at stake is far greater than the mere pitting of independent FM stations against those with a network or AM affiliation. It is a question of depriving the public of a service. Just as it is the listener's right and privilege to tune in Kate Smith, Bing Crosby, Jack Benny, the NBC symphony and other programs on AM, it should be his right to enjoy them on FM."

HAMS WHO LISTENED IN on the record flight of B-29's non-stop from Tokyo to Washington late in the summer as part of the Air Force Day celebration may be surprised to know that AAF hailed one aspect of the flight as a brand-new radio development. "Thoughout the forty-hour flight from Japan to the United States," said an AAF news release after the big jump, "the Army Air Forces was in continuous communication with the planes. The transmissions, first long-range, continuous, air-to-ground exchange of radio messages ever accomplished, were made possible by development of a technique, familiar to many amateur radio operators, which permits constant radio contact from Washington with aircraft flying in any part of the world." The technique, to many a ham, is familiar indeed, employing as it does an antenna which can be rotated to point in the direction of the plane and "follow" it in flight. Long before AAF began using it in plane-to-ground communications, this rotary beam parasitic array was in use on a point-to-point basis. AAF adds that the technique has obvious wartime values, especially since it requires no special equipment in planes. Standard AAF liaison sets in all aircraft can receive the transmissions sent by a one- and two-kw. set in Washington which exploits the directional assistance offered by the rotary beam. A supersensitive receiving antenna of the rotary beam principle, in Washington, picks up

MONEY BACK GUARANTEE We believe units offered for sale by mail order should be sold only on a "Money-Back-If-Not-Satisfied" basis. We carefully check the design calibration and value of all items advertised by us and unhesitatingly offer all merchandise subject to a return for credit or refund. You, the customer, are the sole judge as to value of the item or items you have purchased.



The New Model 60-T TUBE and SET TESTER

A COMPLETE TUBE TESTER

Tests all tubes including the new post-war miniature loctals such as the 12AT6, 12AU6, 35W4, 50B5, 117Z3, etc. • Tests by the well-established emission method for tube quality, directly read on the scale of the meter • 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.

A COMPLETE MULTI-METER

- 6 D.C. Voltage Ranges: 0 to 7.5/15/75/150/750/1,500 Volts
- 6 A.C. Voltage Ranges: 0 to 15/30/150/300/1,500/3,000 Volts
- 4 D.C. Current Ranges: 0 to 1.5/15/150 Ma. 0 to 1.5 Amps.
- Low Resistance Ranges: 0 to 2,000 Ohms (1st division is 1/10th of an ohm.)
- 2 Medium Resistance Ranges: 0 to 20,000/200,000 Ohms
- High Resistance Range: 0 to 20 Megohms
- 3 Decibel Ranges: −10 to +38, +10 to +38, +30 to +58 DB.

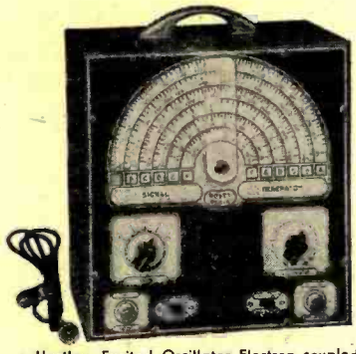
$49.85 NET PRICE

Model 60-T operates on 90-120 Volts 60 Cycles A.C. Housed in sloping leatherette covered cabinet. Comes complete with test leads, tube charts and detailed operating instructions.

EXTRA: WE CAN NOW SUPPLY THE MODEL 60 HOUSED IN A BEAUTIFUL HAND-RUBBED OAK CABINET. COMPLETE WITH PORTABLE COVER MAKING IT SUITABLE FOR EITHER BENCH OR OUTSIDE USE. ONLY $2.75 ADDITIONAL. SPECIFY MODEL 60-C

The New Model 650-A A.C. Operated

SIGNAL GENERATOR



- Operates on 110-120 Volts 50 to 60 Cycles A.C.
- R.F. Frequencies from 100 Kc. to 35 Mc. on Fundamentals in 5 bands by front panel switch manipulation. One additional band provides Harmonics from 30 to 105 Mc.
- Audio Modulating Frequency—400 Cycles Pure Sine Wave. Distortion less than 2%.
- Attenuation: Features a newly designed 3-step ladder type of attenuator (T pad). The first step provides lowest output and can be multiplied by 10 and by 100 by turning the multiplier switch.
- Hartley Excited Oscillator Electron coupled to a Buffer Amplifier. Frequency stability is assured by modulating the amplifier stage.

Complete with coaxial cable, test leads and instructions. Heavy gauge grey crystalline cabinet with beautiful two-tone etched front panel. Size 9 1/8" x 10" x 6."

$39.95 NET

The New Model CA-11 SIGNAL TRACER

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 Valtmeter circuit.
- ★ Tube and resistor-capacity network are built into the Detector Probe.
- ★ COMPLETELY PORTABLE —weighs 5 lbs. and measures 5"x6"x7".
- ★ Comparative Signal Intensity readings are indicated directly on the meter as the Detector Probe is moved to follow the Signal from Antenna to Speaker.
- ★ Provision is made for insertion of phones.

THE MODEL CA-11 COMES HOUSED IN A BEAUTIFUL HAND-RUBBED WOODEN CABINET. COMPLETE WITH PROBE, TEST LEADS AND INSTRUCTIONS.

$18.75 NET

The New Model 670 SUPER METER

A Combination VOLT-OHM-MILLIAMMETER plus CAPACITY REACTANCE, INDUCTANCE and DECIBEL MEASUREMENTS

D.C. VOLTS: 0 to 7.5/15/75/150/750/1500/7500. A.C. VOLTS: 0 to 15/30/150/300/1500/3000 Volts. OUTPUT VOLTS: 0 to 15/30/150/300/1500/3000. D.C. CURRENT: 0 to 1.5/15/150 Ma.; 0 to 1.5 Amps. 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" x 7½" x 3".

$28.40 NET

The New Model 450 TUBE TESTER

Speedy operation—assured by the 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 Megohms 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 NET

GENERAL ELECTRONIC DISTRIBUTING CO.

Dept. RN-11, 98 Park Place
NEW YORK 7, N. Y.

signals transmitted by the aircraft. Signal Corps engineers, who have worked with AAF in developing the antenna for defense purposes, state that the lessened amount of space required for locating the antenna, the ease and speed with which it may be erected, and the push-button rotation characteristics, also offer new communication possibilities in fast-moving military ground operations.

THE BIGGEST "Men Wanted" sign in the country today, according to Dr. Lawrence R. Hafstad, director of the applied physics laboratory of the Johns Hopkins University, is hung up in front of laboratories working on guided missiles. Radio experts are among those needed on the "wanted" list, he emphasized. He speaks not only as the head of the Johns Hopkins research work but also (although unofficially) for the Joint Research and Development Board. But before you rush to the nearest lab for a job, you might consider a couple of additional remarks made by the good doctor. "How can a man qualify as being good for such work?" the doctor asks. "Only by past achievement or on the recommendation of a person with a record of past achievement." Experience is the prime prerequisite, in other words. As for what kind of experience, perhaps Dr. Hafstad's record will give an idea. He became the director of research at the Johns Hopkins laboratory in 1946 and had important roles in the development of the proximity fuze, the supersonic ram-jet engine, and a propulsion unit for a Navy guided missile.

SECOND HIGH HURDLE that Dr. Hafstad puts in the way of prospective guided missile radio employes is the extreme difficulty of the radio problems involved. "Numerous major problems must be solved in the completely new field of supersonic aerodynamics, propulsion and launching, before guided missiles will become operational weapons," he says. "But all these problems are only incidental nuisances compared to the problem of guidance. In propulsion and launching, we are providing the mechanical muscles for our weapon—the guidance system is our attempt to provide mechanical brains." He adds that although "we have had radio-controlled airplanes for years, even decades, yet they have never been permitted to wander more than a few miles from a control airplane. This is a simple problem compared to that of guided missiles." Yet the problem must be solved, and radio is the way to solve it.

AFTER A SLIGHT DECLINE during the late summer, radio production started on another upswing toward establishing what will probably be a new all-time annual record. Plant vacations were responsible to a great extent for decreased production in July. All types produced, according to reports by Radio Manufacturers Association members, totaled 1,155,456 for the month, off from the June total of 1,213,142. But the trend upward began during the closing weeks of July and shows every sign of continuing. In the work week ending August 1, a total of 357,240 receivers were turned out, as compared with weekly totals during the immediately preceding periods of 269,530, 187,723, 138,030, and 202,933. Even television receivers were off in July, dropping to 10,007 units from the record 11,484 sets produced in June. The July total was, however, well above any other preceding month this year. Total radio set production by RMA member companies for the first seven months was 9,766,100.

RMA IS OPPOSING recent developments in the foreign field restricting importation of radios. Nine countries, headed by Mexico, Argentina, and Chile, have restricted American set imports. U. S. dollar shortage south of the border is blamed. RMA believes that bootlegging of radio sets across the border will be the result of the Mexican ban. Other evils will include no saving in dollar exchange, higher radio costs to the Latin American public, loss of revenue to foreign countries, and general commercial confusion. James E. Burke, chairman of the RMA export committee, is leading the fight to lift the bans.

—30—

The BEST in SURPLUS

BC 223 TRANSMITTER

One of the most desirable military transmitters. 4 crystal-controlled frequencies and master oscillator. Meters for Osc., Ant., and total current. Uses 46 speech amplifier, 2-46 modulators, 801 each as oscillator and power amplifier. Practically no conversion necessary, plug in crystal, mike and connect power supply and it's ready to operate. Brand new with tuning units to cover 2000 K.C. to 5250 K.C. (less tubes) **$12.95**

BC 222 WALKIE TALKIE

Supplied with antenna. The latest type covering 28-52 MC, includes crystal calibrator, range 15 miles. Only 130 available at this low price..... **$19.50**

BC 454 AND BC 455B RECEIVER

Six-Tube Western Electric superheterodyne, 3 gang condenser, R.F. stage, two I.F. stages, tunes 6-9.1 MC. Offered brand new in original carton for the price others ask for war-weary sets, with six new tubes. 3-12SK7, 1-12SR7, 1-12A6, 1-12K8.
Our price, BC 455 **$4.95**

BC 454 (tunes 3-6 MC) as above $4.95
Rack FT 277A holds both above $1.00
Dynamotor DM32A for above, new $1.50

★ ★ KITS ★ ★

Kit of ten ceramic variable air trimmers, 12 M. M. F. to 50 M. M. F.	$1.95
Kit of assorted mica and silver mica condensers, all marked	25 for $1.00
Kit of assorted ceramic condensers	20 for $1.00
Kit of Potentiometers long shafts, 600 ohms to 200M ohms	10 for $1.95
Kit of tube sockets, miniature, loctal, octal	20 for $1.00
Kit of power rheostats, 25 and 50 watt	6 for $2.95
Experimenter's Kit, a paradise of condensers, coils, transformers, resistors, etc., all useful parts. 5 full pounds for	$1.00
Resistor Kit ½ -1-2 Watt, all excellent sizes, color coded	100 for $1.95
Kit of Microswitches	3 for $1.00
Kit of bypass condensers, .01 to .25 MFD, 200 to 600 volts, all marked	15 for $1.00
Kit of vitreous resistors, 5 and 10 Watt	15 for $1.00
Kit of Selenium Rectifiers	4 for $1.00
Kit of transmitter crystals, assorted between 2000 and 6000 KC in holders	4 for $1.00
Kit of R.F. Chokes, excellent assortment	10 for $1.00
Kit of power, microphone and headphone cords, rubber covered, with plugs	10 for $2.95
Kit of screw driver type Potentiometers	10 for $1.00
Kit of Metal Tubular Bypass Condensers	20 for $1.00
Kit of Bathtub Bypass Condensers .1 M.F.D. to 1 M.F.D.	20 for $1.00
Kit of Relays, excellent assortment	5 for $2.50
Kit of Rotary Switches, Mallory, Centralab, etc.	5 for $1.00

6 or 12 VOLT DYNAMOTOR

Brand new. Operates from either 6 or 12 Volts. Supplies 500 Volts at 160 MA. In original carton.. **$5.95**

Dynamotors, Western Electric, 12V input, 220V at 80 MA output in original carton..... $1.95
Dynamotors, Western Electric, 24V input, 220V at 80 MA output in original carton..... $1.50
Dynamotors, BD-77, 12V input, 1000V at 350 MA output..... $7.95

BC 306 ANTENNA TUNING UNIT

Used on the General Electric 150 Watt BC 375 transmitter to match it to any type antenna. Excellent for use with any transmitter. Supplied brand new in original carton **$3.95**

RG-8/U FLEXIBLE COAXIAL CABLE

Only **4¢** PER FT.

RG-8/U is the ideal cable for feeding receiving and transmitting antennae for all frequencies up to 250 mc, and can be used up to 3,000 mc and down to dc. Prices at less than WAA wholesale. This is the last big lot — order while available.

BC-605 INTERPHONE AMPLIFIER

The famous tank interphone, thousands bought for intercommunicating systems, call systems, etc. Uses two 1619 tubes (2.5V fil. 6L6's) used, in excellent condition, lowest price ever offered, with tubes..... **$2.95**

PUSH BUTTON TUNER

A ten push button assembly, operating a 4 gang silver plated variable condenser. Each shielded section has silver plated APC type ceramic air trimmers. Drum dial manual tuning. An outstanding surplus value at lowest prices ever offered **$2.50**

Specials

455 KC slug tuned I.F.'s square can	39¢, 3 for $1.00
4-gang 147 MMF silver plated variable condensers, long shaft, a buy at	$1.00
Ceramic variable condensers, 50 MMF. Screw driver adj.	Special 5 for $1.00
Choke, 20 henry 50 MA, cased	$1.00
Choke, 10 henry, 200 MA, cased	$1.50
HS30 miniature type headphones, similar to hearing aids with band and cord	$1.00
12 MFD 150V Mallory electrolytics, extra special	6 for $1.00
.01-600V paper tubular condensers	20 for $1.00
.05-600V paper tubular condensers	15 for $1.00
Interphone control box, BC606, contains potentiometer, pilot lite, switch, etc.	2 for $1.00
Tuning Unit, BC-746 contains receiver ant. coil, tuning condenser, and crystal, transmitter crystal, slug tuned tank coil sockets, etc. Ideal foundation for Walkie-Talkie or small amateur rig	$1.00
Circuit Breakers, G. E., 50 Amp. 220V 2 pole in original carton	$2.95
Lip Microphones in original sealed cartons	$1.00
Mine Detectors SCR 625 in excellent used condition	$19.50
BC 306A Antenna Tuning Units. Mfg. by General Electric. Matches 150 watt transmitter to antenna. Brand new	$3.95
U.H.F. Loctal Sockets, Mica filled cinch	10 for $1.00
Thermocouple for R. F. Ammeters. New.	3 for $1.00
Technical Manual on BC312 and BC34 Receivers, instructions and circuit diagrams, etc.	.50
Technical Manual on BC375 and BC191 Transmitters	.50
4.3 MC. IF Transformers, double slug tuned	25¢, 5 for $1.00
Power Transformer cased 120V 60 cy. pri. Sec. 400V 30 MA, 6.3V at 2.35A, 6.3V at 1.1A, 6.3V at .6 A., Extra Special	.89
Power Transformer RCA cased pri 100V 60 cy. Sec. 640V CT at 105 MA, 5V at 3 A, 2.5V at 5 A, 6.3V at .4 A or 12V at .1 A A real buy	.98
Power Transformer, 110V 60 cy. pri. from Hammerlund Super-Pro, cased, supplies 465V at 160 MA, 300V bias at 11 MA, 6.3V at 7.5A, 5V at 3A, and 5V at 2A. Ideal for PA systems and quality amplifiers	$4.95
Power Transformer, 110V 60 cy. pri. General Trans. Corp., cased, 500V at 25 MA, 6.3 V at 3.25 A, 5V at 2 A.	$1.49
Ammeter 0-6 amps 2" flg. mtg.	1.00
Simpson Meter 2½ 0-3V DC	1.95
BC 729C Antenna Tuning units from BC 610. Matches 500 watt transmitter to antenna made by Hallicrafters. Has 0-15 RF Ammeter. Brand new	$14.95

FREE Free T 30 throat microphone with each order of over $10.00

WE WILL SHIP C.O.D.
NO ORDERS UNDER $2.00

The HEATH COMPANY
BENTON HARBOR, MICHIGAN

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.

FREE POSTER

Olson Radio Warehouse, Inc. of Akron, Ohio, is now offering radio servicemen a 17" x 22" poster which explains in non-technical fashion the reasons why an electrolytic condenser shorts out.

The poster is designed to be used to "educate" customers who know nothing about radio. Two comical rats (corroding agent) are used to illustrate the point.

Lithographed in color, the poster is suitable for the store or repair shop. *Olson Radio Warehouse, Inc.*, 73 E. Mill Street, Akron 8, Ohio, will forward a copy of the poster free of charge upon request.

ROTO-BEAM MANUAL

Gordon Specialties Co. of Chicago has just issued a 32-page manual covering the installation of the "Roto-Beam" rotator and "Synchro Anten-A-Cator."

Full details covering the mounting, balancing, connection, examination, impedance matching, coupling, and tuning of the rotator are included in the text.

The booklet sells for $1.00 and is available from *Gordon Specialties Co.*, 542 South Dearborn Street, Chicago 5, Illinois.

AUTOMATIC SYNCHRONIZER

The new Type SN, Model SF Automatic Synchronizer, manufactured by *Burlington Instrument Company*, is fully described in a new 4-page bulletin just issued by the company.

Besides discussing the physical characteristics of the unit, this bulletin covers a description of the circuit, application data, operation, installation and maintenance, and special applications. The equipment is used to automatically control circuit breaker closure of a.c. generators in parallel to a common bus.

A copy of Bulletin SN-400 may be secured by writing *Burlington Instrument Company*, Burlington, Iowa.

MERCURY CONTACT RELAYS

A 12-page technical booklet covering Type 275 and Type 276 relays is now available from *Western Electric Company* of New York.

Designed for high speed switching operations under adverse atmospheric conditions, these new relays provide repetitive precision within one percent of its minimum operating current.

The new booklet gives operating characteristics for both of these relays which may be used in devices such as computing machines, signaling devices, servo-mechanisms, high speed keying relays, sorting machines, tabulating machines, relay amplifiers, and vibrator power supplies.

A copy of this booklet, "Mercury Contact Relays," may be secured from *Western Electric Company*, 195 Broadway, New York 7, New York.

CERAMIC MATERIALS

Manufacturers of electronic and electrical equipment should be interested in a new booklet just published by *General Ceramics and Steatite Corporation* of Keasbey, New Jersey.

This informative 32-page booklet lists commonly-used dielectric ceramics, explains their manufacturing processes, and lists the various properties of each specific type of ceramic produced.

Complete engineering details on dielectric strength, volume resistivity, surface resistivity, dielectric constant, and flashover are given, along with performance graphs under various conditions.

General Ceramics and Steatite Corporation, Keasbey, New Jersey, will provide a copy of this booklet upon request.

LAMINATIONS HANDBOOK

A new electrical laminations handbook and catalogue has just been issued by *Thomas & Skinner Steel Products Company* of Indianapolis.

The booklet contains complete and comprehensive information on the company's line of stock lamination dies, plus valuable data on weights, characteristics, and suggested applications of electrical steels. A section is devoted to oriented steels and thin steels with a table of data on core loss for very thin steels.

Applications for this handbook must be made on your company letterhead. Send requests to *Thomas & Skinner Steel Products Company*, 1166 East 23rd Street, Indianapolis, Indiana. Ask for catalogue No. 47.

RELAY CATALOGUE

A new 12-page catalogue describing the "Phil-trol" line of relays has just been issued by *Phillips Control Corporation* of Chicago, manufacturers of relays and other control units.

The catalogue fully illustrates and describes these relays which are designed for electronic and industrial control, signal and traffic control, radio and communication.

Coil characteristics, contact assemblies, operating and release times, and dimensional drawings of each relay are included.

NOW AVAILABLE FOR IMMEDIATE SHIPMENT!

Here it is

BC-728-A FOUNDATION KIT

Nowhere except at Niagara will you find such a bargain offered. At very low war surplus prices the value of the individual pieces total to more than $25.00—yet Niagara gives you more than $25.00 worth of equipment for less than $10.00. The kit consists of the following pieces as pictured above:

- 1—spare receiver as illustrated ..... value $ 1.79
- 1—4" P.M. speaker with output transformer ..... value 15.00
- 1—4 prong Vibrator.....value 1.79
- 1—7 prong 2 V. Vibrator..value 2.20
- 1—2 V. Storage Battery....value 3.49
- 1—Cord with plug.....value 1.25

Complete total value....$26.71

$9.95

All of the above complete with schematic diagram with broadcast conversion data at the Giant Bargain Price of....$9.95

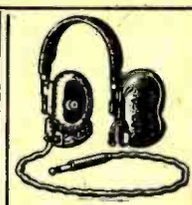
Complete Set of 6 Tubes, list value $13.20—
Our Special Price.....$5.95

DO YOU OWN AN SCR-522?

Combination Offer

Both Items

$2.25



HS-16 HEADSET

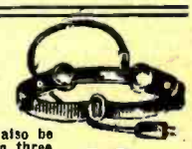
- 8000 ohms Hi-impedance
- Noise proof
- Most sensitive phone built
- May be used as a sound powered intercom.

Light, durable, efficient. Molded neoprene earcups shaped to completely envelop entire ear. Adjustable steel headband extends or retracts. Especially suited to hams, commercial operators, aircraft pilots, recording engineers and many others. Can be used with simple Xtal to make complete radio receiver.
Special..... **$1.89**

Original Cost $25.00

6 foot extension cord.....$0.49

CARBON THROAT MICROPHONE



This microphone will work into any 200 ohm impedance input circuit. Has adjustable strap to fit any neck. In operation this microphone is strapped around the throat thereby facilitating full freedom of both hands and head movement. Ideal for ultra high frequency mobile work for hams. Can also be used as a hi-grade Carbon Mike by simply drilling three holes in case. Sensitivity of this mike equal to mikes costing $10 and $15. Supplied with strap, 10" cord and plug.
Your cost..... **49c**

MASTER OSCILLATOR MI-19427-B

This unit was built for R.C.A. Add a final—becomes a complete transmitter with signal shifter. 2:20 mg—also FM—only a few cycles drift from cold start. Complete with regulated power supply and heavy duty deluxe rack. Illustrated flyer giving complete description, technical summary and specifications available upon request.

COMPLETE (less tubes)..... **$225.00**

MINIATURE TUBE PULLER

Niagara solves your miniature tube breakage problem with this new sensational invention. Tubes may now be easily extracted or placed into those hard-to-reach places, without the fear of breakage or burning of hands. This new invention incorporates a heat resistant rubber cap with aluminum body and handy thumb-operated plunger release. Be sure to get yours today. Money back guarantee.
Only 88c

ANTENNA LEAD IN BOWLS

Made of genuine Pyrex—3" in diameter; brass rod 5½" long—complete with hardware and waterproof rubber gaskets
Special—$1.49

WESTINGHOUSE MN OVERCURRENT RELAY

Adjustable to .4 amp. Has automatic 110 v. AC reset—glass encased—perfect for any overload application where tube damage must be avoided

A Steal—$12.95

BAT HANDLE SWITCH

Mfgd. by Cutler-Hammer—10 amp. SPDT with neutral position—Perfect for rotary beam control—a positive steal at.....29c

NEW, STANDARD BRAND TUBES

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
1A3	$ .98	12K8	$ 1.25	812H	$ 6.90
1A7GT	1.10	1488	.99	813	8.95
1H4G	.98	25L6	.99	814	4.49
1L4	1.10	28D7	.75	815	2.25
1R4	1.29	30	.76	828	1.75
1T4	1.10	34	.98	829B	3.95
1H5	.99	35Z3	.99	830B	5.25
1N5GT	1.10	35L6	.99	832	2.25
1N21B	.35	32L7	1.50	832A	2.25
1LN5	1.10	35W4	.89	837	2.50
1R5	1.10	37	.69	838	3.75
1S5	1.10	38	.89	860	3.00
3Q4	1.10	39/44	.59	861	75.00
3Q5GT	1.10	41	.69	5514	3.95
3S4	1.10	45	.64	7193	.49
6AB7/1853	.99	46	.65	8005	3.25
6AC7	.99	47	.90	8011	4.95
6AQ5	.99	50B5	1.59	8012	4.95
6AG7	.99	50L6	.99	8016	1.49
6AK5	.99	70L7	1.59	0Z4	1.25
6AL5	.99	71A	.69	2D21	.75
6AT5	.98	75	.69	2X2	.89
6B4	1.29	713A	1.65	3B24	1.95
6B6G	.89	717A	1.25	4C/35	7.95
6B8	.99	954	.75	5R4GY	1.15
6C4	.64	955	.75	5T4	.98
6C5	.51	956	.75	5U4	.98
6C21	12.95	957	.75	5W4	.98
6C6	.75	958A	.75	5Y3	.60
6D6	.75	959	.75	5Y4G	.59
6F5	.51	9001	1.15	5Z3	.89
6F6	.95	9002	.98	5Z4	.89
6F6G	.80	9003	.98	6X5	.89
6F8	1.10	9004	.98	25Z6	.98
6G6	1.10	9005	.98	35Y4	.99
6H6	.59	9006	.69	35Z5	.99
6H6GT	.89	10Y	1.50	80	.75
6J4	1.50	15E	1.50	82	.98
6J5	.59	HF100	6.95	83	.94
6J6	.89	HY69	1.75	83V	.98
6J7	.80	HY75	1.25	84	.90
6K6	.69	HY615	1.25	2J7G	7.50
6K7	.79	T20	1.95	250R	3.95
6L6	1.49	TZ40	2.95	836	1.15
6L6G	1.20	V70D	6.90	866A	.95
6L7	.98	100TS/	3.00	872A	2.25
6N7	1.25	2C26A	.75	884	.75
6R7	.98	2C34	1.15	991	.50
6SA7	.90	2C40	2.60	2050	.90
6SC7	.85	2C44	1.75	2051	.90
6SF5	.79	2E25	3.95	8020	5.95
6SQ7	.89	2E30	2.25	RK60	1.25
6SH7	.65	2J32	20.00	RK72	3.50
6SJ7GT	.69	2J33	20.00	VR78	.75
6SK7	.79	211	1.25	VR90	.75
6SL7	.89	2J56	20.00	VR105	.75
6SN7GT	.69	3C24/	1.35	VR150	.75
6SQ7	.89	3E29/	2.95	2225	1.95
6SR7	.89	75T	2.95	874	1.95
6SS7	.75	304TH	5.95	1613	.95
6Q5	.98	304TL	4.95	1614	1.75
6Q5G	.98	307A	6.25	1616	2.95
6U5	.98	446A	2.60	1619	.98
6V6GT	.99	6C4	.64	1624	.98
6Y6G	.89	703A	7.50	1625	.98
7AE7	.75	705A	4.95	2AP1	2.25
7C4	1.50	715B	4.95	3AP1	3.45
7F7	1.25	723A/B	9.95	3BP1	2.95
7L7GT	1.39	800	2.25	5BP1	3.95
12A6	.59	801A	1.25	5BP4	5.45
12AT6	1.10	802	1.49	5CP1	3.95
12SA7GT	.99	803	8.95	7BP7	7.95
12SQ7	.89	805	3.75	902	3.00
12SH7	.89	807	1.35	913	3.00
12SJ7	.79	808	2.95	7DP4	14.95
12SK7	.69	809	1.50	7EP4	16.95
12SN7GT	.79	811	1.95	10BP4	39.50
12SQ7GT	.99	812	3.25		

METERS

- MM 4-0-100MA Model 301 Weston 3½"....$3.95
- MM 10-0-1 amp DC-Model 301 Weston 3½" 3.95
- MM 14-0-150MA NX 35 Westinghouse 3½". 3.95
- MM 19-0-800MA Weston Model 301MA..... 3.95
- MM 33-0-1MA-MD-300 I K-McClintock 3½" 3.95
- MR 13-0-8 R.F. amp—425AM-Weston 3½". 4.95
- MZ 1-0-130 v. AC-25 to 125 cy.—376M Weston 3½" 3.95
- MV 8-0-4 K.V. DC—Roller-Smith 3½".... 2.95

RA RADIO SUPPLY CORP.

nwich St. New York City 6, N. Y.

Write for latest Bulletin 10 RN.
All prices F.O.B. New York City.

A copy of catalogue No. 7 is available by writing to *Phillips Control Corporation,* 612 North Michigan Avenue, Chicago 11, Illinois.

NEWA BULLETINS

To help the wholesaler's salesman help his customer and thereby step up sales volume, the *National Electrical Wholesalers Association* has announced that it will publish a series of printed bulletins entitled the "Appliance Sales Booster" and the "Supply Sales Booster."

These new *NEWA* sales boosters will cover a wide range of electrical appliance and apparatus and supply subjects from time payment selling to lighting, store arrangement, product demonstration, control equipment, etc.

National Electrical Wholesalers Association maintains headquarters at 500 Fifth Avenue, New York 18, New York.

PHOTOELECTRIC CELLS

Selenium Corporation of America is making available a new 12-page brochure covering its line of self-generating photoelectric cells.

Included in the booklet are characteristics, applications, and design factors. Standard specifications and illustrations of the various shapes and sizes of photoelectric cells are also given.

A copy of the booklet is available upon request to *Selenium Corporation of America,* 2160 East Imperial Highway, El Segundo, California. —30—

TRANSVISION KITS

BUILD YOUR OWN TELEVISION *and* FM SETS

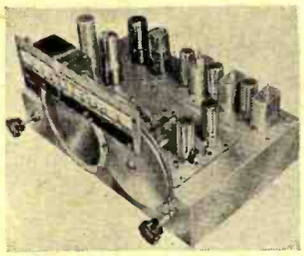
12" KIT (Table Model)

Acclaimed TOPS IN TELEVISION VALUE! Engineered for easy, rapid assembly. Completely equipped. Nothing else to buy.

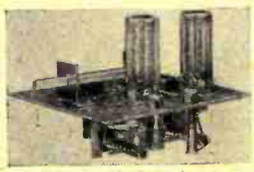
12" TELEVISION KITS—STANDARD and DELUXE MODELS—Picture size 1½ times larger than with 10" tube. . . . A big 75 square inch picture!

Sharp, steady picture achieved with advanced Transvision television circuit . . . Picture has remarkable brightness even in lighted room (no darkening of room is required).

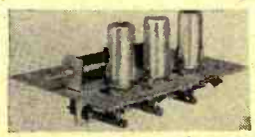
- **NO TECHNICAL KNOWLEDGE REQUIRED FOR ASSEMBLY.** Complete, easy-to-follow instruction sheets provide all the knowledge needed for assembling this high quality television receiver.
- **SAVES YOU HUNDREDS OF DOLLARS**—By assembling your own receiver with the Transvision Television Kit you save several hundred dollars on the cost of a high quality set.
- **IDEAL for HOME and COMMERCIAL installations.**



FMF-1 FM Radio Receiver



FMF-2 FM Tuner Front End



FMF-3 FM Tuner Front End

FM107 FM IF Amplifier Kit

FM-107R FM IF Amplifier Kit

Featherweight SOLDERING IRON

12" TRANSVISION TELEVISION KIT . . . Standard Model . . . FEATURES: 12" picture tube . . . Picture size 1½ times larger than with 10" tube . . . RF Unit designed for 13 channels: factory wired and pre-tuned for 7 channels (no areas have been assigned more than 7 channels; however if desired, up to 6 more channels may be added at very nominal cost) . . . 4 mc bandwidth for full picture definition . . . High fidelity F.M. sound reproduction . . . picture size 75 square inches . . . 9000 volts second anode potential for brightness and contrast . . . maximum picture sensitivity, better than 50 microvolts . . . 22 tubes and 12" picture tube, antenna, lead-in wire, etc. Cabinet extra, if desired. **LIST $289.00**

12" TRANSVISION TELEVISION KIT . . . DeLuxe Model with Superb Built-in F.M. RADIO. Same characteristics as the Standard Model, plus the following ADDTIONAL FEATURES:—50-216 mc continuous tuning . . . Covers the entire F.M. band and all 13 television channels . . . Cut-off switch eliminates unused tubes when set is used only as F.M. receiver. **LIST $359.50**

7" TRANSVISION TELEVISION KIT . . . Standard Model . . . Lowest Priced . . . Biggest Value in the Field. FEATURES: 18 tubes including 7" picture tube . . . Newly designed sweep and synchronizing circuit . . . 3000 volt second anode voltage . . . 3.5 megacycle bandwidth in picture circuit . . . High signal sensitivity—100 microvolts for picture circuit . . . RF unit factory wired and pre-tuned for local stations . . . Complete with front panel. **LIST $169.00**

ALL TRANSVISION KITS ARE COMPLETE—Nothing more to buy! . . . All Transvision Television Kits are COMPLETE with all tubes, including picture tube, wired and pre-tuned RF units and IF's, high gain folded di-pole antenna with 60 ft. lead-in cable, wire and solder.

TRANSVISION TELEVISION CABINETS . . . Beautiful, sturdily built cabinets with handsome rubbed wood finish. Fully drilled.

12" Table Model Cabinet . . . . . **LIST $44.95**
12" Console Cabinet with compartment for record changer . . . . . **LIST 74.50**
7" Table Model Cabinet . . . . . **LIST 32.50**

Transvision F.M.-1 . . . 8-tube F.M. High Fidelity Radio RECEIVER KIT . . . COMPLETE . . . Nothing else to buy. When wired this is a high quality F.M. Radio which would retail for 2 to 3 times the cost. Complete instructions for easy, rapid assembly. Makes an F.M. Receiver of the highest quality and fidelity. Easily assembled, this F.M. Receiver covers the entire F.M. band from 87.5 to 108.5 megacycles. NO PERCEPTIBLE FREQUENCY DRIFT from a cold start. Complete with wired Transvision FMF-2 tuner front end and Transvision F.M. 107R IF amplifier, and 10" PM speaker and a matched set of 8 tubes: (3—6AK5, 1—6C4, 1—6V6, 1—5V3, 1—6AL5, 1—6SN7) . . . All component parts are of the highest quality. Assembly is simple to follow from our easy to follow instructions. For operation on 110 volts, 50-60 cycles AC. **Model FM-1** . . . . . **LIST $64.95**

Beautiful furniture-finish cabinet available at additional cost. Also, BASIC ESSENTIAL PARTS of the Transvision 8-tube F.M. Radio Receiver available separately.

Transvision FMF-2 2-tube F.M. TUNER Front End . . . A high fidelity 2-tube Tuner Front End, completely wired, can be used with a wide band 2 or 3 stage IF amplifier (10.7) mc such as the Transvision F.M. 107 or 107R to form a complete F.M. tuner. FEATURES: Tuning range 87.5 to 108.5 megacycle . . . Input matches 300 ohm line . . . NO PERCEPTIBLE FREQUENCY DRIFT from a cold start . . . Intermediate frequency to be used is 10.7 megacycles . . . Voltage requirements—6.3 volts at .45 amps, 100 volts at 10 millianps . . . Positive mechanical drive—no backlash . . . Tube complement—6AK5 mixer, 6C4 local oscillator (tubes not supplied with tuner) . . . Chassis size 4½"x4½" (mounting hole dimensions $3\frac{15}{16}$" x $3\frac{15}{16}$") . . . Unit completely wired and aligned at factory . . . permeability tuned . . . When used with our FM107 I.F. Amplifier a 15 microvolt signal will give to within 3 DB of absolute quieting. **Model FMF-2** . . . . . **LIST (less tubes) $21.65**

Transvision FMF-3 3-tube F.M. TUNER Front End . . . Characteristics same as the above, with the following differences: 3 tubes—6J6 RF Amplifier, 6AK5 Mixer, 6C4 Local Oscillator—Added RF stage; RF stage gain is 8 minimum . . . Image ratio is 500-1 minimum . . . Chassis size is 7¼"x4½" (mounting hole dimension 3⅜"x6½") . . . Voltage requirements, 6.3 volts at 1.05 amps, 150 volts at 30 mils. NO PERCEPTIBLE FREQUENCY DRIFT from a cold start. **Model FMF-3** . . . . . **LIST (less tubes) $30.75**

Transvision F.M. 107 (10.7 mc) . . . F.M. 6-tube IF AMPLIFIER KIT . . . A six tube high gain, broad band, intermediate frequency amplifier designed for use with either the Transvision FMF-3 or FMF-2 Tuner Front Ends. Also useful in other applications where an amplifier of this type is required. For optimum performance three 6AG5's used in the intermediate amplifier, two 9001's are used as limiters and a 6AL5 as a demodulator. IF frequency is 10.7mc. Bandwidth is 150KC. Chassis size is 13" x 2½" wide. Mounting hole dimension 12" x 2¼". **Model F.M.-107** . . . . . **LIST (less tubes) $41.20**

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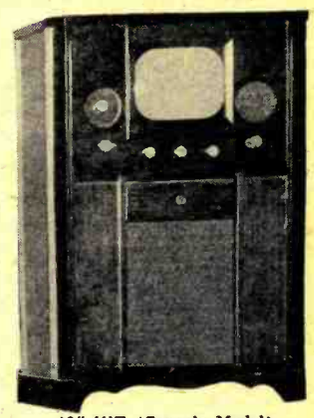

12" KIT (Console Model)

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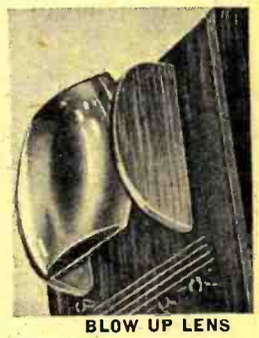

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Technical BOOKS

"F-M SIMPLIFIED" by Milton S. Kiver. Published by *D. Van Nostrand Company, Inc.*, New York. 342 pages. Price $6.00.

Too often discussions of frequency modulation have been limited to a chapter or two in a general engineering text with the result that the average engineer or serviceman seeking to learn something of the specialized techniques of FM have found it difficult to get the complete picture of the various phases of the subject.

Mr. Kiver has eliminated this difficulty in his new book. In a short span of approximately 350 pages he has managed to concentrate an amazing amount of material regarding FM. The book is divided into five sections, covering the fundamentals of FM, FM receiver principles, FM transmitters, receiver alignment, and commercial receivers.

The author's style, as RADIO NEWS readers know from his series of articles "Theory and Application of U.H.F.", is lucid and characterized by a complete lack of any unnecessary embellishments. A careful study of the text should provide the reader with a thorough and fundamental grasp of FM principles. Because of the practical approach to the problem, this book should be of special interest to radio servicemen. Chapters have been devoted to alignment and servicing of FM receivers as well as sufficient background material to provide the serviceman with a working knowledge of the medium.

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* * *

"ADVANCED RADIO SERVICING" by M. N. Beitman. Published by *Supreme Publications*, Chicago. 224 pages. Price $3.00.

This book is a compilation of a series of lectures delivered by Mr. Beitman to a group of radio technicians.

The text is divided into three sections dealing with the business side of radio servicing, equipment used in locating radio faults, and radio circuts and troubleshooting.

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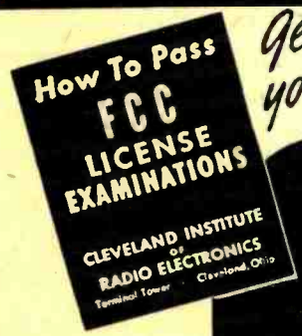

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various types of test equipment which will be needed in the well-equipped service shop and the technique of using this equipment properly. The third section discusses the various circuits and their functions and includes a brief resumé of FM and television receivers and the faults which might be encountered in these units.

The approach to the subject throughout the book is informal and the writing is sufficiently clear to allow the book to be used as a home-study text.

* * *

"CONVERSION DIAGRAMS," compiled by Technical Staff, R & M Radio Company. Published by *R & M Radio Company,* Arlington, Va. Price $2.00.

The availability of many worthwhile surplus items has caused many amateurs and servicemen to think seriously of the problems of converting this equipment to usable gear for the service shop or ham shack.

This handy booklet has taken the guess work out of surplus buying. The compilers have selected certain items of surplus electronic equipment which may be easily converted.

Included in the book are the SCR-274-N, BC-375-E, SCR-522, BC-625 BC-348-E-M- or P, a crystal frequency chart, and directions for changeover to 110 volt a.c. power supplies.

Complete schematic diagrams of the necessary changes have been incorporated in the text.

Amateurs who have surplus equipment on hand or are contemplating the purchase of some of these items can save a lot of time and brain power by using these conversion diagrams.

* * *

"1947 RADIO DIAGRAMS," compiled by M. N. Beitman. Published by *Supreme Publications,* Chicago. 192 pages. Price $2.00.

This is Volume 7 of the series devoted to the circuit diagrams and servicing information most needed by the radio servicemen, and covers receivers issued between June 1, 1946 and March 1, 1947.

In addition to the circuit diagrams and parts lists, in some instances instruction on alignment, dial stringing, voltage test values, stage gain, parts layout, location of trimmers, method for removal of chassis and other pertinent data have been given.

Fifty-seven manufacturers are represented in this new manual with the listing including auto radios as well as home receivers, and some test equipment circuits.

—30—

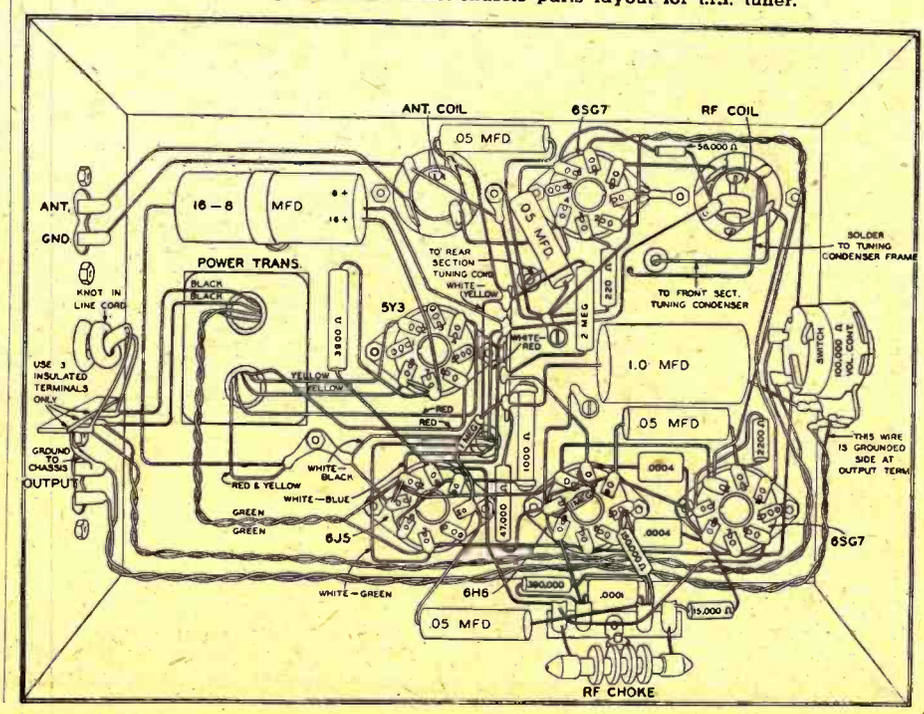
Hi-Fi Tuner

(*Continued from page* 45)

types, well insulated, and as high above ground as possible, is also OK. Make a good ground to a cold water pipe.

Now that you have a quality signal coming out of the tuner, don't spoil it by using any old amplifier, or the audio amplifier of your radio. It will be worth your while to build, or buy one of the many amplifier kits or complete amplifiers that are available. These units have good frequency response, and low hum and distortion. Use the best quality speaker you can afford to buy. A great deal of speaker development work has been going on in the last couple of years. Investigate new names in the speaker field and new numbers by old reliables. If you can afford a coaxial speaker system, so much the better. —30—

Pictorial diagram shows under-chassis parts layout for t.r.f. tuner.



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A Pocket V.T.V.M.

(*Continued from page* 66)

to zero. (4) Leave instrument turned on for about 5 minutes, observing from time to time whether meter reading drifts from zero, necessitating readjustment of rheostat R_9.

If the meter cannot be set initially to zero in the manner explained in the foregoing paragraph, look for some error in wiring. Because of the low currents and voltages in this instrument, zero drift will be extremely small, when present at all, hence it should not be necessary to reset the meter to zero frequently.

Adjustment of Cathode Rheostat. This instrument, like all v.t.v.m.'s of its type, operates between two extremes of input resistance. The first extreme is represented by any very low- resistance voltage source (such as a resistor of 1 ohm or less) across which the test leads must be connected. The other extreme is represented by a voltage source having a resistance of several megohms. For accuracy of measurement over the entire range included between these two extremes, the zero setting must not shift as the resistance of the voltage source changes. In other words, it must be possible to set the meter once for zero and to know that this setting will hold steady whether measuring the voltage of a dry cell or the voltage drop across a 20-megohm resistor.

Proper adjustment of rheostat R_5, with respect to the setting of rheostat R_9, produces this zero-set stability. This adjustment is described below.

With voltage range switch S_1 set to its .8-volt position, (1) Set instrument to zero, as explained under *Preliminary Check.* (2) Connect pair of test leads to input jacks J_1 and J_2. (3) Touch test prods together, noting that meter is deflected either up or down from zero. (4) With test prods touched together, adjust rheostat R_5 to return meter to zero. (5) Open test prods, noting that meter again is deflected from zero. (6) This time, adjust rheostat R_9 to reset meter to zero. (7) Again, touch test prods together and if meter is deflected from zero, readjust R_5 to return meter to zero. (8) Continue to jockey back and forth between R_5 (with test prods shorted) and R_9 (with test prods open) until meter remains at zero whether test prods are open or shorted.

Voltage Calibration. After all adjustments are completed satisfactorily, as explained in the foregoing sections, the individual voltage calibration may be made. For this purpose, provide an accurate d.c. voltmeter (preferably with a 0-1 d.c. volts range) and a variable d.c. voltage source, continuously adjustable from zero to 1 volt. The voltage source can be a fresh dry cell and a 10,000-ohm volume control-type potentiometer connected as shown in Fig. 7. The voltmeter must be the most accurate model obtainable to the reader. If a 0-1-volt

scale is not obtainable, any other scale may be used on which the 0 to 1-volt region is well spread out so as to be accurately readable at least to tenths of a volt.

The following procedure is recommended in the voltage calibration: (1) With range switch S_1 set to its .8-volt position, set the v.t.v.m. to zero. (2) Connect calibration circuit, shown in Fig. 7, to the unit (have potentiometer in its "off" position). (3) Set potentiometer for .1 volt reading of standard voltmeter, and record deflection of microammeter in vacuum-tube voltmeter. (4) Advance potentiometer to obtain .15 volt deflection of standard voltmeter, and record corresponding deflection of microammeter. (5) Repeat for following readings of standard voltmeter: .20, .25, .30, .35, .40, .45, .50, .55, .60, .65, .70, .75, and .85 volts.

If the range resistors (R_1 to R_4) have been carefully selected, the basic 0-.8-volt range will be multiplied, by the successive settings of the range switch, S_1, to 0-8 volts, 0-80 volts, and 0-800 volts.

Operation

Operation of the pocket v.t.v.m. is simple and conventional. In using the instrument, it is necessary only to switch on the batteries, set the meter to zero, set the range switch to the proper scale, and to touch the test prods to the terminal points of the voltage source. It is good practice to start with the range switch set to its 800-volt position, and to change this switch successively to its lower ranges until a deflection is obtained in the upper half of the microammeter scale. In this way, instrument damage may be prevented.

Because of the high sensitivity of the instrument when the range switch is in its .8-volt position, the microammeter will be deflected up-scale if the operator simply touches the metal prod of the "positive" test lead. For this reason, it is advisable, although not mandatory, to shield the entire "positive" test lead and particularly the prod itself.

The miniature batteries which fit the pocket v.t.v.m. are not suitable for excessively long periods of continuous operation. Because of this fact, discretion should be exercised in use of the instrument. It is an easy matter to switch off the batteries when the instrument is not in use. Since the meter has unusually low zero drift, it is perfectly plausible to flip off the switch between individual measurements. By paying reasonable attention to this little detail, long life may be obtained from the tiny batteries.

According to regular custom, the author will be pleased to furnish any additional information concerning this instrument, required by any reader, and will give every reasonable assistance to any reader who has difficulty in reproducing the device.

—30—

What's New in Radio

(*Continued from page 86*)

tower requires no painting or protective coating in most areas. Maintenance is limited to tightening bolts once every six months, according to the manufacturer.

The tower is self-supporting and can be easily installed by one man. Complete instructions, mechanical drawings, and marked parts facilitate the erection of the tower.

Specifications and illustrated literature on the "Trig Tower" may be secured from *Rostan Corporation*, 202 East 44th Street, New York 17, New York.

AMATEUR TRANSMITTER

The *James Millen Manufacturing Company, Inc.*, of Malden, Massachusetts, is currently producing a new ultra-high frequency transmitter with outputs on the 10-11, 6, and 2 meter amateur bands.

This crystal-controlled transmitter

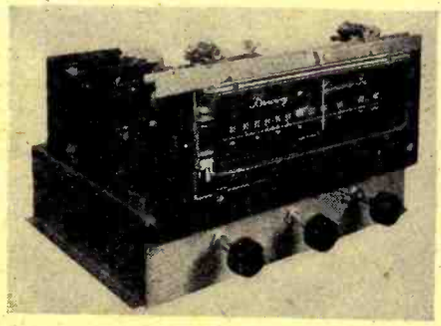
uses an 829B tube in the final power amplifier stage, with plate input up to 100 watts. Crystal control is by means of the newly developed *Bliley* overtone crystal oscillator unit.

Additional details on this transmitter will be supplied by *James Millen Manufacturing Company, Inc.*, 150 Exchange Street, Malden 48, Massachusetts.

BROWNING FM TUNER

A new FM tuner, the Model RV-10, covering the 88 to 108 mc. band, has been announced by *Browning Laboratories, Inc.*

This new unit features the Armstrong circuit with dual limiters to provide exceptional freedom from



noise. A sensitivity of 10 microvolts provides reception outside of the accepted service area of FM transmitters. The antenna input is designed for a 300 ohm RMA standard downlead.

The RV-10 has a built-in power supply, a large, easily read slide-rule dial with vernier drive, an edgelighted

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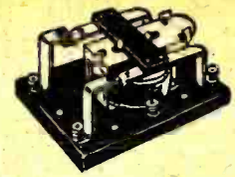

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Units A, B, E. Each 2.00

RADIO-SONDE XMTR, T-49/AMPI

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1KW pulse output on 154 to 186mc. 117 VAC power supply. Can be converted to CW or Voice operation and lowered to 144-148mc band. 5 stagger tuned receiver IF stages make for ready adaptability to FM or TV. Can be used as a low power Radar set. Plenty of room on chassis for additional components and modifications.
RC-145, NEW, complete with instruction book, including Selsyn rotary beam direction indicator unit $200.00
RC-148, consists only of transceiver and power supply. Both units with tubes $47.50
Antenna for RC 148 ..... 40.00

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B-19 transmitters, receivers, army tank, New 2 sets complete in 13 cases.

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For the DX'er. 75 watts CW, 60 watts phone and MCW. Freq. range—400 to 12,500 kc. by means of plug-in tuning units. Comes with one tuning unit nearest your specified frequency.
Slightly Used. Excellent condition $9.95

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3BP1 ..... $3.00 5CP1 ..... $4.98
3FP7 ..... 2.50 5FP7 ..... 3.00

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DYNAMOTOR PE 73-C

Input 28 VDC, Output 1000 VDC at 350 Ma. Comes with solenoid starting relay. Originally for use as power supply for BC 375.
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New Insert Type—HS 30 headset, lightweight, efficient; 500 ohms impedance ..... $ .85
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With Batteries 21.65

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SPDT 115 AC WE Wheelock type 1.26
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31-N Liberty St., DIGBY 9-4124, New York City 7, N. Y.

scale on which frequencies and channel numbers appear, and a tuning indicator incorporated in the dial assembly.

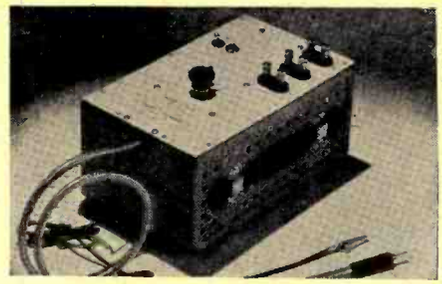
The unit is 6½" x 9" x 11", which permits "built-in" installation in small spaces. The tuner is also available for rack mounting and is designated the RV-11.

Browning Laboratories, Inc., Winchester, Massachusetts, will supply additional details on the tuner, upon request.

PHANTOM REPEATER

A new instrument for the quantitative measurement of high impedance circuits is being manufactured by *Keithley Instruments* of Cleveland.

This Model 102 Phantom Repeater



may be used to bridge measuring instruments to high impedance circuits, give simultaneous indication of voltage, waveform, and aural tone, increase the sensitivity of voltmeters and cathode-ray oscillographs, and simplify test connections.

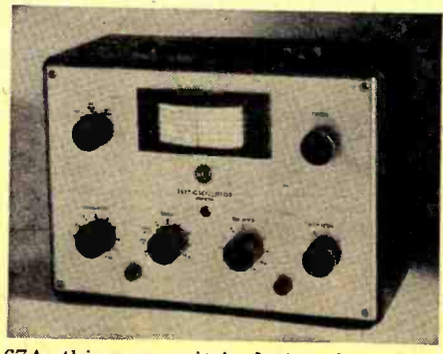
The repeater features 200 megohm, 5.5 $\mu\mu$fd. 200 ohm output impedance, a small sized test probe, exact reproduction of input signal at the output, gains of 1, 10, and 100, low background noise, wide frequency response, and small size.

A special booklet describing the features of the Model 102 is available upon request to *Keithley Instruments*, 1508 Crawford Road, Cleveland 6, Ohio.

RCA TEST OSCILLATOR

A new test oscillator which provides three fixed frequencies for the high speed servicing of radio receivers is currently in production at *Radio Corporation of America*.

Designated as the *RCA* Type WR-



67A, this new unit is designed to simplify the alignment of superheterodyne and t.r.f. receivers. A 455 kc. position is provided for aligning the i.f. channels, while 600 kc. and 1500 kc. signals are used for the alignment of r.f. and

SPRAGUE TRADING POST

SWAP—BUY OR SELL

WANTED—Commercial variable frequency oscillator. Prefer Meissner with all coils or equivalent. Send description. W. T. Rainey, Venable Hall, Chapel Hill. N. C.

SELL OR TRADE—National ham receiver 100XA (550 kc to 30,000 kc) crystal filter with matching speaker, like new. Want Leica or Contax camera with F-2 lens in perfect condition. Larrys Radio Service, P. O. Box 320, Pittsfield, Mass.

FOR SALE—3 band receivers R 100/URR 54/1.5mc, 3.6/8.5mc, 8.5/19mc 110v or 220 ac-dc batteries; excellent condition in olive drab or battleship grey cabinet. $70. H. Kanter, 1301 E. 57th St., Brooklyn, N. Y.

FOR SALE—Hallicrafters S38 $40; Triplett 3212 tube checker, $42.50. Both in new condition. W5JLT, 1414½ Hall St., Dallas, Tex.

WANTED—Pocket multitester new or used. Will trade Wilcox CW3 receiver new with two sets of coils. A Payne, W2UGG, 2913 Middletown Road, Bronx 61, N. Y.

SELL OR TRADE—New tubes. HK54, GL446, 3B24, 6J6, 6AG5. Write for list of other parts. Kit Carlos, W3MJB, 2146 Cherry St., Philadelphia 3, Pa.

FOR SALE—750 watt CW transmitter, 6L6 Tri-tet, 807 Doubler, 812 buffer, PP100th's final, 600/1000/2500v supplies, Triplett meters, steel rack, antenna coupler, overload relay, tubes and 20 meter coils, $350. Ray Tomlinson, 623 East Brown St., Trenton 10, N. J.

SELL OR TRADE—Carl Fischer flute, mandolin; 6" telescope mirror; S-9 receiver; SW-3 receiver; rebuilt RCA-ACT-40 xmitter; two year Communications, QST and CQ magazines; parts for 1500vt power supply; transmitting tubes; old Remington typewriter. Want 20 or 10 meter phone and receiver, portable typewriter or camera. Send self-addressed postal card. W9NVC. 1161 Eaton Ave., Beloit, Wis.

WANTED—Burnt out Weston 301 meter, also burnt out Simpson meter 7198 with 0-100 or 0-150 or 0-200ma scale. Have Millen exciter for sale at $33. J. C. Nelson, W2FW, 75 Minaville St., Amsterdam, N. Y.

FOR SALE—OSCILLOSCOPE. B. C. 412 $40; Mark II transreceiver brand new with all equipment as packed in three cases $78. Will not sell separately. Irving Hornichter, 320 Beekman Ave., New York 54, N.Y.

FOR SALE—Commercial built 10 and 20 meter 40 watt phone transmitter complete ready to go $75 and S-20-R receiver and DB-20 preselector $75 or all $140. Want BC-348-Q and 2000 volt 400 MA transformer. F. F. Taylor, 208 Delafield, Richland, Wash.

FOR SALE—250 watt transmitter. In 3FT par metal cabinet; T40s RF TZ40s AF. Complete with mike and ECO, $10. Herb Krechman W2LLR, 115 17 237 St., Elmont, Long Island.

WANTED—Used communication receiver, preferably Hallicrafter. State model, condition and price. Joseph DeLuccia, 82 E. 25th St., Paterson, N. J.

SELL OR TRADE—Lafayette LRC-130 FM-AM kit 88.6, 107.6 m.c.; G-E JFM-90 FM translator, Hallicrafters FM converter for new band. Hallicrafters S-20 Sky Champion communications receiver. Want FM and Television receiving equipment. A. M. Stump, 13,900 Wisconsin Ave., Detroit 4, Mich.

FOR SALE—RCA, ACR136 communications receiver, 550 kc to 18 mc, added 6E5 tuning indicator. Will trade for BC-221 or LM frequency meter. W. T. Gompertz, W6DDO, 1116 Ordway St., Albany 6, Calif.

SELL OR TRADE—RCA vertical and lateral broadcast pickup and Philco signal generator. Want instructograph or similar code practice equipment with tapes or good binoculars, at least 6x3. Robert E. Snyder, 3649 East 113th St., Cleveland 5, Ohio.

WANTED—Your ideas, or pro. B.C. 375, conversion data for any ham band. Will buy, beg, borrow, swap or what have you? Kenneth Dunn, 5701 Ave., L. Brooklyn, N. Y.

FOR SALE—Hammarlund HQ-129-X in good condition used only a short time. Perfect alignment, 10". Jensen P.M. speaker in matching cabinet, $155 prepaid. P. L. Woodbury, WOTLT. 907 Market St., Emporia, Kans.

SELL OR TRADE—28 volt, 200 ampere GM aircraft generator, packed for overseas shipment, and new Willard 24 volt aircraft battery, steel cased, dry. Both for $45. Want S-36, VHF-152, transmitting equipment. Guy Black, 12, Lambert Road, Belmont, Mass.

FOR SALE—Hallicrafters S-20R in good condition. Used only one year $50. P. H. Nilson, 805 E. Liberty Drive, Wheaton, Ill.

FOR SALE—Precision Ham FO — one watt, 3500 to 4000 KC and 7000 to 7500 KC, 6F6-6F6-VR75 sel. rect. 6" x 8" x 5", streamlined gray cabinet. Band switching, $30 postpaid. S. B. Brown, W4KYV, Box 204, Alexandria, Va.

WANTED—McElroy E.C.O. crystal exciter transmitter unit FU-40, either assembled or foundation kit with or without tuning units or what have you? State price, will pay cash. All replies answered.

FOR SALE—2 tube code oscillator with headphones and key, very wide pitch range $6 complete. Meters, O-5v; O-35A; O-50v. and O-75v. $1 ea. J. Lambias, 3211, 102 St., Long Island, N. Y.

FOR SALE—BC348R for 110v with new NC speaker set, looks like new $100. Arthur E. Cooper, 103 University St., W. Lafayette, Ind.

FOR SALE—Mobile or Fixed transceiver with removable J. antenna for car or home use. Complete with tubes power supply for 110 or 6 volts, 300v, 100ma. Range 130 megacycles to 170. Make cash offer. All replies answered. Walter Ninneman, W9QJW, C/O WLBL Transmitter, Auburndale, Wis.

WANTED—Manual for ART-13 Collins transmitter or information where I might get one. Cash or trade. Ed. Watson, Sr., 1562 E. Dorado St., Vallejo, Calif.

FOR SALE—Pocket type Supreme d-c minimeter 402; voltmeter 0-5-50-500 volts, 1,000 ohms/volt, new $8. Gordon E. Wall, Jr. Rt. 1, Box 286 Riverside, Calif.

FOR SALE—National FB7XA with coils for 160, 80, 10 meters including power supply and 12" dynamic speaker, $40; Hallicrafters SX23, 540 to 27000 k.c., $80 and General Radio Wavemeter 55-400 megacycles, $12 or $125 for the lot. W9ONO, 6149 N. Ozark Ave., Chicago 31, Ill.

SELL OR TRADE—Pair 8005's brand new in cartons, never used, good for ½ kw rig. Want small receiver, exciter power supply or what have you? Cecil Tankersley, W4FHM, 1800 Goodyear Ave., Brunswick, Ga.

FOR SALE—Radio tubes, 50% off list; 1B4T, 1D7G, 1E7G, 1LD5, 1F5, 2A4G, 395G, 33, 5Z3, 5U4, 5Y4, 6H7, 6Z5, 6B8, 6F7, 6A4, 6R7GT, 6P5G, 6C8G, 6ST7, 6SF5, 6N7G, 6L7, 12SF5, 12F5, 12SC7, 12A3, and 12H6. Joseph Anderson, New Sweden, Me.

SELL OR TRADE—Knocked down BC37SE & tubes with all parts, tuning units & dynamotor. Good 6 tube ac- 0.5 to 16 mc built-in preselector receiver and external speaker. All for BC342, 348 or similar or $60. Hutchison, 242½ E. Mine, Hazleton, Pa.

FOR SALE—Back issues of Radio News, Q.S.T., Radio World, Radio Craft, Service, Radio Television, Radio Service Dealer, Shortwave Craft, 10c per copy. Joseph Shack, 329 S. Racine Ave., Chicago 7, Ill.

FOR SALE—Philco 014 station setter $5, 070 signal generator $25; Supreme 89D tube tester $15; Solar CB-1-60 capacitor analyzer $15; Solar CBQ condenser tester $15; Meissner analyst (new) $110; Royal portable typewriter $25—all in good working condition. F. E. Kirtlan, 560 Pala Way, Sacramento 16, Calif.

FOR TRADE—Meissner 150 B for new HT9, including $50 worth of parts all new and extra 811's and 813. Extra 20 meter Meissner signal shifter coils for 10 meter operation ordered; two mikes, key, filter, condensers, etc. Edwin Clark, Frank P. O., Pa.

SELL OR TRADE—1945-46 Sprayberry Radio course $75 or will trade for low power 20 to 40 watts, 10 meter transmitter with power supply or with schematic for power supply. Charles R. Butcher, 1158 Eighth Ave., Fort Worth, Tex.

WANTED—BC-412 A 5" oscilloscope (surplus) H. S. Gerbi, 34 Sullivan St., Claremont, N. H.

FOR SALE—PE-103 power supply in good condition except for small defect in wiring, dynamotor in perfect condition. $10. Leo Hurick, Jr., 7033 W. Vernor, Detroit 9, Mich.

FOR SALE—Techno craft overhead cutting mechanism, cuts discs up to 12" new $50. G.I. transcription motor with 10" turntable $8. Alvin Zimmerman, 727 E. 182 St., Bronx 57, N. Y.

FOR SALE—Motorola car radio 45 with 6" separate speaker and controls for attaching to dash or steering column. Radio is operating and in good condition. J. Ervin Derrickson, 422 Marsh Road, Wilmington, Del.

FOR SALE—Abbott TR4 in excellent condition, $35. Sheldon Cleaver, 210 Iron St., Berwick, Pa.

FOR SALE—Large variety of high fidelity audio transformers. BC-645 brand new in original carton $15. Radio Communication Service, 4475 Myrtle St., San Diego 5, Calif.

FOR SALE—I.F. transformers, 455 Kc, name brand, $1.10 per set; 10 sets for $9.50—35Z5GT, RCA, Kenrad, etc. 10 for $5 and other tubes at correspondingly low prices. All new. General Research Laboratories, 222 St. Marks Ave., Brooklyn, N. Y.

WANTED—25B8GT tubes, Smaid's Radio and Electric Service, 724 Meadow Ave., Rockdale, Joliet, Ill.

FOR SALE—Approved model 100 signal generator a-c like new $35; Carron r-f microvolt metered signal generator, 10 k-c-60mc fundamentals $30 and Electronic inverter, 12v d-c to 110v 60 cycle a-c, 100 watts, $15. Jack's Radio Shop, 23 Washington St., Rensselaer, N. Y.

WILL TRADE—BC348 Q receiver converted for 110v a-c; takes in 10 meters. Want good pair binoculars. Everett Cox, 2029 Brighton St., Kansas City 1, Mo.

SELL OR TRADE—Boxed new 6K6's, 75% off list, 100 IRC resistors, assorted. Cash or C.O.D. or will trade for typewriter or Rider's manuals. Roy, St. Louis, 322, 18th Ave., Newark, N. J.

SELL OR TRADE—New prewar Meissner deluxe signal shifter with all coils to 10. This is self-contained 7.5 watt transmitter $75; Rider chanalyst, $100; 6 to 18 v. hi-current battery charger, $20, converted BC-312 receiver, $75; 35 watt phone transmitter, all bands to 10 in cabinet, $75 and several radio correspondence courses. K. H. Stello, 12026, Peoria St., Roscoe, Calif.

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The Sprague Trading Post is a free advertising service for the benefit of our radio friends. Providing only that it fits in with the spirit of this service, we'll gladly run your own ad in the first available issue of one of the six radio magazines in which this feature appears. Write CAREFULLY or print. Hold it to 40 words or less. Confine it to radio subjects. Make sure your meaning is clear. No commercial advertising or the offering of merchandise to the highest bidder is acceptable. Sprague, of course, assumes no responsibility in connection with merchandise bought or sold through these columns or for the resulting transactions.

DEPT. RN-117 SPRAGUE PRODUCTS CO.

North Adams, Mass.

(Jobbing distributing organization for products of the Sprague Electric Company)

local oscillator circuits. The new instrument can also be used for general troubleshooting, measuring of response characteristics, analyzing circuit performance, and determining stage-by-stage gain.

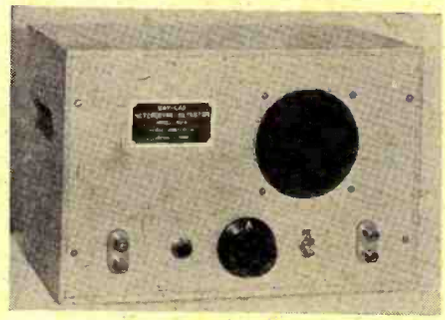
Another feature of this oscillator is a signal injection probe, supplied with the instrument, which simplifies the application of i.f., r.f., or audio test signals to any part of a radio receiver without the use of clip connection.

The *Test and Measuring Equipment Sales Division* of *Radio Corporation of America,* Camden, New Jersey, will supply complete details on this new test oscillator.

HETERODYNE DETECTOR

Kalbfell Laboratories, Inc., of San Diego, California, have announced the availability of the company's new "Kay-Lab" Heterodyne Detector.

This unit, which features high sensitivity and wide frequency range, is capable of measuring signals of 100 microvolts and is usable from 500 cycles to 50 megacycles. This wide range is possible because no r.f. amplification is used. The instrument is used to compare an unknown frequency with that of a signal generator. This system permits the comparison of fundamental frequencies over the entire range, thereby eliminating the ambiguity which often exists in heterodyne frequency meters operating from harmonics of a narrow-band, built-in oscillator, according to the company.



The sensitivity of the instrument is sufficient to pick up local broadcast stations as frequency standards for checking laboratory oscillators. Audio frequencies may be measured as well as radio frequencies because the human ear is capable of detecting a zero-beat condition even in the presence of continuous audio tones. In addition to measuring the frequency, this instrument will also demodulate an amplitude modulated signal, without the use of a second oscillator. The circuit consists of a pentagrid converter and a high gain audio amplifier with loudspeaker.

Complete details on the Heterodyne Detector will be supplied upon request to *Kalbfell Laboratories, Inc.,* 1076 Morena Boulevard, San Diego 10, California.

NEW AM-FM TUNER

The Radio Craftsmen, Inc. of Chicago are now in production on a new AM-FM tuner which features automatic frequency control. This feature

Use my 19 years of Radio Experience To Double Your Earning Cut Servicing Time in ½

Lectures by M. N. Beitman, radio engineer, teacher, author & serviceman.

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Four complete lectures by M. N. Beitman. Discussion of radio service problems. Opening and operating a radio store and shop. Selecting the right location. Store arrangement. Tested advertising ideas that cost little — bring big results. Window display suggestions. Service department. Model shop. What to charge. Bookkeeping and records.

BOOK 2. USING RADIO TEST EQUIPMENT

Visual and aural time-saving methods. Meters, volt-ohm-milliammeters, related circuits. Vacuum tube voltmeters. Voltage and resistance point-to-point servicing. Tube testers (emission, leakage, dynamic, and mutual conductance types). Using a signal generator. Cathode ray oscilloscope as a servicing tool. Tuned signal tracers. Simplified signal tracing technique. Condenser testers. Bridges. Advanced test equipment. Twelve illustrated lectures on every type of modern test equipment. Hints, ideas, diagrams, practical tips.

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Fourteen easy-to-follow lectures on radio testing and making repairs. Tests for audio voltage and power amplifiers. Audio corrective circuits. Inverse feed-back. Phase inverters. Understanding impedance. Loudspeakers and output transformer matching. Function and adjustment of tuned circuits (a non-mathematical treatment for servicemen). Detector and AVC circuits. Troubles in R.F. and I.F. stages. Superhet converters and alignment hints. Power supplies: AC, AC-DC, and doubler types. Television facts. F.M. fundamentals and receiver description. Trouble-shooting and alignment in F.M. receivers. All 30 lectures of all 3 books, only $3.00, see top of next column for more details. Send coupon today.

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Complex and unusual radio faults may waste hours of your valuable time. The author has foreseen all possible problems (above the elementary level) and provided explanations and practical solutions in this unique on-the-job manual. Keep it on your work bench to aid and guide you on tough repairs. Use the thousands of hints and advanced servicing suggestions to speed up routine jobs. No other training book or course can compare to this new manual. Published in September, 1947. Be first to use it and forge ahead of others. Learn to do complicated repairs in minutes instead of hours.

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makes for ease in tuning by eliminating the usual troublesome side responses and by providing more degrees of distortionless tuning range for each FM station. The problem of warm-up drift has also been eliminated in this unit, according to the manufacturer.

This unit contains 8 tubes, a stage of tuned r.f., separate i.f. transformers for AM and FM and is designed for the greatest versatility by incorporating separate input channels and switch positions for phonograph and television. The chassis is chrome plated and is especially recommended for custom-built installations.

Information about this tuner is available from *The Radio Craftsmen, Inc.*, 1341 South Michigan Avenue, Chicago 5, Illinois.

RADIO-TELEPHONE UNIT

Several unique features have been incorporated in the new radio-telephone unit which is being manufactured by *Applied Electronics Company* of San Francisco.

A special *Apelco* "Q" coil boosts the effective power output by cutting loss in power between the transmitter and the antenna. The new coil also reduces noise pickup and allows for instant adjustment of the set to any antenna length.

All of the sets come completely pretuned with all bands prealigned at the factory.

All transmitter and receiver coil adjustments can be made by simply lifting off the top cover. It is not necessary to disassemble the set.

The radio-telephone is available in three models ranging from a four-

channel, 22 watt input set to a ten-channel, 260 watt input unit.

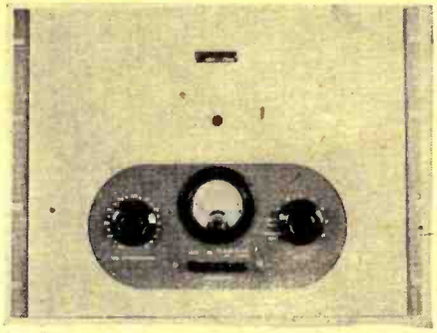
Full details on this line of radio-telephones will be supplied by *Applied Electronics Company* 807 Ellis Street, San Francisco, California, to those requesting the information from the company.

TYPE 92-A AMPLIFIER

Presto Recording Corporation has just introduced a new amplifier, designated the Type 92-A.

Designed for rack mounting, the 92-A has a vertically mounted chassis giving access to the tubes from the rear of the relay rack. The front panel of the unit is removable while the amplifier remains in the rack, giving access to circuits, resistors, etc.

One meter and a selector switch serve to indicate, variously, output level and plate currents of each of the tubes. Four push-buttons select any of the following recording characteristics: flat response, 20-17,000 c.p.s.,



78 r.p.m. lateral, NAB lateral and NAB vertical.

The output stage is unusual, having four 807's in push-pull parallel and provides peak power at low distortion.

The frequency response of 20 to 17,000 c.p.s. within 1 db. exceeds present frequency modulation standards.

Full details and a specification sheet may be secured from *Presto Recording Corporation*, 242 West 55th Street, New York 19, New York. —30—

Networks for Television

(*Continued from page* 41)

Telephone Company to lease any sizable proportion of its coaxial cable facilities, because these facilities will yield higher revenue when used for other communications services.

Seeking to avoid excessive cable tolls, some television broadcasters and manufacturers have turned hopefully to fixed, point-to-point, microwave radio relay systems.

Radio Relay

The development of microwave techniques for *selective* communication makes these tiny radio waves ideally suited for highly directional, overland point-to-point transmission of video signals. Because of the nature of these waves, low-power but stable radiation is possible at operating frequencies of thousands of megacycles with virtual elimination of noise and other interference.

The portion of the frequency spectrum between 1 *meter* and 1 *centimeter* is relatively unused by other radio services. In that range there is instantly available nearly 10,000 channels (3-mc. wide) for transmission of monochrome television, *or* nearly 5000 channels (6 mc. wide) for radio-relay transmission of chromatic (color) television programs. These figures can be amplified to almost any number, since distance limitations permit many stations to operate on the same channel frequency within relatively small distances of each other.

Much of the effectiveness of a microwave radio-relay system is due

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Vitally important for tuning and aligning FM and Television receivers where tuning is very sharp and critical. The extreme wide range and accuracy afforded by the micro-cycle vernier band spread dial assures accurate frequency adjustment for test or alignment of broadcast FM or Television receivers. Vernier dial divided into 100 divisions. Any frequency can be tuned and repeated within .02% accuracy. Spring loaded split gears eliminate back lash and play providing smooth accurate tuning. Window casing encloses and protects the lighted dial and its fine pointer from accidents and jarring out of calibration.

- Range 75 KC to 150 MC.
- Complete broadcast band from 550 KC to 1700 KC covered on one range without switching.
- Unused coils are automatically shorted out to eliminate dead spots and absorption.
- Linear dial calibration, DOES NOT CROWD UP on high frequency end of dial.
- Accuracy better than .5% throughout the broadcast band and 1% on the higher frequencies.
- Just as accurate at high end of dial as at the low end.

$64.50 YOUR NET

EICO MODEL 113-A

THE ONLY SIGNAL TRACER WITH VACUUM TUBE PROBE

Permits rapid tracing or following a signal audibly through the receiver from antenna to speaker, locating the faulty section quickly. Isolates the precise cause of trouble with the VTVM section by making point to point checks giving both audible and visual indications. Perfect for checking distortion or fading. Signal may be traced through entire receiver without interfering with normal operation.

MULTI-ANALYST

- Wide frequency response from 30 cycles to 300 mc.
- High input impedance of 26 megohms on DC.
- All electronic AC and DC voltmeter and ohmmeter.
- DC and AC ranges 0-5, 10, 100, 500, 1000 volts.
- Ohmmeter reads from .1 ohm to 1,000 megohms in six ranges.
- Built-in speaker for monitoring either IF, RF or AF channel.
- VTVM cannot be damaged by overload.
- Tests—phono pick-ups—microphones, etc., for distortion or voltage output.
- Will substitute for any defective stages in a radio receiver or amplifier.

$89.50 YOUR NET

MODEL 210—VACUUM TUBE VOLTMETER

A versatile test instrument for all radio and electronic service work, in manufacturing plants, laboratories, etc. Accurately measures wide ranges of resistance and voltages easily and rapidly. Visually traces signals in any receiver. Its HUGE 8½" METER makes readings easier and more accurate.

- No drift after short warm-up period.
- RF-AC probe permits linear readings from 50 cycles to 300 megacycles.
- DC ranges 0-5, 10, 100, 500, 1000, 5000 volts.
- AC ranges 0-5, 10, 100, 500, 1000 volts.
- Ohmmeter reads .1 ohm to 1,000 megohms, in six ranges.
- 26 megohms DC input resistance minimizes loading when making voltage tests.
- Electronic on all functions.
- Meter circuit is designed to make burnout of meter impossible.
- Meter specially damped for fast accurate reading.

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TOWN_____ ZONE_____ STATE_____

to the characteristics of such waves.

Microwaves are extremely short in length, and behave much in the manner of light waves. Radiated energy from a microwave transmitter can be concentrated toward a distant receiving point by means of a highly directional antenna. At the receiving point, such radiations are "collected" by another, similar antenna. Microwaves, like light waves, travel in straight lines and do not follow the curvature of the earth, thus the receiving point must be within view of the transmitter. Such a group, of transmitter and distant receiver, is known as one *link* of a relay system.

By feeding the output of the receiver to another transmitter and its antenna, at the receiving site but facing oppositely, the microwave signal is reradiated and can then be picked up by another, distant receiver. In this manner, by arranging successive *links* in tandem, the microwave beam of concentrated energy can be relayed to any desired, distant point of reception. The process is practically instantaneous, almost at the speed of light.

Although the distance range of a single *link* is limited to the line-of-sight or optical distance between transmitter and receiver, two or three frequency assignments can be used and reused by successive *links* of the system.

The microwave beam is modulated by the wide-band or video signal, and the factor of bandwidth is just as important as for the coaxial cable. Two-way operation of a relay system *over the same path* requires a double beam, one directed oppositely to the other. Thus, a single relay point is equipped with two directional antennas for each of the two *links* of the relay circuit; one for transmission of one beam, one for reception of the other beam. For centimeter operation, these usually consist of parabolic reflectors (Fig. 4) or horn or lens antennas (Fig. 3).

A microwave radio relay system has several advantages over coaxial cable for television networks. Very little time is required to locate or relocate towers or other antenna structures. Difficulties of construction over water, deserts, rocky regions, and mountains are greatly reduced. When all *links* of the relay system are adjusted and functioning properly, the general quality of video transmission is much improved. All maintenance is concentrated at the antenna towers or buildings, instead of being distributed along the length of a cable buried underground.

Main disadvantage of microwave radio relay systems is their inherent ability to generate and amplify noise and similar interference. Improved circuit design of amplifiers is likely to overcome this important objection. While operational and maintenance costs are low, the initial cost of this equipment is considerable, since a great many relay points are required

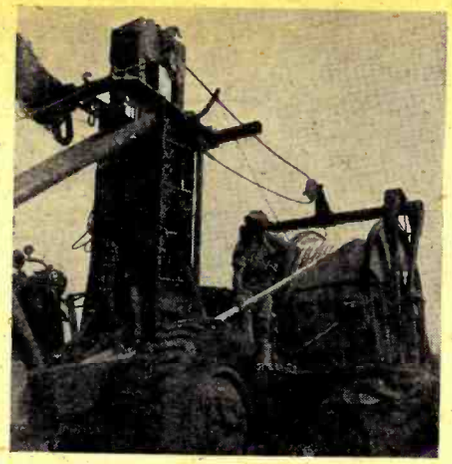

Fig. 7. Coaxial cable on reel (at right) is guided into cable plow (left) and buried in earth, as plow is drawn by tractors.

to *link* cities separated by an appreciable distance.

Relay towers are generally constructed as high as is compatible with structural safety, and the transmitting and receiving antennas are mounted somewhere near the tops of the towers. Equipment at all relay points is standardized, and individual stations operate unattended. Maintenance personnel is stationed at main terminal points, equipped with precision, fault-finding apparatus.

Cost of constructing a microwave radio relay system of any appreciable circuit length (over 50 miles) is considerable, and increases with distance at a greater rate than coaxial cable facilities.

Again, the operational cost figures heavily against television. Because of the expense of such installations, it is far more profitable for the microwave relay system to be used by the other communications services, telephone, telegraph, wirephoto, etc., who are prepared to pay high rates for use of the facilities. Resultant revenue would be far in excess of that obtained from a *single* television or video service over the same system.

After five years of extensive experience in the operation of a commercial radio relay system between Philadelphia and New York, *RCA* has developed a 1-centimeter radio relay system for *Western Union*, having a bandwidth (received) of 4 megacycles occupied by 32 channels for carrier telephone, telegraph, facsimile, and similar services. There is no provision for television service in the *Western Union* system.

Unless a radio relay system is owned and operated, or its operations directly controlled, by individuals or corporations *within the television industry*, it is unlikely that television programs will be transmitted by such a system, because of the economic factors involved.

Philco, Raytheon, and a few other radio manufacturers have inaugurated extensive programs covering research and development of new, microwave radio relay systems. But detailed data on their technical ac-

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OUTPUT VOLTS: 0 to 15/30/150/300/1500/3000.

D.C. CURRENT: 0 to 1.5/15/150 Ma.; 0 to 1.5 Amps.

RESISTANCE: 0 to 500/100,000 ohms 0 to 10 Megohms.

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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" x 7½" x 3".

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complishments, if any have been made, are not available.

Effectively competing with itself in at least one aspect—coaxial cable—the *Bell System* has also entered into active development of microwave radio relay equipment with some very promising results. Construction work begun a year ago on a Boston-New York relay circuit (Fig. 6) has just been completed. The system consists of two main terminals, and seven relay stations. One of them is shown in Fig. 3. Average distance between relay points is about 27 miles; distance of the total circuit is about 230 miles. The system operates with a frequency in the vicinity of 4000 megacycles, using two channels in each direction of transmission. A usable frequency bandwidth of almost 4 megacycles is available for television service, but all channels are to be used normally for carrier telephone operation. At each relay point, radiation and reception is accomplished by electromagnetic horns (Fig. 3) with 10x10 foot apertures, and equipped with a metal lens to focus the microwaves into a highly directional beam.

A similar radio relay circuit between New York and Chicago will soon be under construction, also by the *Bell System*, requiring more than 40 relay points between terminal stations. Three years will be needed to complete the work, at an estimated cost of seven million dollars.

One other type of radio relay system called "Stratovision" is worthy of mention, only because of its unique nature and purely theoretical possibilities. This system of television broadcasting—from a specially equipped, high-altitude plane in flight over a service area—was publicized widely a few years ago. But despite a few tests made under ideal conditions, the system has yet to be proven practicable.

Video programs originating on earth are transmitted—via microwaves—to a stratoliner, flying above an area in continuous circles at an altitude of about six miles. There the television signals are received, and then broadcast toward the earth with a more-or-less conventional television transmitter. In this way, limiting effects of the horizon are overcome and, theoretically at least, a vast area on earth could receive the radiated programs. The originator *(Westinghouse)* claims that 78 per-cent of the population from coast-to-coast would be able to receive guaranteed (sic) clear reception and sharp images. Main difficulty with this *theory* of operation, is that airplanes characteristically deflect television signals causing momentary interference and, occasionally, ghost images at the point of reception. Exhaustive tests are said to have been made during the past year, but no results have been published or made available to the public.

Film

Quite apart from the economic limitations and any technical inefficacies

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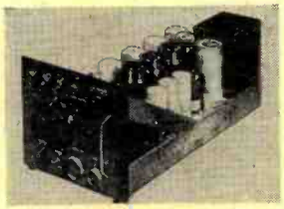

Has four screw driver tuned R.F. channels selected by switch—I.F. frequency 1050 kc, I.F. band width 45 to 60 kc, R.F. frequencies 1600 kc to 2000 kc. Tube lineup: (2) 2Y2, (1) 5U4, (3) 6B4, (1) 6SU7, (1) 6SA7, (4) 6SK7, (1) 6SN7, (1) 6SL7, (1) 6H6 and (1) VR150. The components of this receiver are the finest money can buy. Makes excellent fixed tuner for medium frequency police calls or public address system. Has power supply for 5-inch scope—just the set to make a panoramic scope for these high frequency I.F. receivers—power transformer 400 cycle. Low voltage supply is electronically controlled and delivers 260 v.d.c. 150 mils regulated to .01%. The power supply alone is worth more than the price.

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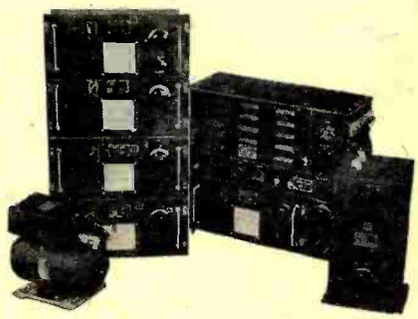

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of the types of network systems previously described, there is an important element of *availability* of these systems, which should certainly be considered.

Even after completion of the proposed coaxial cable network, it may be of no practical use for television if the industry is expected to lease sections of the cable at a price in proportion to the number of channels required for transmission. With a swing to higher definition or, eventually, to chromatic pictures, in either event the coaxial cable will be obsolete.

Most *potential* hope for television networks are microwave radio relay systems, *if* they are owned and operated by those within the television industry. However, it will take many years to construct sufficient beam circuits to reach all centers of large population.

Television is in need of a mass audience *today!* And unless a definite audience is assured, advertisers will not spend money for television programs—a station's only source of revenue.

Solution of the immediate problem of a television network is *film.* Not ordinary *theater* motion-picture film, but motion-picture-*type* film—made for, and used by, television broadcasting stations only. Though not strictly a "physical" television network, the use of television film is the most practical *and immediate* means of intercity multiple-station programming.

Film could be produced much more economically than the installation costs of coaxial cable or radio relay equipment. Film would be equal to, or a considerable improvement over, a "live" presentation of the same program, because the television film could be edited just as motion-picture or theater film. Since the film is exclusively for video reproduction, all aspects of its production are specifically designed for television's small screen and gray shading.

Only film guarantees adequate lighting of scenes, flawless dialogue, absolute focus, and repeat performances of uniform quality. Time-zone differences—such as exist between New York and California—would be unimportant if the video program was on film.

The technical aspects of film production more correctly belong in the category of motion pictures, since only the lighting, directing, and general philosophy are changed when making films exclusively for television. For this reason, technical data on film production is not included in this system's analysis.

Film size most likely to be used for television will be 16 mm, which is more practical and economical than larger motion-picture theater film. The speed of television film, 30 frames per second, requires special projection equipment, but general operation is identical to theater technique. Operating *costs* of a film "network" are negligible.

Entertainment, *not* spontaneity, is an important factor in television program appeal. And from the economic standpoint, as shown, the cost is very low. Until suitable coaxial cable or radio relay network systems are established, requiring *at least a decade* for national coverage, the logical and economical method of multiple-station television programming is by means of *film.*

—30—

NBFM Adapter

(*Continued from page* 46)

experimentally by trying different values or by using the formula $R = E/I$ where E is the difference between the source voltage and that required for the limiter, say, 10 volts. I is approximately 1 ma., the total plate and screen current of most pentodes at this low voltage. In any case, the value of R_2 will work out to be something between 100,000 and 200,000 ohms. C_8 is necessary for the operation of the discriminator and should be a good mica or ceramicon condenser with low leakage in order to keep any d.c. voltage from the plate of the limiter out of the discriminator secondary. The two r.f. chokes can be of any value from 1 to 2.5 mh. depending on the frequency of the i.f. At frequencies higher than 455 to 465 kc. smaller values of inductance should be used. The output load of the discriminator is conventional with C_{10} and R_6 forming a de-emphasis circuit to attenuate the higher audio frequencies. C_6 may be necessary if the particular i.f. transformer does not tune to resonance. Its value should be determined experimentally to bring the circuit to resonance, and will usually be something between a 10 and 15 $\mu\mu$fd. condenser.

Using this unit as an adapter, "B" and filament voltages can be tapped from the receiver. The only other connections are to the i.f. output and audio input circuits. The unit described is currently used with an SX-28A. The presence of a power plug and phono input jack at the back of the chassis, conveniently solved a greater part of the problem. Connection to the i.f. output was made by wrapping the pigtail lead of the coupling condenser, C_1, around pin 4 or 5 of the 6B8 second detector tube, and replacing the tube in its socket. It was then necessary to realign the secondary of the last i.f. transformer slightly because of the capacity loading of the shielded input cable. This proved to be no objection, however, inasmuch as the normal operation of the receiver was not impaired by the connection or readjustment. The audio output from the discriminator was connected through another shielded cable to a phone plug. For the reception of FM, this plug was pushed into the phono jack at the back of the SX-28A, and for AM signals this plug was merely removed and the receiver operated normally.

Aligning the discriminator trans-

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former is quite simple. The method does not require the use of any laboratory test equipment. With the FM adapter completely connected to the receiver for the reception of FM signals, tune in an AM signal right on the nose. A broadcast station will do very nicely. Adjust the primary trimmer, or core, if a slug-tuned i.f. is used, for maximum audio output from the receiver. Then, very carefully adjust the secondary trimmer, or core, until there is a noticeable dip in audio. This adjustment may be fairly critical with some types of transformers, therefore, go through the procedure carefully to find the null. If this null cannot be found then it may be necessary to add C_6 across the secondary. To check for proper alignment, tune across the AM signal with the regular tuning dial. There will be a definite null in audio in the very center of the carrier and an even increase on either side. Now, if an FM signal is tuned in, audio will be maximum in the center and down on either side. This is not exactly the case, however, for as the signal is tuned farther off center there will again be an increase in audio, giving the appearance of three-spot tuning. The two spots on either side are, however, not the correct ones as there will be noise and distortion present on the signal. There is a noticeable absence of noise when tuned to the very center of even a weak FM signal.

Connecting this adapter to the various types of communications receivers is an individual problem, but should not discourage anyone from appreciating a device of this sort. The connection to the i.f. output of the receiver can usually be made to the diode pin of the second detector tube, and the audio grid of many tubes is a cap on top. The other point to keep in mind is to break the audio output from the second detector in the receiver when using the FM adapter. In other words, do not have the audio from both the second detector and discriminator feeding into the audio stages of the receiver. A s.p.s.t. switch can be connected in the circuit if no other method of cutting out one or the other is available. By referring to the circuit diagram of the receiver, and with a little amateur ingenuity, some convenient method of attachment will be discovered. In most cases, it will not be necessary to remove the receiver from its cabinet.

Although this design may not be the ultimate, it is definitely effective and something to start with. Refinements can be made on the basic unit. It is hoped that the simplicity of this FM adapter will enable many more amateurs to make the comparison between the reception of FM and AM signals and give narrow-band FM a fair chance before it is condemned. —30—

International Short-Wave

(*Continued from page 67*)

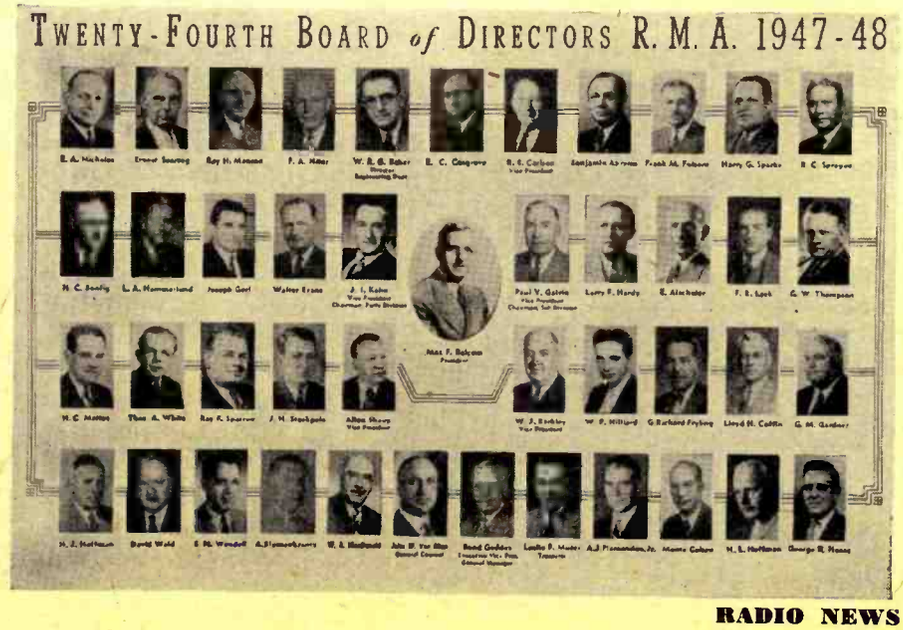
Ravag, however, is now building a new broadcasting station in the vicinity of Vienna (Rotneusiedl). With a capacity of 20 kw., this station is destined to become transmitter Wien II. Transmitter Wien I is to be rebuilt at Bisamberg, with a power of 100 to 120 kw.

A new short-wave station is planned, with a power of 20 kw., for the purpose of propagating the *"Voice of Austria"* all over the world.

At present the Austrian broadcasting network is cut into four parts, according to the Allied Zones in Austria. *Ravag* is using only the transmitters in the Russian Zone of Occupation.

It is hoped by *Ravag* officials that unity in broadcasting will be reestablished as soon as the Austrian treaty with the Allies is concluded. This would mean that reconstruction could be achieved within a reasonable time, and that Austria could go ahead with its projected third program—dedicated chiefly to broadcasts in foreign languages for overseas listeners.

Now there are no regularly sched-



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The complications have been removed in this entertaining book revealing the "mysteries" of Radar. By John F. Rider, Lt. Col. Signal Corps (Ret.) and G. C. B. Rowe, both of whom worked on Radar literature for the last three years of the war. In "Radar" they explain the simple facts and interesting applications of one of the most talked-of scientific developments of our time.

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Publishers of RIDER MANUALS

uled broadcasts in *English* from *Radio Wien.* However, lessons in *English,* French, Italian, Russian, and Esperanto are given several times a week, and from time to time there are special series in *English* or French. An example is a series in *English,* which was recently started, on "Modern English Literature."

Radio Wien has been sending out verifications by letter from its Technical Department, but hopes soon to have verification cards available. Official QRA is Radio Wien, Argentinierstrasse 30A, Vienna (Wien IV), Austria.

Austrian broadcasting stations are listed as follows:

Ravag Wien, Vienna (Russian Zone)—Wien I, 592 kcs., 10 kw.; Wien II, 1312 kcs., 2 to 10 kw. On short-wave, Wien I, 6.155, 0.3 kw.; Wien II, 7.175, 0.25 kw.; Wien III, 9.664.82, 0.25 kw.; Wien IV, 11.785, 0.20 kw.

Sendergruppe Alpenland (British Zone)—Alpenland, 886 kcs,, 100 kw.; Graz, 1285 kcs., 15 kw.; Klagenfurt, 1285 kcs., 15 kw.

Sendergruppe West (French Zone)—Dornbirn, 519 kcs., 6 kw.; Innsbruck, 519 kcs., 2 kw. On short-wave, listed 6.145 but reported using 6.005, 0.20 kw.

Sendergruppe Rot-Weiss-Rot (American Zone—Salzburg, 1267 kcs., 5 kw.; Linz, 1294 kcs., 15 kw.; Wien (Vienna), 1429 kcs., 1 kw. On short-wave, listed 31.37 m. (9.563, 1 kw.). (The short-wave transmitter is reported to operate as high as 9.575.)

American Military Forces Station WOFA—KOFA, Salzburg, 1104 kcs., 1.3 kw., and on short-wave, 7.220, 0.75 kw.; WOFA, Vienna, 626 kcs., 1 kw.; WOFA, Linz, 1068 kcs., 1 kw. (These stations radiate programs for the U.S. Occupation Forces in Austria.)

The six transmitters operating from Vienna are all "Class B" amplifiers, grid-modulated. As to antennas, Wien I, 592 kcs., uses a self-radiating vertical top-load antenna; Wien II, 1312 kcs., a T-antenna; Wien I (short-wave), 9.664.82, a half-wave dipole antenna; Wien II (short-wave), 11.785, a half-wave vertical antenna; Wien III (short-wave), 6.155, a half-wave dipole antenna; and Wien IV (short-wave), 7.175, L-antenna.

Schedules

Vienna broadcasts Sundays on 11.785 and 6.155 at 2355-1705*, and from 1630-1705 also on 7.175 and 9.662.82; weekdays, the same except sign-on is at 2345. On weekdays, lessons in various languages (including *English* some days) are scheduled for 0035. (NOTE: *These schedules were listed to us in Mid-European Summer Time; thus, it is possible by this time that programs have been advanced one hour for standard time.*)

* (Note: Unless otherwise indicated, time herein is American EST; *add* 5 hours for GCT. Time is indicated on the basis of a 24-hour clock, that is, 1 a.m. is 0100, 1 p.m. is 1300, etc. All times indicated as 1200 through 2400 fall in the p.m. so in order to convert the times, subtract 12 hours from figures over 12 to get the p.m. time. "News" refers to newscasts in the *English* language. "V" following a frequency means that the frequency varies.)

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TERRIFIC VALUE!
24-VOLT STORAGE BATTERY, BRAND NEW!
Made by Delco. 12 cells, heavy duty, very rugged. Shipped dry, uses standard sulphuric acid electrolyte.
VERY SPECIAL.. **$14.95**

6-VOLT STORAGE BATTERY, Navy standard BRAND NEW, 15 ampere-hour rating. **$4.95**

SETCHEL-CARLSON BEACON RADIO RECEIVER BC-1206-C
Receives A-N beam signals, operates on 24-28 V DC 5 Tubes: 3—14H7, 14R7, 28D7. Tunes 195 to 420 Kc. Size 4"x4"x6⅝" wide. 4 lbs. Slightly used, A-1 condition.
Each.. **$4.95**
Same as above, BRAND NEW, in original carton.. **$7.95**

PE-104-A VIBRATOR POWER SUPPLY
Works on 6 volt or 12 volt battery. Supplies 84 volts and 51 volts DC, also 1.4 volts "C" bias. Size 7"x4"x 3¾". Fits BC-654 (SCR-284) exactly. Can be used to operate many types of receivers now on market.
ALL BRAND NEW, very low price.. **$4.95**

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195 to 20,000 Kc modulated, complete with tubes and crystals, less power supply. Navy type, used, good condition.. **$39.50**
Less calibration book.

140 MMFD MIDGET TUNING CONDENSER
Long shaft.
Lots of 3, each.. **44¢**

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Very Special Ham Value! 31 plates, Airgap .109" overall length 4⅛", ceramic insulation, normal list price $11.85.. each **99¢**

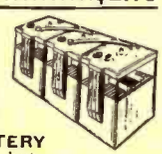
BEEDE DC METER, new, black bakelite case, 3" round 0-1000 DC Ma. Special **$1.95**

BC-412 OSCILLOSCOPE (Modified to BC-612)
With very little effort you can convert this 5" C.R. Oscilloscope to first class laboratory instrument! ALL BRAND NEW, in original sealed crate. Contains 13 tubes: 6AC7, 6—6L6's, 2—6SJ7's, 879, 5T4, 6A6, 5BP4. C.R. Tube. 110 V 60 cycle. Shpg. wt. 200 lbs. Only **$59.50**

ALLIANCE PHONO MOTOR, special.. **$2.75**
ASTATIC CRYSTAL PICKUP, with L-26 crystal cartridge.. **$1.79**

FREQUENCY METER CABINET
For BC-221 Series freq. meters. BRAND NEW! 3 compartments. Massively built. 14½"x10½"x10". Value $20.00.
Yours for only.. **$2.95**

WILLARD 6-VOLT STORAGE BATTERY 27 amp. hrs.
3-cell battery, transparent plastic case, very specially priced.. **$4.50**



WILLARD 2-VOLT BATTERY
20-amp. hrs. similar to above, but single cell.. **$2.75**

ONE-QUART BOTTLE BATTERY ELECTROLYTE
Made by Willard, for above storage batteries. 1 quart sufficient for two 2-volt cells. Hermetically sealed. SPECIAL. per qt. bottle **95¢**

7-PRONG 2-VOLT RADIO VIBRATOR for Portable and Farm Sets Replacement for GE LB 530.. **$1.65**

BC-645 XMTR-RECVR 15 TUBES 435 to 500 Mc.
Only a few left! Tubes alone worth twice the price! Operates on Citizen and Ham frequencies. ALL BRAND NEW, complete with tubes each.. **$14.95**
TWO FOR ONLY...$27.00

PE-101C DYNAMOTOR for above.. **$3.95**

FAMOUS SCR-522 V.H.F. XMTR-RCVR

100 to 156 Mc.

10-tube xtal controlled superhet rcvr, extremely sensitive; 7-tube xmtr, temperature stabilized. Delivers 15 Watts. Used on AAF and RAF planes—now yours at tiny fraction of original cost! Easily converted to 110 volt 60 cy. operation. Complete with 17 tubes. A-1 condition only.. **$14.25**
TWO FOR.. $27.90

Dynamotor power supply for SCR-522 above, BRAND NEW.. **$3.95**

SCR-522 RECEIVER ONLY (Model BC-624)

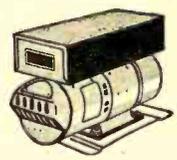
10 tubes, 100 to 156 Mc, 4 crystal channels. Fine on 144 Mc! Ideal basic unit for FM or television conversion.. **$9.95**

SCR-522 TRANSMITTER ONLY. Model **BC-625-A.** 2 or 6 meter transmitter. 7 tubes incl. two 832s.. **$9.95**

TRANSMITTER BC-223-AX

Ideal for 80-meter band! 801 osc., 801 P.A., 2—46 modulators, 1—46 speech amp., 4 xtal freq. and master osc., on selector switch. 10 to 30-watt output, tone, voice or C.W. Black wrinkle case, complete with freq. chart and tubes in original cases, less xtals. BRAND NEW, sensationally low price, shpg. wt. 125 lbs.. **$14.95**

80 VOLT A.C. INVERTER



Sig. Corps PE-206A. Terrific Value! 80 Volts AC Output, 800 cy. 28 V DC Input 6000 RPM. Complete with Filter.
Value $100.00.
Your Cost.. **$6.95**

CW-3 HAM RECEIVER
6-tube crystal cont. Superhet. Complete with set of 3.5 to 6.1 Mc coils.
Includes 6 tubes, ONLY.. **$14.95**

9-FT. ANTENNA 3 section, special.. **98c**

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Inquiries welcomed from institutions, wholesalers, dealers, large users . . . Phone, write, wire for quantity prices.

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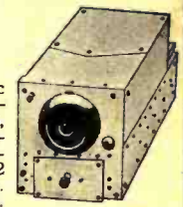
ARMY AIRCRAFT RECEIVER— BC-946-B



Covers 520 Kc to 1500 Kc Broadcast Band. 6 Tubes: 3—12SK7, 1—12SR7, 1—12A6, 1—12K8. Designed for dynamotor operation; can be easily converted to 110 volt or 32 volt use. Two IF Stages. Three-gang tuning cond.
BRAND NEW, in sealed carton, with tubes and instruction manual, less dynamotor.. **$12.95**
Dynamotor DM-32A.. **$1.95**

RADIO RECEIVERS
All Brand New in Original Cartons
BC-453-A 190 to 550 Kc complete with tubes **$7.95**
BC-454-A 3.1 to 6 Mc complete with tubes... 5.95
BC-455-A 6 to 9.1 Mc complete with tubes.. 5.95

40-WATT VFO DRIVER
BC-696A 3 to 4 Mc.. **$7.95**
BC-457A 4 to 5.3 Mc.. 5.95
BC-458A 5.3 to 7 Mc.. 5.95
BC-459A 7 to 9.1 Mc.. 6.95

RCA AVT-112A AIRCRAFT XMTR

2500 to 6500 Kc, 6 tubes, compact, powerful, operates on 6, 12 or 24 volt source.
Less crystal,
BRAND NEW **$12.95**

Sensational Value! 80-Meter RECEIVER
RCA Model AVR-20-A LIMITED QUANTITY! USED, GOOD COND. Originally designed for Aircraft. Tunes 2300 to 6500 Kc. Perfect for 80 meter Ham work. Crystal controlled. Phone and CW. Provision for low and high impedance phones. Tubes used: 6B8, 6F7, 6S7, 6K8. 3-gang tuning cond. vernier tuning. Designed for 6 volt operation. Easily converted to 110 volts AC. Less power supply.
SENSATIONAL GIVE-AWAY PRICE.. **$8.95**

WESTERN ELECTRIC FIELD PHONE SET EE-8

Leather case, With handset, generator, ringer, etc. Requires 2 flashlight cells. Wonderful value! Good used
each ...**$8.95**
TWO FOR...$16.50

HEADPHONES—*All Brand New!*
Individually packed, complete with phone plug.
HS-33 600 ohms, in lots of 3.. **$1.85 each**
HS-23 2000 ohms, in lots of 3.. **1.65 each**
HS-30 headphones, with earplugs, LOTS OF 12.. **44c each**

HANDSET

Cradle-type handset with butterfly switch, unbreakable black plastic, 4-ft. 3 wire cable, BRAND NEW, individually packed, each.. **$2.75**
Same as above but slightly used, each.. **$1.65**

HANDMIKE T-17

Shure model T-17 mike, 200-ohm carbon single button, with press-to-talk switch, 5-ft. rubber cord and plug. BRAND NEW, individually packed, in lots of 3, each.. **88¢**

Astatic R-3 Crystal Handmike, with 6-ft. R.C. mike cable.. **$4.50**

WESTINGHOUSE "RECTOX" DRY DISC RECTIFIERS—*All Brand New!*
5 Amps DC at 25 volts.. each **$2.95**
5 Amps DC at 50 volts.. each **3.95**

Dr. Siegmund Guggenberger is director (Public Administrator) of the Austrian Broadcasting System.

About Austria

Austria of the present day was established at the close of World War II when the Allied Control Council assumed supreme authority over Germany and forced that country to disgorge all her territorial conquests obtained by fraud or force. By this action Austria was restored to her borders of 1937, but it was a mere remnant of the former Austrian Empire. To the west and north it had Germany as a neighbor, to the north and east Czechoslovakia, to the east, Hungary, to the south Yugoslavia and Italy, and to the west Switzerland.

In the pre-World War I days of Emperor Francis Joseph of the Hapsburg dynasty, the Austro-Hungarian Empire had an area of 261,259 square miles and a population of approximately 51,000,000. The Dual Monarchy included Austria proper, with Vienna, one of the brilliant political, commercial, and art centers of the world; Hungary, Transylvania, Czechoslovakia, Polish Galicia, the Trentino, Slavonia, Croatia, Bosnia, Herzegovina, the Banat, territories which gave Austria access to the Adriatic and practically all of the Danube River. Since then Hungary has become an independent kingdom (functioning as a Republic), and the other provinces have been lost to Austria, absorbed by other nations, or organized by themselves.

Total area of Austria in 1937 was 32,369 square miles; census figures of 1939 listed the population as 7,009,014.

Austria was proclaimed a republic on November 12, 1918.

Following World War II, a Provisional Government was established on April 29, 1945, under the leadership of Dr. Karl Renner who restored the Republic under the Constitution of 1920. The new Government declared Austria a democratic republic, composed of eight provinces and the city of Vienna. Representatives of the provinces approved the Renner Government and the Allied Council also accepted the Government in October 1945. On December 20, 1945, Dr. Renner was elected by the National Assembly as president of the Republic.

The Allied Council granted to Austria on June 28, 1946, more nearly complete control over its destiny than it had possessed at any time since annexation by Germany. All zones of demarcation were removed, permitting free movement throughout the country of Austrian citizens and Austrian traffic. The country also was permitted to establish frontier and customs administrations.

As we take our leave of radio in Austria, it is with the hope that the day is near when again the *"Voice of Austria"* may be heard regularly throughout the globe. As Miss Hartner points out:

"Already *Radio Wien* can boast of one of the best European programs which, in part, is relayed to foreign stations (such as in Switzerland, England, France, Czechoslovakia); parts of the Salzburg Festival, for example, were even relayed to the United States. Our future plans include not only close contact with radio circles, but also with scientific and artistic circles and institutions throughout the world. Thus, we hope to contribute widely to mutual understanding among the nations, and to resume our role as mediators between West and East."

* * *

Verifications

In reply to a report of WAR, 16.340, George Darwin, Captain, Signal Corps, Liaison Officer, AARS, War Department, wrote: "Your reception report of WAR signals is hereby acknowledged, but verification cannot be given due to the fact that no station announcement log is kept by the Army. It is highly probable that your report is correct as the carrier strength and modulation report indicates they were received under unusual skip conditions and by a receiver not capable of receiving the type of modulation used. Thank you very much for submitting the report on our signals." (Kary)

Nordwestdeutscher Rundfunk, Hamburg 13, Rothenbaumchaussee 132-134, wrote Kary, Pennsylvania: "We are glad to learn that you are able to hear our station fairly well, and especially because the one we now have is only 25 kw., not having the full energy of 50 kw. These broadcasts are more or less for testing purposes while we alter our antenna system. We would like to hear from you again, but during a different season when the days become shorter."

The following verification data was compiled by Paul Kary, Pennsylvania, from reports of URDXC members: XGOY, Chinese International Broadcasting Station, Chungking, Zechwan, China, airmail letter verie on official stationery takes about a month; all CBA stations have been directed to verify all *correct* reports promptly; non-receipt of veries by DX-ers can be attributed to loss in the mail. All India Radio, Queen's Road, Bombay, India, verifies the Bombay stations by usual AIR card within 5 months; same goes for AIR at Eastnook, Egmore, Madras, India (Milne). *Radio Kuala Lumpur* verifies from Department of Broadcasting, Java Street, Kuala Lumpur, Malaya; sent letter verification in 5 months (Milne). CS2WI, Radio Club Portuguese, Parede, Portugal, verified by card in 5 months; card shows map of world in blue and white with call letters overprinted in gold.

From Radio Club de Benguela, Caixa Postal 19, Benguela, Angola, Mervyn Laubscher, South Africa, received a nice card—green, with a grey elephant standing below a map of Africa in white, with radio waves radiating from Benguela's QTH; call-signs CR6RB and CR6RF are at top of card in red. Latter call may be medium-

NOW-24 Hour service on your order

SEND FOR HERSHEL RADIO CO'S GIGANTIC FREE BULLETIN!

Shallcross AKRA-OHM

±1%

1 MEG. 89¢

30MC IF TRANSFORMER

29¢

SLUGGED TUNE

CODE PRACTICE BOARD

89¢

KEY IN HIGH FREQ. BUZZER

SCOPE TRANS.

$3.95

110V Pri: 60 cy, Sec: 4000 V at 10MA. Size 6 x 4 x 3½

DYNAMOTOR UNIT - PE-101-C

Duo output Dynamotor input voltage 12 to 24V., output voltage 400V. at 135 ma, 800V. at 20 ma, and 9V. at 1.1 amp.

$2.95

BC-654 TRANS. & RECEIVER

LESS TUBES AND CRYSTALS USED - IN GOOD CONDITION $7.50

The frequency range of both transmitter and receiver is continuous from 3700 to 5800 kilocycles; all stages gang tuned by anti-back lash worm gear dial mechanisms.

The BC-654-A is 18" wide, 14" high, and 9½" deep. Weight 44¾ pounds. Power required for Receiver—1.5,45, and 90 volts D.C. Power required for Transmitter—1½, 6, 51, 84 volts D.C. and 500 volts D.C. at 160 Ma. Operates from Dynamotor PE-103-A. Complete with carrying case.

TRANSMITTER TUNING UNIT-BC375 only $1.95

Approximately 65 MMFD cond., coils, RF chokes, dials, assorted mica condensers, 2500 WVDC. Over $50.00 in parts!

BN IFF TRANSMITTER & RECEIVER

$9.95

Widely used on 144MC and now also successfully used as a television receiver, this being made possible by the wide band 30 MC I.F. channel and video amplifier: being sold at this exceptionally low price for the encouragement of television. Original diagram furnished. Less tubes and power transformer, wt. 100 lbs.

PYRANOL CAPACITATOR

$2.95

General Elect. 1 MFD, 5,000 VDC, 4" x 4½" x 3¾".

NEW BC-223AX TRANSMITTER $12.50

Complete with tubes and tuning unit covering 80 meter Ham band, including frequencies charts, less Xtals.

BUTTERFLY CONDENSERS

Oscillator assembly 76 to 300 MC with acorn tube socket mounted on condenser $1.95

Type B—frequency range 300 to 1000 megacycles. 95¢

BC4 antenna condenser. 105-330 MC. $1.95

Oscillator 105-330 MC. $1.95

SPRAGUE Condenser .1 MFD 7000V.

$1.95

Condensers

Cap. MFD	Working Volt	Your Cost
1	1000 oil	44c
8	600 oil	95c
2	600 oil	49c

POWER TRANS. $1.29

110V, 60 Cy. Pri. Sec: 255V ea. side of center at 80 Ma, 5V at 4 Amps, 6.3V at 3.8 Amps. Hermatically sealed case.

HIGH SPEED PHOTO FLASH TUBE

$8.95

12,000,000 lumens light output. Stops all action. Ignition coil included on back of bulb. 10,000 flashes. Diagrams furnished.

POWER TRANSFORMER $1.95

110V, 60 Cy. Sec: 300V ea. side of center at 125MA, 6.3V at 2.1 Amps, 5V at 3 Amps., Hermatically sealed, size 6" x 3½" x 4¼".

POWER TRANSFORMER $1.95

110V, 60 Cy. Sec #1: 4V at 16 Amps, Sec #2: 2½V at 1.75 Amps; Ideal for 2X2 and 826 tubes. Hermatically sealed, size 6" x 3½" x 4¼".

POWER TRANSFORMER $1.95

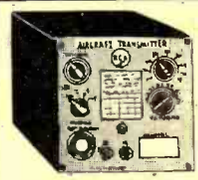
primary 110V, 60 Cy., Sec: 700V each side of center at 80 MA, 6.3V at 1.2 Amps, 5V at 3 Amps. Hermatically sealed size 6" x 3½" x 3".

Filament TRANS.

110-V, 60 cy. Pri. sec.—5V—3A. Shelled Case..... $1.49

110-V, 60 cy. Sec.:, 2.5V at 5.25 amps. Shelled Case.... $2.45

110-V, 60 cy.; Sec.: 1, 5V at 10 amps.; Sec.:2, 5V at 10 amps.; Connected in series will give 10V at 10 amps. Shelled Case..... $3.95



RCA Trans. & Rec.

RCA TRANSMITTER

MODEL AVT 112-A

OPER. ON 6-12 OR 24V.

FREQ. RANGE, 2.5-6.5 MC

5⅜ x 6¼ x 4⅞ - WT. 6 LBS.

CORONA BALLS

10¢ ea. -$1.00 DOZ.

IF TRANS.

95¢

mounted in aluminum shield can, 1500 KC, with air trimmer, impedance coupled type.

RCA-AVR 20A RECEIVER

OPERATES ON 6 OR 12 V.

FREQ. RANGE 2500-6500 KC

4 TUBE SUPERHETRODYNE CIR.

TUBES USED

6S7-6K8-6F7-6B8

THIS RECEIVER IS BUILT TO OPERATE WITH THE AVT-112A.

$12.95 EA. $25.00 PR.

MICA CAPACITATOR 49¢

.002MFD. 3000 VDC

GENERAL ELECTRIC METER

$3.95

type D041, 0-1 MA, meter scale graduation 0-5 D.C. Kilo V and 0-10 MA D.C

General Electric 25 MFD Photoflash pyranol capacitator 2000 VDC—INT.....$14.95

SPST Relay 24V. 528 ohm. coil contact rating 5 amp. Packed 2 to a carton.....2 for 49c

Coxail Solid Copper tubing, 30 foot.....$2.95

30-20 MFD Solar condenser 150 V tubular.....49c

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wave outlet or may be for the new station operating in the 41-m. band; report was verified on reverse side of card, in Portuguese; no operational details given.

Reports for the Paris s.w. outlets may be sent to The French Broadcasting Corporation, 501 Madison Avenue, New York; they will be forwarded to France and *if found correct*, will be verified. (Kneitel)

GTTM, *Mauretania*, verified for Kary, stating that 17.640 is used when working WOO while 17.600 is used when working GBC. Transmitter is a Marconi Type TFS 7C, crystal-controlled, 18 frequencies. Power in antenna is 1 kw. c.w.; 400 watts A2 and A3 (voice); antenna is inverted "L."

Transmitter is remotely controlled from the receiving room. Maximum time to change from one frequency to another is ten seconds. Receiver is Marconi Type RC 66, a special job for ship-to-shore telephony; transmitter is a dual job, ten frequencies being used for telephony and eight for telegraph work using A1 or A2.

Letter and card received from CE-1227, Radio Ejercito, Punta Arenas, Chile; the card depicts a penguin talking into a mike. (Kary)

* * *

Club Notes

Australia—The Australian DX Radio Club (South Australia) has effected this organization for the coming year: J. N. Paris, president; E. H. Suffolk, A. W. Wright, vice-presidents; A. W. Wright, secretary-treasurer; J. N. Paris, J. D. Riley, E. H. Suffolk, A. W. Wright, G. Goldsmith, D. R. Garratt, R. G. Gillett, executive council; R. G. Gillett, DX editor; E. H. Suffolk, club editor; J. D. Riley, publisher and circulation manager; Gordon L. Duffield, auditor; E. H. Tinning, Victorian representative and delegate to ADXRC Headquarters; J. N. Paris, E. H. Suffolk, R. G. Gillett, competition judges of BCB and SW sections; G. Goldsmith, D. R. Garratt, A. W. Wright, amateur section judges; A. N. Peterson, singletons officer; C. W. Batten, C. C. Wicks, K. McDonald, T. P. Hoey, J. S. Larkin, Arne Skoog, patrons. Clubrooms are at 17, Weymouth Street, Adelaide; secretary's QRA is 539 Marion Road, South Plympton, South Australia. Monthly official organ of this club is called DXSA.

United States—Walter E. Welch, 30 Elaine Avenue, South Peabody, Massachusetts, is now s.w. editor for the Universal Radio DX Club.

The former Grand National Short Wave Listeners Club (GNSWLC) has changed its name to The Grand National Radio Society and its monthly publication is now the GNRS News. The SWL section still retains the subtitle of GNSWLC. The Board of Directors made the name change at the recent annual convention of the organization in Cincinnati, Ohio, in order "to accept and take care of more 'hams.'" Ed Shirley will continue to edit the SWL section, while Walter Downes (W3UVD) will have charge of the "ham" section. George Jacobs is president of the club; QRA is P.O. Box 781, Fort Wayne, Indiana.

* * *

This Month's Schedules

(NOTE: By now some stations will have returned to Standard Time from Summer Time—making certain schedules herein *one hour later than listed*.—K.R.B.)

Algiers—Radio Alger, 11.837, appears to have changed schedule; heard in West Virginia signing off at 1800. (Arthur)

Andorra—Radio Andorra, 5.980, informed Seese of URDXC that schedules are 0630-0900, 1300-1900, with *English* at 1600-1630. (Welch)

Angola—CR7RE, "The Radio Clube

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de Malange," P.O. Box 83, Malange, Angola, is operating on an announced frequency of 7.140 at 0700-0745, 1430-1530 daily, except Sundays when schedule is 0200-0300, 0730-0830; although the 7.140 frequency is announced, our ISW monitor in South Africa, Mervyn Laubscher, reports CR7RE is actually heard on 7.164.

CR6RA, 9.470, Luanda, is heard in Australia with good signals to 1600 sign-off. (Gillett) Is heard with fair level in Eastern U.S., sometimes is QRM'd by a phone station (CUZ, Madeira Islands). (Kary) CR6RL, listed 15.895, is in parallel; this one, measured at 15.899 to 15.901, heard in West Virginia 1455-1600 sign-off; dual station measured at 9.473. (Arthur)

Argentina—Edward Hofert, Chicago, writes: "I have just received a postcard from Ushuaia signed by Vicente Rafael Guillen, chief, Radioelectrica, Ushuaia, Tierra del Fuego. It's a pretty picture card, showing a panorama view of Ushuaia. On the other side, Senor Guillen wrote, 'Received your welcome letter. Am sending you a picture of Ushuaia, which I hope will please you, and at the same time, I would like you to send me a picture of your place.'" Mr. Hofert had asked details on the Ushuaia s.w. outlet, but received only the above message. A letter, in Spanish, received by Sidney Pearce, England, from Jefe Radioelectrica, Ushuai, dated June 23, states that station L5PS is owned by La Administracion General de Correos y Telecomunicaciones, and says frequencies are 14.850, 10.330, 7.425, 6.430, 3.215, with 1 kw. power.

LRS, 9.32, LRS-1, 5.985, LRS-2, 11.97, Buenos Aires, are heard in parallel evenings, relaying LR-4; good signals in New York. LRX, 9.66, now runs to 2303, relaying LR-1. LRR, 11.88, Rosario, has returned to the air after several months absence. (Beck)

Australia—Swedes report Australia's VLA6, 15.200, with a good signal almost every day in the transmission beamed to Europe, 0115-0230. (Petersson)

VLW7, 9.52, Perth, now signs on at 0515 instead of former 0530. (Balbi) VLW3, 11.830, heard in East at 0400 with news, good level. (Ferguson)

Austria—Vienna's 9.665 and 11.785 channels are heard in New York with fair to good signals at 2245 sign-on to 0100 fade-out. (Beck)

The 6.005 transmitter is heard in Britain before 0000 with recordings; at 0000 has gong, time, and some days the call, "Studio Innsbruck," other days, says "Studio Dornbirn"; news (German) at 0015; program schedules are then given, followed by concert. (Pearce)

Azores — Ponta Delgada, 11.090, signs off with clock chimes at 1500, and signs on again at 4.845 at 1600, with chimes and "A Portuguesa." (Pearce)

Brazil—ZYC8, 9.610, *Radio Tamoio*, Rio de Janeiro, heard in Cuba at 1915 with comic program in Portuguese; good signal. (Ogazon)

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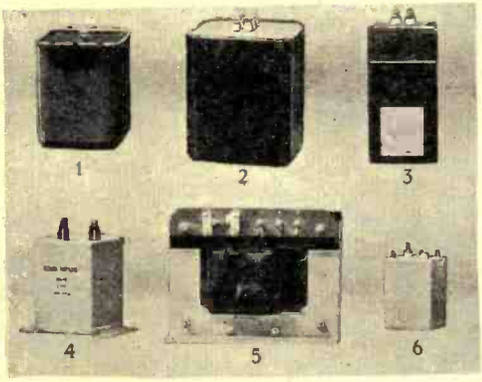

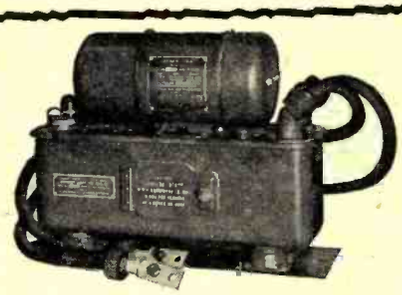

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British Honduras — ZIK-2, 10.598, Belize, still has news at 1330 daily, but signals are poor to inaudible. (Arthur)

Burma—Rangoon, 6.035, heard in New Zealand with *English* period at 0915-1015 sign-off; news at 1000. (Gray) In New York peaks at 0615 and usually fades out around 0700. (Beck)

Canada—CBC's International Service gives schedule as CKCX, 15.19, 0845-1100; CKNC, 17.82, 0845-1800; CKCS, 15.32, 1105-1800; CKNC, 17.82, 1820-1935; CKRA, 11.76, 1820-1935; CKNC, 17.82, in Spanish, 1935-2100, but on Mondays carries Portuguese during this period; to Australia and New Zealand on Sundays at 0245-0400, CHOL, 11.72. Important changes in schedules will be announced on November 2. (Law) Some Sundays I have noted the 9.63 outlet (probably CKLQ) in parallel with CHOL in the Australia-New Zealand beam, 0245-0400.

Celebes—Radio Makassar, 9.265, is very good signal in New York at 0500-0600 peak, fades out there 0715. (Beck) Has been quite good here in West Virginia; scheduled to have news *(English)* at 0800 on Mon., Wed., Fri.

Ceylon—Radio SEAC is again heard in Eastern U.S., signing on at 1930; in New York the 15.12 outlet is heard from beginning to fade-out at 2200, with bad QRM from HCJB at times; 15.23 is heard there in parallel with better signal. (Beck) Here in West Virginia I note good signal from the 15.12 outlet, despite QRM from HCJB, but the 15.23 spot is usually spoiled by CWQRM and/or Moscow; relays BBC news from London at 2000.

At the time this was compiled, *SEAC's* Sunday beam to Britain was being broadcast 1230-1430 on 15.12, 17.77, both good signals here in West Virginia; at closedown announces that 9.52, 6.075, 3.395 frequencies are directed to listeners in India and Ceylon. Listeners in the Eastern U.S. should try for this one on 15.12 on Sundays at 1230-1430; last winter signals were excellent on this frequency and transmission.

Chile—CE-1185, 11.850, Santiago, is extremely difficult to hear due to QRM from Paris and BBC; identification consists of three chimes, followed by announcement, "CB-138 y CE-1185, Radio el Mercurio en Santiago de Chile." (Kary)

CE-1227 states frequency as 9.200, schedule 1900-2230. (Kary)

China—On approximately 8.450, a Chinese station announced as XGIO, Shanghai, has been heard irregularly around 0500, weak to fair signal, only heard at intervals, bad CWQRM. XRRA, 10.260, Peiping, signs on irregularly around 0700; relays XGOA often, good signal on West Coast. (Balbi) XRRA is usually heard fair to good here in the East to around 0800.

The Chinese station on about 11.685, believed to be XGAF (or XGAS), location unknown, is heard on West Coast from 0500. (Balbi) At times has been heard fair in the East. Reported to have *English* news at 0800.

XGAF, 7.100, location unknown, carries the same news as XMAG, 4.275, Nanking, at 0800, also at times on 11.685 (this one may be slightly lower on occasion); they have trouble picking up XMAG some days, in which event carry same music as XMAG when latter is unable to bring in news from the United States; other days they "fish around and bring in the XGOY news around this time." XGOE, 9.820 (approximately), sometimes carries the XMAG news at 0800. (Dilg)

XORA, 11.725, Shanghai, has "world-wide" news at 0530. (Balbi)

XGOY, 15.165V, appears to run from 0745 to 1040 sign-off, weak to fair. (Balbi) Has been heard in East with news at 1000. (Kary) Also has news scheduled for 0800 (relay from XGOA, Nanking), 0900, and sometimes at 0930.

XGOA, 15.35, is heard often with fair signals here in the East around 0800 when has news; however, the announcer says, "From the Nanking studios, XGOY, the 'Voice of China,' presents tonight's news," both at opening and close; at close of the news, usually XGOA is announced, also.

Unidentified Chinese stations are heard early mornings on frequencies of approximately 9.450 and 9.452; latter may be XGOA, Nanking. Dilg, California, reports the 9.450 signs off at 0900 with the Chinese National Anthem. XGOA is known to have used 9.450 some time ago but this frequency is no longer listed in schedules received from XGOA.

XTPA, 11.65, Canton, is being heard again quite well in the East early mornings. (Arthur) I note considerable CWQRM on this frequency; does *not* carry XGOA news at 0800.

XMPA, 12.200, Nanking, has been heard recently in Pennsylvania with Western music at 0445-0515. (Kary)

XUPB, 8.338, Amoy, reported heard at 0515. (GNRS-GNSWLC)

Colombia—HJCA, 4.857, Bogota, has strong signals nightly; usually identifies on quarter or half hour with three chimes and announcement, "Emisora Radio Cristal, HJCU y HJCA, transmitando de Bogata, Colombia"; verifies. HJGF, 4.847, Bucaramanga, fair nightly; chimes and identifies as "Esta es Radio Bucaramanga en Bucaramanga, Colombia"; relays medium-wave HJGE. HJEX, 4.865, Radio Pacifico, Gali, has world news in Spanish at 2045, and at 2100 has Colombian and local (Cali) news to 2115; identification is usually, "Esta es Radio Pacifico, Departmento del Valle de Cali, Colombia." HJAP, 4.923, Cartagena, identifies with three chimes and announcement, "Esta es Radio Colonial en Cartagena, Republica Colombia"; signs off at 2230 with Colombian National Anthem. HJCF, 6.240, Bogota, "La Voz de Bogota," has an *English* program Sunday nights, entitled "Songs to Remember," consisting of popular U. S. swing music; ends at 2030 and is followed by "Hits From

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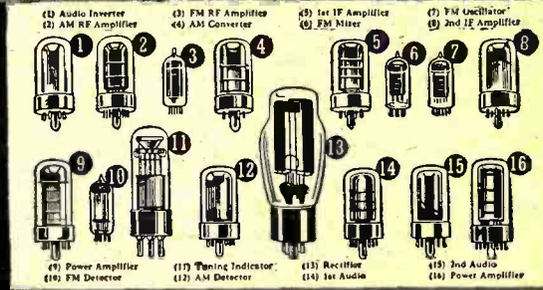

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Hollywood" to 2100; relays medium-wave HJCC; has CWQRM. (Kary)

Cuba—COHI, 6.450, "RHC-Cadona Azul" (Blue Network), is scheduled 0630-0100. (Beck) COBC, 9.369, Havana, for some time has been above Madrid's 9.368 and suffers QRM accordingly; announces as "Radio Prog-

(*Continued on page* 179)

High Quality

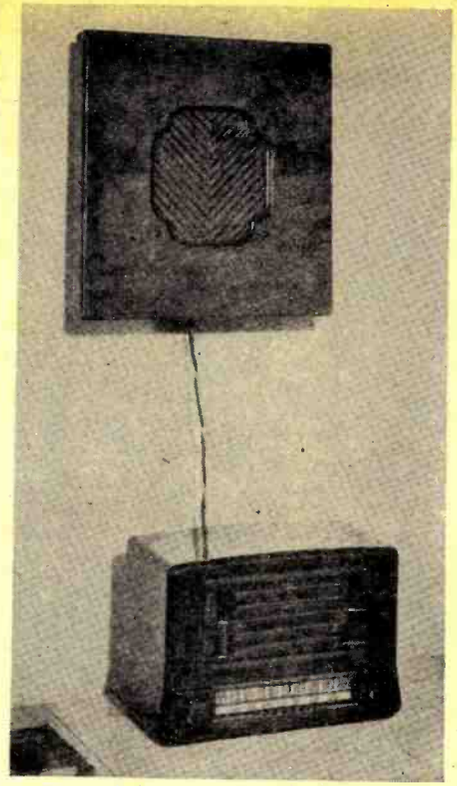
(*Continued from page* 47)

The fidelity characteristics of the set can be varied by adjusting the tone control potentiometer, R_8. Fig. 2 shows several typical fidelity curves for different settings of R_8. The tone control consists of a high frequency degeneration circuit. R_8 determines the frequency of the degenerated signal and consequently the over-all fidelity characteristics.

The volume control was revised to allow for low level compensation. As the volume of the signal is turned down, there is a tendency for tones of both high and low frequencies to fade more rapidly than tones of other frequencies. To overcome this, a condenser C_5 is introduced across the volume control to peak the highs and the R_4C_6 circuit is used to peak the lows when the volume control is turned down. This assures good fidelity reception for all settings of the volume control.

To reduce both hum and distortion, an inverse feedback circuit (R_6 and R_4) is used. This circuit, in combination with the improved filter used, made possible by the high current carrying capacity of the selenium rectifier, virtually eliminated hum. The actual measured hum level across the primary of the output transformer was only .01 volt, which is considered inaudible.

It should be noted that two negative coefficient resistors are inserted in the circuit. These resistors have a resistance of 1400 ohms when cold and only 200 ohms when hot. One is used in the filament string to prevent large initial surges of current, thereby increasing the life of both the pilot light and the remaining tubes in the receiver.

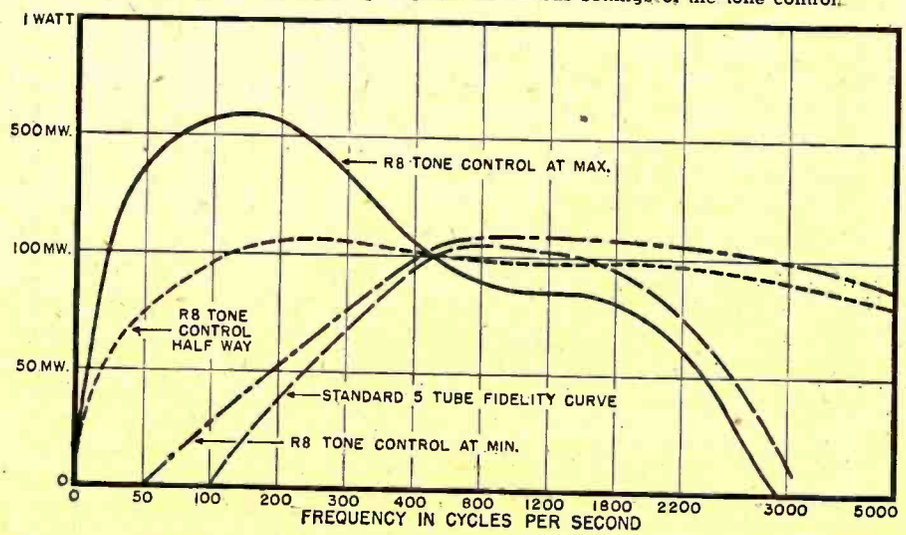


The external speaker can be neatly mounted on a wall as shown in the photograph.

It is well-known to those in the radio industry that the major source of tube and pilot light burnouts is the large initial current flowing through the filament string when the set is turned on. This initial current is high because the filaments, when cold, have a very low resistance. However, with the negative coefficient resistance in the circuit, the resistance of the entire string becomes virtually independent of temperature and the current maintains a steady value at all times.

The other negative coefficient resistor used in the set functions as a "B+" dropping and filter resistor. In

Fig. 2. Curves show frequency response at various settings of the tone control.



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C.D. Dykanol A cap No. TQ20020; 2 MFD 2000v DC	1.95
C.D. oil cap. TJ10020; 2 MFD 1000v DC	1.00
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Supreme Model 537 Volt-Ohmmeter; 3" full vision type scale, with basic 100 Microampere D'Arsonval type movement. Described fully in Oct. issue	9.95

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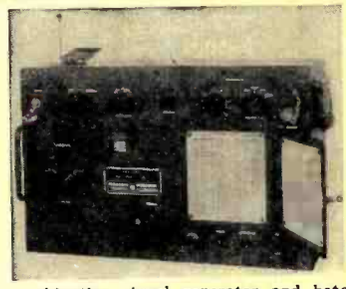

A combination signal generator and heterodyne wave-meter. It consists of a 5 megacycle crystal-controlled oscillator used as frequency standard calibrator, a variable two-range oscillator, an untuned detector with two stages of audio amplification, a sliding-rod stub antenna, a rough pi-type RF attenuator, a frequency calibration chart and a power supply. Coverage of the test oscillator on the low range setting is from 8 to 15 megacycles; the high frequency range coil covers from 45 to 76 megacycles and since the third harmonic is utilized, this gives a coverage of from 135 to 230 megacycles.

The signal generator cabinet measures 19½" wide, 12" high, 7½" deep; weight 50 lbs. Tube complement: 6J5 crystal-controlled oscillator; 9006 detector; two 6SJ7 audio amplifier; 9002 variable two-range test oscillator; 5Y3G full wave rectifier for power supply. An additional extra power supply and tubes, with many other small items including cables packed in wooden chest is included in this price.

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this circuit it limits the surge current passed through the electrolytic condensers when the set is first turned on. This increases the life of the condensers and allows the use of lower voltage rating condensers for C_{13} and C_{18}.

In order to take full advantage of the improved quality of this receiver, a better type speaker should be used. This speaker can be particularly effective if it is placed in series with the speaker already in the set, and placed several feet away from it. This gives the tone a third-dimensional quality and assures additional listening pleasure. Due to the increase in audio output, it is advisable to load the 4" speaker in the radio. This is accomplished by placing a 3 ohm resistor (R_{15}) across the voice coil of the small speaker.

-30-

N.Y. FEDERATION OF TECHNICIANS

THE RADIO Technicians Guild of Rochester has issued an invitation to all radio service organizations and individual servicemen in New York State to attend a two-day meet to be held Saturday and Sunday, November 15th and 16th, in Rochester, New York.

This meeting will be an organizational session to set up the State of New York Federation of Radio Technicians. This association is for radiomen, run by radiomen, for the benefit of radiomen.

The opening meeting of the conclave will begin promptly at 11 a.m. Saturday at the Seneca Hotel, with the annual dinner of the R.T.C. of Rochester being held at 6:30 p.m. All persons attending the meet are invited to the banquet. Sunday will be devoted to an all-day technical "info-meet" which will feature outstanding speakers who will present papers on FM, television, tubes, business management, etc. An inspection trip through Rochester's new "Radio City" is also scheduled.

For further information and reservations for the meet, correspondence should be addressed to The Radio Technicians Guild, 703 Temple Building, Rochester 4, New York. Sessions will be held at the Seneca Hotel, Clinton Avenue, South, Rochester, with registration at 9 a.m. Saturday morning.

-30-

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BC-348 Communications Receiver	$47.75
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Trans. and 1 funing unit	17.50
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Antenna Tuning unit (BC306A)	3.95
BC-221 Freq. Meter	
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PE-103 Dynamotor (New)	8.95
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Telrad Freq. Standard (New)	19.50
Turbo Amplifiers (1 dozen)	10.00
Radar Trans. T-39/APQ	11.50
BL Selenium Rectifier (New) @	1.25
HRU-28 70 Amp. 28 V. Gen. (Gas Driven)	49.75
Collins AN/ART-13 Trans.	74.50
Navy ARB or CRV-46151 Rec.	19.75
SCR-625 Mine Detector (New)	54.95
AN/PRS-1 Mine Detector (New)	9.50
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Motor only 24-28 V.	8.95
Motor with mounting plates, etc.	19.50
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ARN-1 Rec.	4.95
Radio Set SCR-510 (New)	49.75
ARC-4 Trans. & Rec.	22.50
T-17 Microphone (New)	1.35
T-17 Microphone (Used)	.75
Willard Lead Acid Cells	
6 V. (New) (Charged)	3.00
In metal carrying case	4.00
HS-33 headphones (New) 600 Ohms	1.60
HS-33 headphones (Used) 600 Ohms	$ .75
Telegraph Keys (New)	.45
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2 cyl. 170 amp. 28.5 V. gasoline generator	139.50
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Tents: 16"x50", 12' apex, 4" sidewalls (New)	116.50
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Practical Radio Course

(Continued from page 74)

I.F. Response Requirements in Simple AM Communications Type Receiver

In radio communication involving the transmission and reproduction of speech intelligence, modulation frequencies from about 250 to 3000 cycles only are necessary for good intelligibility. Consequently the maximum total sideband width that needs to be passed by the i.f. amplifier in a simple AM communications type receiver designed for speech communication only is about 2 x 3 = 6 kc. Such a passband is also satisfactory for receiving c.w. signals, when a beat frequency oscillator is employed. A rather sharp, steep sided i.f. response characteristic is usually used so that there will be adequate high discrimination against unwanted adjacent channel signals, and less noise.

In addition to this selectivity characteristic, most AM communications receivers also make available a more selective characteristic by incorporating suitable arrangements for making the total i.f. passband only about 3 or 3.5 kc. wide. Such a selectivity characteristic is very desirable for reception in crowded channels where noise and adjacent channel station interference might combine to make satisfactory reception impossible were it not for such sharp cut-off. With such a characteristic, speech is less intelligible since now all sideband frequencies above approximately 1500 cycles will be sharply attenuated. Naturally, much "quality" is lost, but "quality" under such conditions is secondary since it is a question of hearing the signal in distorted form or not hearing it at all.

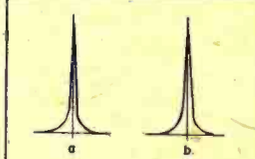
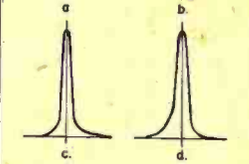
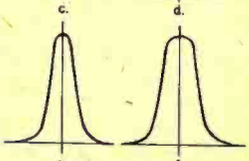
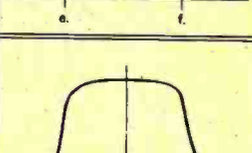
By making the i.f. amplifier regenerative, passband widths as narrow as 1 kc. are easily obtainable for use under extremely bad interference and noise conditions.

For c.w. reception, bandwidths even narrower than this, down to 100 cycles or less, can be achieved through the use of a quartz crystal filter in the i.f. amplifier. These are total bandwidth figures at 10 per-cent maximum response, or to express it differently, total bandwidth at ten times resonance input. If several degrees of selectivity are desired when the crystal filter is employed, they are obtainable through the use of variable-selectivity crystal filter circuits employing trimmer condensers that can be switched in or out to change the degree of selectivity. Three such degrees are often provided to produce "Broad," "Medium," or "Sharp" crystal selectivity.

FM Communications Receivers

In FM communications systems, such as those employed for police radio, emergency radio, some phases of amateur radio, etc., it is necessary to transmit *speech* intelligence only. In such communication the highest audio modulating frequency that must be handled for intelligible communication is of the order of only about 3000 cycles. For such transmission the maximum deviation ratio need be only about 15 kc., or a total swing of 30 kc. Consequently, the i.f. amplifier selectivity characteristic for such receivers needs to be only wide enough to pass a total band of frequencies 30 kc. wide

Fig. 6. Summary of i.f. amplifier selectivity characteristics available in a modern communications receiver of the type illustrated in Fig. 5.

TUNING BAND	TYPE OF SIGNAL AND FREQUENCY RANGE	I. F. EMPLOYED	I. F. SELECTIVITIES AVAILABLE	I. F. SELECTIVITY CHARACTERISTIC
BAND 1	AM 540–1620 KC	455 KC	a. SHARP CRYSTAL b. MEDIUM CRYSTAL	
BAND 2	AM 1620 KC. – 5 MC.	455 KC	c. BROAD CRYSTAL	
BAND 3	AM 5–15 MC	455 KC.	d. SHARP e. MEDIUM	
BAND 4	AM 15–30 MC.	455 KC.	f. BROAD (FOR AM BROADCAST RECEPTION)	
BAND 5	FM–AM 27–55 MC.	10 7 MC.	BROAD-BAND	
BAND 6	FM–AM 55–110 MC	10 7 MC.		

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FEATURES:

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- ★ SIMPLE TO OPERATE—ONLY ONE 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.
- ★ BUILT-IN HIGH GAIN AMPLIFIER—ALNICO V SPEAKER.
- ★ COMPLETELY PORTABLE—WEIGHS 8 POUNDS—MEASURES 5½" x 6½" x 9".

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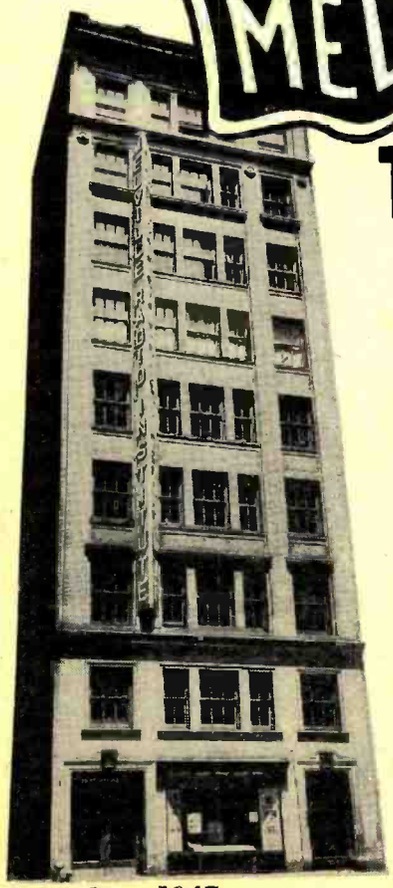

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I.F. Response Requirements in Modern Combination AM-FM Communications Receivers

As facilities are added for reception of more and more types of signals by a communications type receiver so that it will be capable of receiving not only both code and voice signals in the ordinary amateur bands but also in the new v.h.f. and u.h.f. bands assigned for amateur operation—also the signals from both AM and FM broadcast stations — the operating characteristics required in the i.f. amplifier become increasingly varied. It is necessary to employ one value of intermediate frequency when signals in the lower frequency bands are being received and a different, higher i.f. when signals in the v.h.f bands are being received. Furthermore, several different degrees of selectivity must be provided for reception of the various types of signals, and for widely differing reception conditions.

To illustrate how complex the requirements can become, and to what lengths designers of such receivers have gone in fulfilling them, it will prove instructive at this point to briefly analyze a rather advanced type of postwar communications receiver such as the *Hallicrafters* SX-42 illustrated in Fig. 5, for it embodies, in a single receiver, all the i.f. amplifier characteristics discussed thus far in this article. Let us examine the signal-frequency ranges provided for, the types of signals receivable in each range, the intermediate frequencies employed, and the degrees of i.f. selectivity provided for each range. All of this information has been summarized in Fig. 6, for convenient reference. The various passband response characteristics available for each receiver function are illustrated at the right.

It will be observed that a total signal frequency range of 540 kc. to 110 mc. is provided, in six bands, for AM reception. This includes the standard range (540 to 1605 kc.) in Band 1, and all the AM amateur channels in the other five bands. For the AM signal frequency bands from 540 kc. to 30 mc., an i.f. of 455 kc. is employed. For the FM-AM bands from 27 to 110 mc., a higher i.f., 10.7 mc., is necessary in order to obtain satisfactory image ratio and rejection of image frequency signals on these higher frequencies. Thus, two i.f. channels are employed, the one of lower frequency being 455 kc. and the upper one 10.7 mc.

The 455 kc. i.f. channel contains provisions for making three degrees of selectivity (broad, medium, sharp) available. When conditions require even greater selectivity than the "sharp" band will provide, a quartz crystal filter that will give three additional degrees of sharper selectivity (broad crystal, medium crystal, sharp crystal) can be switched into the circuit. Therefore, a total of six degrees of selectivity are provided for AM reception, to cope with any conditions encountered.

Broad-band high fidelity FM reception is provided on Bands 5 and 6 (which include the FM broadcast band 88 to 108 mc.) by providing a suitable wide-band response characteristic in the 10.7 mc. i.f. amplifier.

In the amateur band from 28 to 29.7 mc., FM transmission is authorized in the portion from 29.0 to 29.7 mc. In order to provide for both AM and FM reception in this band, an overlap has been provided between tuning Bands 4 and 5. The upper limit of Band 4 is 30 mc., while Band 5 begins at 27 mc. to allow either type of reception at will. By means of this expedient, a choice of either the selectivity of the 455 kc. i.f. amplifier, or the broad-band characteristics of the 10.7 mc. i.f. amplifier is available. The 10.7 mc. i.f. also offers the advantage of inherently better image rejection.

A beat frequency oscillator contained in the receiver may be switched into the circuit to make possible the reception of c.w. signals over the entire frequency range.

The design of this receiver illustrates perfectly the practical application of all of the fundamentals concerning intermediate frequency choice, selectivity and response curve requirements, etc., that have been explained in this and the previous article of this series.

(To be continued)

50-watt Modulator

(Continued from page 43)

homemade spark gap across the output terminals is adjusted to break down in case the load is removed from the modulator while the latter is delivering power. With no load presented to the modulator, excessively high voltages may be developed in the output circuit and possibly break down the insulation within the modulation transformer.

The coil of the plate relay is connected in parallel with the coil of the r.f. unit plate contactor and operates simultaneously when transmitting.

All other components are mounted under the chassis where convenient and in accordance with good engineering practices. It was originally planned to use fully encased interstage transformers and mount them on top of the chassis. However, the only transformers available were the open type, so in the interest of appearance, these units were mounted below the chassis.

Some of the resistors and condensers are mounted on a bakelite terminal board for added convenience and neatness. Coupling condensers and resistors in plate and grid circuits, however, should be connected directly to tube sockets to obtain the shortest possible leads. Low level grid and plate leads of any appreciable length should be shielded, and special attention should be paid to shielding the first grid lead and resistor.

In a previous amplifier using this circuit, the input control was located

in the grid circuit of the 6C5. However, it was found that due to the fact that the 6SK7's were then operating at full gain at all times, they were sensitive to hum picked up by T_1. This was cured by moving the input control up to the grid circuit of the 6SK7 stage. This control is a dual potentiometer. In this position, higher audio signals are available from the secondary of T_1 and the 6SK7's may be operated at reduced gain. If desired, a magnetically shielded transformer may be used at T_1, but it was deemed an unnecessary expense in the case under consideration.

It was found that by grounding the metal shields on the tubes, no trouble was experienced with r.f. pickup. In the previous model, the shields were connected to their respective tube cathodes. This resulted in a slight sensitivity to r.f. in the first stage. Grounding the shields cured the trouble. Of course it is necessary, or at least desirable, to connect the entire unit to "earth" if best performance is to be expected. The unit described was found to be entirely stable and free from r.f. feedback. A crystal microphone is being used and both the modulator and aforementioned r.f. unit are now mounted in a standard 2 foot enclosed cabinet, with the r.f. unit at the top. The cabinet is grounded to a water pipe.

After construction was completed, the modulator unit was checked with an ohmmeter to determine if the wiring was correct. The two taps on the voltage divider (R_{20}) were set with the aid of a voltmeter to 270 volts (for 6L6 screens and all other tube plates), and 100 volts (for 6SK7 screens). The voltage at the high end of the bleeder under operating conditions was about 360 volts which is the rated voltage for 6L6 plates. The variable resistor in the 6L6 cathode circuit was set at 125 ohms, and gave a plate current of 170 ma. and cathode voltage of about 22.

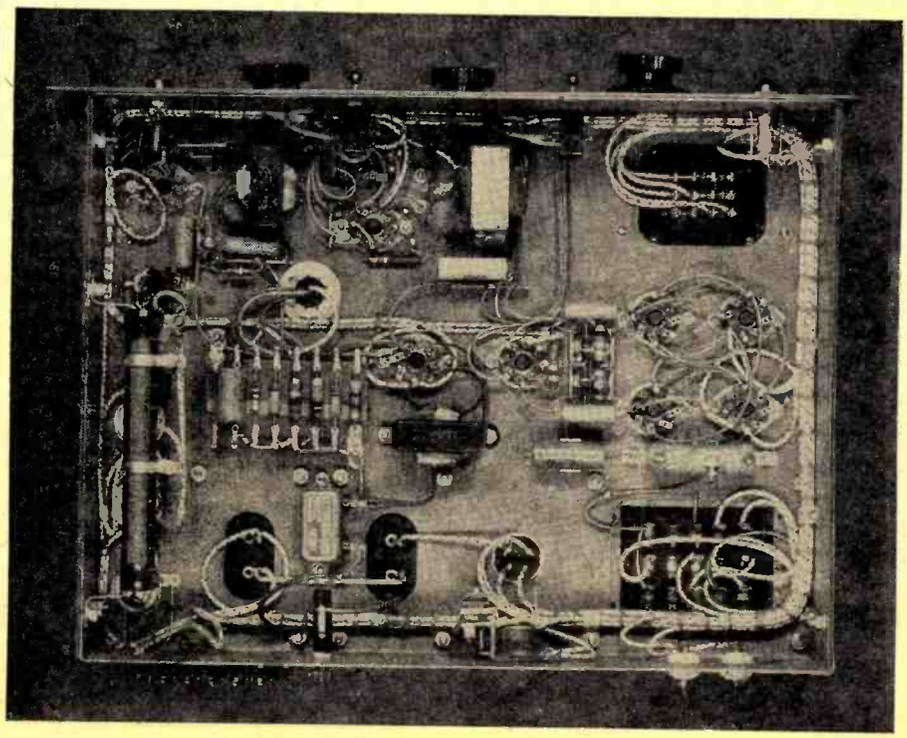
At specified plate and screen voltage, the total 6SK7 plate current (with no compression) is approximately 16 ma.

After making all final voltage adjustments, the modulator output terminals were connected to the modulation terminals on the r.f. unit for an actual test. Of course the taps on the modulation transformer were adjusted to match the r.f. load to the 6L6 plates. In this particular case the r.f. load was 7500 ohms (750 volts at 100 ma.). Plate-to-plate impedance of the primary was set at about 4500 ohms. The r.f. unit was first adjusted to deliver power at rated input of 75 watts, with the modulator off. (If you value your ham friendships you will make all these adjustments while loading the final with a dummy antenna; a couple of 100 watt bulbs in parallel will load up the rig to normal plate current when connected across the BVL link.)

Incidentally, it might be well to mention that a scope or some other accurate modulation indicator is a necessity during these final adjustments.

With the r.f. unit operating normally, the modulator was then turned on, with both input and output controls in "off" position. The microphone was then actuated with a steady 1000 cycle tone from the receiver, and the input control was turned up until a limiting action had begun to take place, as indicated by a downward deflection of two or three milliamperes in the limiter plate current. Then, without changing these settings, and while

Under chassis view of 50-watt modulator unit shows placement of component parts.



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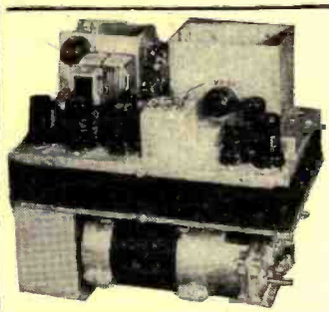

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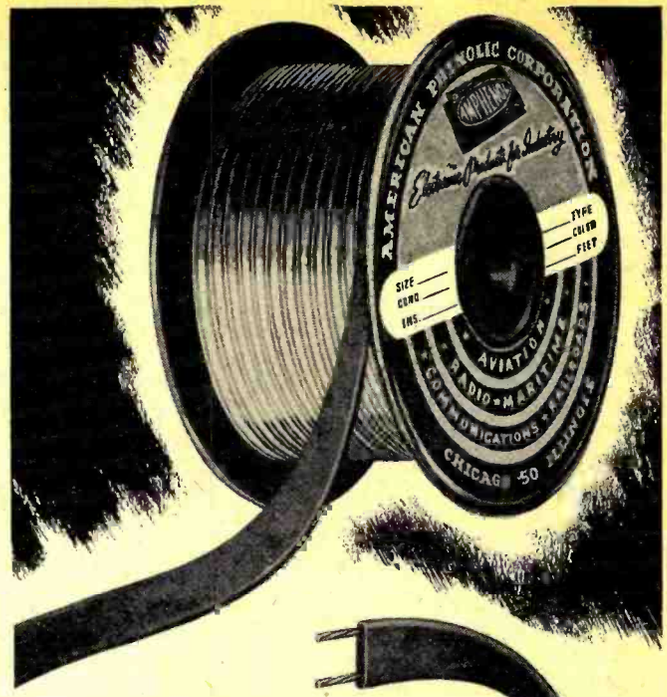

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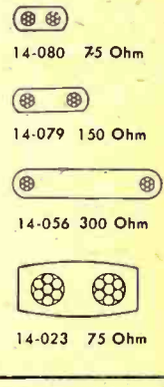

• Amphenol, originator and long-time producer of extruded polyethylene insulated Twin-Lead for transmitting and receiving, now announces an important improvement.

At no increase in price, the dielectric insulation has been changed to solid brown Amphenol Ethylon-A containing an anti-oxidant. This new insulation is equal to the old in low loss properties. It is far superior in resistance to the effects of sunlight and moisture.

Preferred by amateurs for antennas and transmission lines, Twin-Lead transmits signals with minimum loss, is durable and inexpensive. The Ethylon-A dielectric is full thickness edge to edge, minimizing impedance changes caused by moisture collecting on the surface. Amphenol Twin-Lead is unaffected by acids, alkalies and oils. Flexibility remains unimpaired at temperature down to —70°F.

The new *brown* Amphenol Twin-Lead is available in 75 ohm, 150 ohm and 300 ohm impedances for receiving use, and in 75 ohm type for transmitting. Write today for full data on electrical characteristics and prices.

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watching a scope pattern, previously adjusted to show the r.f. envelope or trapezoid pattern, the output control (R_{12}, R_{13}) was gradually raised until the scope indicated about 90 per-cent modulation. Under normal operating conditions and with reasonable amounts of limiting (indicated by downward deflections of 5 to 10 milliamperes in limiter plate current), the transmitter will be modulated in the 75 to 100 per-cent region but with automatic prevention of overmodulation.

Although designed specifically to be a companion unit to the 75 watt transmitter described in the July, 1946 issue of RADIO NEWS, this unit can be used to modulate any r.f. input up to 100 watts, 100 per-cent. It can also be used as a driver for any "class B" modulator up to 500 watts output. When properly adjusted, the peak limiting feature will aid the low power transmitter in getting through QRM. If checked at intervals with a scope for proper adjustment, and with the output control setting left unchanged, the limiter will prevent overmodulation irrespective of input level.

By combining the 75 watt r.f. unit and the modulator in an enclosed 2 foot cabinet, you can have a neat little medium power phone-c.w. rig which will make a good showing among the other stations using higher power.

The modulator unit can be used as a driver without any change in the output transformer, if the *UTC* "Varimatch" transformer specified is used, as connections are available to operate into a 500 ohm line.

If the parts situation ever becomes normal, it is possible that a high-power r.f. amplifier and modulator may be added to the present setup. —30—

Radio transmitting tubes are given "proving ground" tests in these metal cubicles at the Westinghouse Electric Corporation's plant in Bloomfield, N. J. Here a 223 pound, 60,000 watt, a.f. power amplifier and modulator tube, Class B, is being moved into test position with the aid of special handling equipment. As soon as circuit connections are made, the cubicle door is closed and the power applied. The tube's performance is indicated on the meters at left. Air is blown through the radiator fins to cool the tube, as it generates enough heat to keep a small house warm in winter.

A Simple Antenna System

(*Continued from page 59*)

surprising if not downright amazing. In sixteen QSO's ranging from New York to short-skip and ground wave stuff, the average report was Q5R7, certainly not too bad! Definitely sure, even with such reports, that the gismo wasn't right, we did some snooping, but could find no listing on the velocity of propagation factor of the specific material used in the "twin-lead," until finally, *Amphenol* released this information.

The formula normally used for such antennas has been F_{mc} divided into 492 x .95. The difference in length of the "twin-lead" over an air-dielectric folded wire antenna, according to *Amphenol,* was 3% which, when used as a multiplying factor, showed a very disquieting thing had happened to the "resonant" antenna in the rafters. It was just an even 10 inches too long! The mistake was rectified at once and by using their formula of F_{mc} divided into 492 x .92, the folded dipole was now resonant, but broadly, at the proper frequency. Three turns came off the link to the final while the load current remained the correct value. A rough check for standing waves showed them to be, compared to the previous condition, nonexistent.

The rig was put on the air, and reports from previous stations worked, with conditions approximately the same, raised the reports to R8/9. Since the antenna was apparently correctly cut and working so well, it was decided to stick it up in the air and give it half a chance. This was done by taking a single 2 x 2, 20 feet long and attaching light, 10 foot bamboo poles as spreaders at one end. The poles were affixed to the 2 x 2 so as to form a Y-shaped structure, with a spacing of approximately 16 feet maintained between the tips of the bamboo poles, as shown in Fig. 1. This done, the antenna was installed, with suitable insulators, between the spread tips of the bamboo poles, and the feed-line allowed to hang down alongside the 2 x 2. The line was supported with a small stand-off insulator at the junction of the 2 x 2 and the fish poles so as to eliminate strain on the antenna connections.

The assembly, weighing some five pounds, was erected on the top of the house in less than thirty minutes. The antenna height was some 35 feet, the total weight about 5 pounds, the cash outlay was less than $4.00 and the time spent was less than two hours from start to finish! This is just about an all-time low, considering the results the antenna has given.

Reception has been extremely good, with the antenna oriented N x S. European, South African, South American, Canadian, Newfoundland, Alaskan, Aleutian, Australian, New Zealand, etc. stations have been heard with very good signal level, with the

continental stuff pounding in, regular, short skip, and ground wave. The transmitting reports, with a measly 60-watts fighting the terrific 10 meter QRM has been consistently Q5R9/9 plus.

An hour QSO with XE1GE, Mexico City, was solid copy, both ways, and Canadian reports averaged Q5R8/9—certainly not to be sneezed at with such a simple, cheap antenna system.

For the city dweller, and especially the cliff-dwelling "apartmentites," this folded dipole is the answer to a long-felt need. For ten, or even twenty, meters, the antenna is very simple to support, and very inconspicuous. From the results obtained at W6RTP it will apparently outperform the usual doublet, etc. about two-to-one. It is highly recommended as an emergency stand-by antenna, installed in the rafters of the house, and it can be depended upon to give a highly satisfactory account of itself if cut to length and constructed according to the instructions given in this article.

A table for antenna lengths every 100 kc. in the ten meter band is given separately for the convenience of those interested in this band. Use of the formula given will enable computation for any frequency desired, in any band from 80 to 10 or even higher.

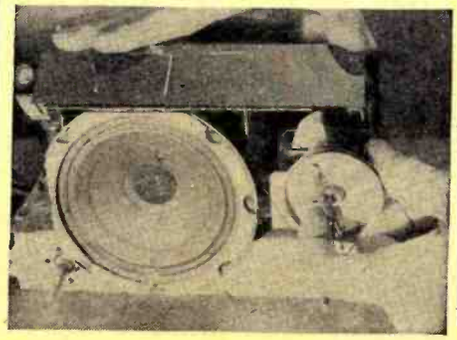
It will be found that when the antenna is cut as recommended, the system will show negligible load changing effects even in the wettest weather. This condition can be further improved by coating the antenna and feed line with a generous application of hard car-polish type wax such as *"Mac's-It," "Simoniz,"* etc. or even floor wax. Consistent R9 reports from the East Coast were received during a week of rain and extremely heavy fog at the QTH, with the final loading changing less than 20 mils from the normal 180.

All in all, it is believed that any ham will find the antenna about tops in performance for such a simple, inexpensive, and easily built affair. —30—

TIGHTENING DIAL CABLES

OFTEN a set will come into the service shop with a dial cable that is slightly loose—just loose enough to make it slip once in a while, but perhaps not loose enough or worn enough to warrant a replacement.

By merely moving the tension spring mounted on the condenser drive drum to the other side of the shaft the dial cord will, in many cases, be tightened sufficiently. . . . . M. A.



Gang-Tuned Transmitter

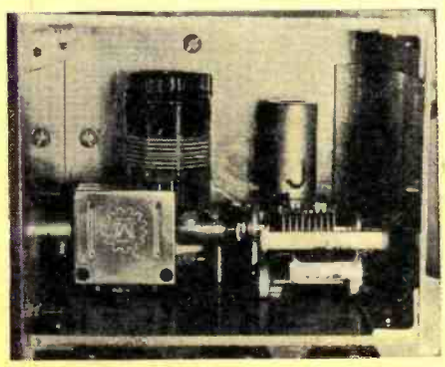
(Continued from page 53)

other possible cause of parasitics is resonance between grid and plate chokes in the 807. A grid choke should be employed here because of the desirability of a low input capacity and therefore, two pi's of the plate choke have been removed so that resonance does not occur between plate and the grid choke circuits. With no load or excitation the 807 plate current is perfectly stable at any setting of the plate condenser. No filter choke was included because of the compact size. On phone a slight hum is present but not objectionable. There is no hum-frequency modulation of the note on c.w. If desired, a choke could, of course, be incorporated.

The modulator stage is conventional but the screen and bias voltages must be carefully proportioned since all stages are operated from a common plate supply and the fluctuating plate current of a "class B" stage would be intolerable. Therefore, to prevent poor voltage regulation and consequent carrier shift, the 6L6's are operated "class A." This necessitates a bias of about minus 17 volts. Then, to prevent excessive plate dissipation, the screen voltage must be approximately 170. The phone-c.w. toggle switch shorts the modulation transformer secondary and removes the filament voltage from the modulator stage and also removes "B plus" from the modulator screen grid circuit to prevent charging the screen bypass to the full plate voltage which would short it. The modulation is applied to the 807 plate and screen in the same proportion as the d.c. voltage. A special two-pole toggle switch (S_5) with a center "off" position is used in the 807 cathode circuit. For c.w. the switch places cathode bias on the 807 for key-up limiting of the plate current. The "off" position is used to zero beat the v.f.o. in the receiver, and the third position shorts the bias so that the grid current is increased to the proper value for phone operation.

A carbon mike has been employed

Inside view of oscillator compartment shows the Millen right-angle drive unit with the oscillator coil beneath it. The tubular zero-coefficient condensers are mounted on the variable. Oscillator box is constructed of ⅛" aluminum and ½" aluminum stock.



V.F.O. Coil (L_1)—1745-2005 kc.
1½" diam., 23 t. #20 en., 1⅛" long. Tickler, 6 t. interwound at gnd. end of grid coil

80 Meter Tuned Circuit
L_2—40 t., #26 en., 1" diam., 1½" long
C_{13}—Approx. 20 μμfd. One sec. of Cardwell ER-35-AD with 3 stator plates

40 Meter Tuned Circuit
L_3—20 t., #18 en., 1" diam., 1 3/16" long
C_{20}—Approx. 15 μμfd. One sec. of Cardwell ER-35-AD with 2 stator plates

20 Meter Tuned Circuit
L_4—9 t., #18 en., ⅞" diam., ½" long
C_{27}—Approx. 27 μμfd. One sec. of Cardwell ER-35-AD with 4 stator plates

10 Meter Tuned Circuit
L_5—6 t., #16 en., ⅞" diam., ¾" long
C_{34}—Approx. 15 μμfd. Same as C_{27}

807 Plate Coils (L_6)
* 80 m.—24 t., #18 en.
* 40 m.—14 t., #16
* 20 m.—10 t., #16 en.
* 10 m.—5½ t., #14 en.
* All coils 1¼" diam., 1⅛" long

Coil Table.

because of its low cost, high gain, and good intelligibility. Since the mike voltage is obtained from the modulator cathode circuit, it is possible that audio feedback will occur unless the mike transformer primary is properly phased. The feedback should be degenerative and this condition can easily be obtained by reversing the mike transformer primary if feedback occurs.

The calibration chart on the front panel is mounted behind a small piece of lucite. The curve was plotted on graph paper and then photostated and reduced to the desired size. By using a shade of red graph paper a well-defined chart will result as the red lines seem more opaque to the ultra-violet light used in photostating than the other colors. The chart shown is not the correct one for this unit but was borrowed from another transmitter to illustrate the result obtained by the photostating process.

The cost of the transmitter was approximately eighty dollars which has been repaid in operating pleasure with 'round-the-world contacts. —30—

OSCILLATION

IN CASES where persistent oscillation occurs and cannot be traced to any particular circuit deficiency, the chances are that the shielding is not as effective as it might appear.

In these cases it is worth the time and effort to slip the shields off and compress the rivets holding the spade lugs and spring lugs which, in turn, hold the can to the chassis. . . M.A.

Within the Industry
(Continued from page 32)

Vice-President and a Director of the new organization. He will assume complete charge of all *Garod* sales throughout the world.

Max W. Weintraub, former President of the firm, has retired from the organization and will become the company's Metropolitan New York distributor through *Belle Electronics Corporation.*

Sale of the company was for cash—the amount of the transaction "greatly exceeding a million dollars," according to officials of the company.

* * *

JACK F. McKINNEY of Dallas, Texas, has been named representative for the *Stancor* line in the states of Texas and Oklahoma.

Before joining *Standard Transformer Company,* Mr. McKinney spent thirteen years in the sales and merchandising fields. During this period he served as District Manager of a large wholesaling company and later as organizer and head of his own firm.

He is a native of Oklahoma and a graduate of the State University.

* * *

CHARLES GOLENPAUL of New Bedford, Massachusetts, was elected president of the Radio Parts and Electronic Equipment Shows, Inc., sponsor of the national Radio Parts Show.

Mr. Golenpaul succeeds Jack Berman of Chicago as president and represents the Sales Managers Club, Eastern Group, on the Show Committee. Jerome J. Kahn, Chicago, representing the Parts division of RMA, was chosen vice-president. R. J. Sherwood, Chicago, representing the Electronic Parts and Equipment Manufacturers, was named secretary, while W. O. Schoning of Chicago who represents the National Electronic Distributors Association was elected treasurer.

The 1948 Board of Directors for the show includes: J. J. Kahn and R. C. Sprague, representing the RMA; Charles Golenpaul and W. W. Jablon, representing the Sales Managers Club, Eastern Group; R. J. Sherwood and John L. Robinson, representing the Electronic Parts and Equipment Manufacturers; and W. O. Schoning and Aaron Lippman, representing the National Electronic Distributors Association.

Committees for the show, as announced by Mr. Golenpaul, include: Budget Committee, W. O. Schoning, chairman, J. J. Kahn, R. J. Sherwood and Sam Poncher; Publicity Committee, John L. Robinson, chairman, R. C. Sprague and W. W. Jablon; Housing Committee, W. W. Jablon, chairman, J. J. Kahn and W. O. Schoning; Arrangements Committee, J. J. Kahn,

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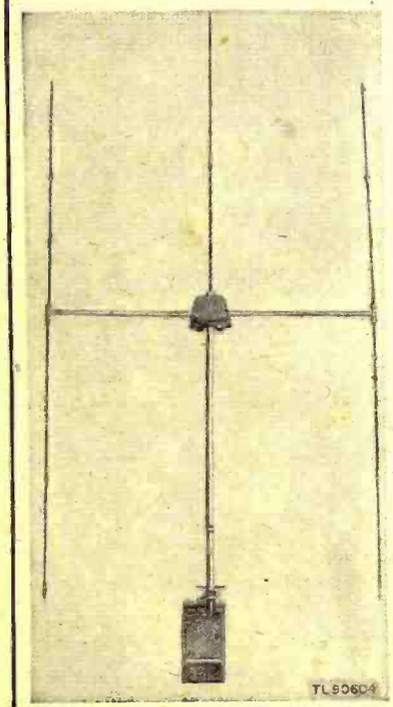

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- All Three Elements Driven
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- Rotator is exceedingly quiet in operation
- Operates on 12V 4½ Amps DC
- Simplified Assembly, easy tuning, ready to go on air one-half hour after uncrating!
- Requires 12'x22' flat space for mounting
- Rotator strang enough to handle additional beams at same time
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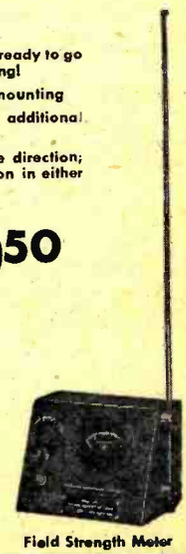

Field Strength Meter

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RADIO NEWS will again publish "THE RADIO NEWS DAILY," official Parts Show newspaper, as a service to the industry.

* * *

STANLEY GLASER has been named Manager of the Radio Section of the *Crosley Division* of *Avco Manufacturing Corporation.*

Prior to joining Crosley, Mr. Glaser was associated with *Goldblatt Bros.* of Chicago, as buyer of radio and phonograph records for the chain's 15 retail outlets.

During the war he served in the U.S. Army Air Corps and following service overseas he was assigned to the aircraft radio laboratory at Wright Field.

Prior to his Army service, Mr. Glaser was general manager of the *Star Radio Company* of Washington, D.C., a firm with whom he had been affiliated since 1926.

* * *

INTERSTATE MANUFACTURING CORPORATION has recently completed a new plant at 32-36 Newark Street, Newark 4, New Jersey.

The new plant is fully equipped with the latest machinery for the volume production of cord sets, heater cords, and wiring harnesses for the electrical appliance and automotive industries, on a custom-built basis.

Executive offices of the company will remain at 138 Sussex Avenue, Newark, New Jersey.

* * *

LES A. THAYER, Sales Manager of the Merchandise Division of *Belden Manufacturing Company* of Chicago was elected chairman of the Association of Electronic Parts and Equipment Manufacturers at the association's annual meeting held in Chicago recently.

Charles Hansen of *Jensen Manufacturing Company* of Chicago was named vice-chairman of the organization, while Helen Staniland, of *Quam-Nichols Company* of Chicago was elected treasurer for the twelfth consecutive year. Ken C. Prince, Chicago attorney, was renamed executive secretary of the association.

* * *

RUDOLF FELDT is the newly appointed head of the *Cathode-Ray Oscillograph Manufacturing Department* of the *Allen B. DuMont Laboratories, Inc.*

Mr. Feldt was graduated as an Electrical Engineer from Technische Hochschule in Berlin and worked in the

plants of the *AEG* and *C. Lorenz Companies*. In 1931 he went to France as a research engineer for an important telephone cable and repeater manufacturer.

He has been associated with the *Allen B. DuMont Laboratories, Inc.*, since 1935, first as a sales engineer for the French representative of the company and later as his associate and technical director.

* * *

DR. R. C. MASON has been named manager of the *Electro-Physics Department* of the *Westinghouse Research Laboratories*, succeeding Gaylord W. Penney, who was recently appointed *Westinghouse* Professor of Electrical Engineering at the Carnegie Institute of Technology.

Dr. Mason who has been on leave of absence at the atomic energy project in Oak Ridge, Tennessee, for the past year, assumed his new duties in September.

He received his B.S. in electrical engineering from the University of Arkansas and his doctorate in physics from Princeton University.

* * *

A. A. WARD, Vice-President of *Altec Lansing*, has been named Vice-President of the parent company, *Altec Service Corp.*

Mr. Ward started his career with *Altec* as a service inspector in the South. He is also responsible for many of the *Altec's* engineering developments in sound engineering.

His elevation to the *Altec* vice-presidency was made at a board of directors meeting in New York where G. L. Carrington was reelected President of the firm and H. M. Bessey, Vice-President and Secretary. P. F. Thomas, Treasurer, and R. J. Belmont, Assistant Secretary-Treasurer, were named for new terms.

* * *

ALBERT E. HAYES, JR., of Baltimore, Maryland, has been named to the full-time post of National Emergency Coordinator of the *American Radio Relay League* to promote and supervise amateur preparedness to supply disaster communication.

Under Mr. Hayes' supervision, selected radio amateurs in each community will call local meetings to establish common operating procedures and arrange regular drill periods when the hams' personal stations may be mobilized under simulated emergency conditions.

In the event of disaster, it will be his job to facilitate the orderly integration of a complete emergency communications system, including spotting of portable self-powered "walkie-talkies" for short-haul traffic, the establishment of agency relief centers of radio stations powered by gas-engine generators and, if necessary, to request of the FCC a special order clearing amateur channels exclusively for

disaster communication. Assisted by local emergency coordinators, he will also establish liaison with local officials of the American Red Cross, other relief organizations and protective services to handle their messages directing relief operations and keeping the outside world informed of the status of the emergency.

Mr. Hayes, whose call letters are W3LVY, was formerly an engineer with the *Bendix Radio Corporation*. He is a graduate of M.I.T.

* * *

INSTRUMENT DEVELOPMENT LABORATORIES have recently moved to a new location at 223-233 West Erie Street, Chicago. The expansion was necessitated by the increased demand for the company's products which are used in both nuclear research and routine testing work with radioactive materials.

In addition to acquiring larger quarters, the company has also created two new divisions to supplement the electronics division. One division for the development and manufacture of quartz-fiber and chamber-type instruments will be headed by Emil Hinspater, formerly in charge of the Instrument Shop at Argonne National Laboratories. The other division will be known as the Radiation Detector division.

* * *

HOWARD C. SCHUBERT has been named senior engineer at *United States Television Mfg. Corp.*

Mr. Schubert served as a research engineer with the *Allen B. DuMont Laboratories* for five years before joining *UST*. He also acted as master control engineer for station WABD. During the war he was with a government project at the Radiation Laboratories, Massachusetts Institute of Technology.

In his new position, Mr. Schubert will work in television design.

-30-

BRITISH INDUSTRY NOTES

THE Port of Liverpool will be one of the first in the world to utilize radar on a full-scale basis. The contract for the construction of the radar station has been placed with Sperry Gyroscope Co. of Brentford, England.

The equipment, which will be the first of its kind in the world, will enable the port to remain open in all weather. It will include an acrial scanner, weighing two tons, rotating on top of an 80 foot steel tower erected at the seaward end of the North Docks system. In the control room, a number of different displays will show large-scale pictures of the approach channels. These pictures will show accurately the positions of all buoys in Liverpool Bay, and enable the position of all ships to be plotted from moment-to-moment within a distance of 20 miles. Completion of the installation is expected by next Spring.

AS A result of experiments carried out over the last three years, it is considered that fine meteoric dust makes a substantial contribution to the maintenance of the atmospheric layer that reflects broadcasting waves at night, and so makes the reception of Continental broadcasting stations possible in Britain. This is the opinion of Sir Edward Appleton, Secretary of Britain's Department of Scientific and Industrial Research and Mr. R. Naismith, Radio Research Station of the D.S.I.R.

The two scientists, speaking before the Physical Society in London, also told the results obtained by using radar to record meteor showers. At the peak of the shower the records showed a maximum meteor frequency of over 40 a minute. The radar method of detection does not suffer from the restrictions of visual examination in that it is applicable in all weathers and in daylight. It has also been possible to detect the occurrence of many very small meteors which escape even telescopic visual examination.

AN ORDER for a 25 kw. FM transmitter has been placed by the British Broadcasting Corporation with Marconi's Wireless Telegraph Company, Ltd. This unit will be used to provide the first commercial FM transmission in England. The transmitter will be built at the Chelmsford Works of the company where 25 years ago the BBC's first transmitter, the famous "2LO" of the Savoy Hill days, was built.

A ROBOT process which is claimed to produce a complete radio receiver every 20 seconds has been invented by a London scientist. The new process is based on an automatic electronic circuit-making machine, known as ECME for short. The basic principle of the system is the deposition of metal and graphite into grooves and depressions on preformed plastic plates. After passing through an electronically controlled machine, the moldings emerge complete with all necessary components, except tubes and loudspeaker.

It is believed that the new process may revolutionize radio receiver production because of the low cost at which sets can be manufactured by this method.

BRITISH television sets will be greatly improved through the help of newly developed plastic mirrors. It is expected that bigger and much clearer images will be obtained, both in domestic sets and in motion picture television projectors.

It has been reported that a 3½-inch television tube, using a 14-inch mirror threw a picture 7½ times as big as the tube image on a flat screen 6 feet away. In the motion picture version, the image was thrown 42 feet and was 37½ times as big as the tube image. In both cases it was reported that the picture was well lighted and clear.

The material used in these plastic mirrors is "Transpex." A new finishing process makes it possible to obtain optical components with an accuracy comparable to the best achievements of glass. The parts will be cheap enough to make them adaptable to domestic sets and will have the sort of precision that is obtained in the most expensive modern telescope systems.

Imperial Chemical Industries has set up a factory which is expected to turn out these units in mass production by the end of this year.

-30-

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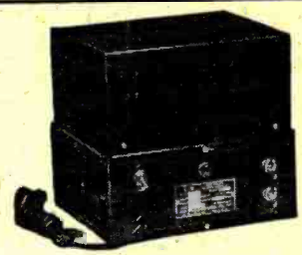

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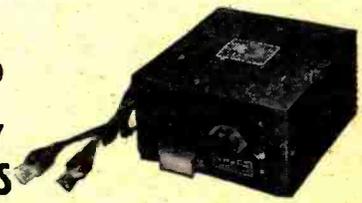

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Recording of Sound
(*Continued from page 50*)

very light, stiff tube is suspended between pole pieces by a cantilever spring. The sapphire stylus is held in an aluminum mounting which is spun into the tube. The mass of the stylus and mounting is approximately .008 grams. The moment of inertia of the entire moving system (referred to the stylus tip) is 11.6 milligrams and the stiffness approximates 1.8×10^6 dynes per centimeter. Resonance between the lateral stiffness and the mass of the arm appears at the sub-audio frequency of 10.5 cycles per second. The restoring force against vertical displacement of the stylus is supplied solely by the cantilever spring and the vertical stiffness is made higher in order to prevent the stylus from losing contact with the groove at higher frequencies.

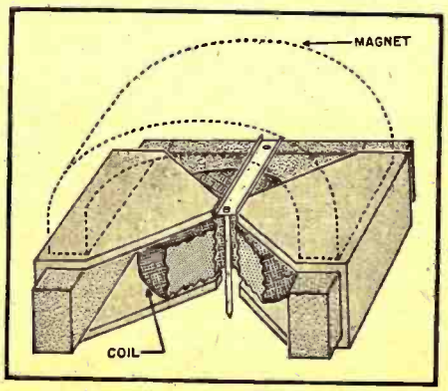
In 16 inch models the spherical radius of the stylus tip has been determined as optimum at .0025 inch for the playing of lateral transcriptions. On the other hand, 12 inch arms are used largely on shellac records. Therefore, the stylus radius is made slightly larger or approximately .003 inch. This is necessary in order to decrease the surface noise and to further decrease tendencies on the part of the pickup to rattle.

The suspension of the armature allows vertical compliance of the stylus in order to minimize record wear and to provide accurate tracking on warped records. However, vertical motion, due to the unique electrical arrangement, does not induce voltages in the coil. This arrangement also provides protection for the stylus against any abrupt shock. Vertical pivots for the arm are of hardened alloy steel. These pivot screws operate in a precision ball bearing to minimize friction in the arm assembly.

The Dynamic Pickup

A dynamic pickup developed by *Fairchild* and illustrated in Figs. 1 and 12 employs a coil which pivots on its own center of gravity. The natural period is determined by the mass of the jewelled tip of the stylus. This is made of diamond. The coil is wound directly

Fig. 11. Mechanical drawing shows internal structure of the Pickering pickup.



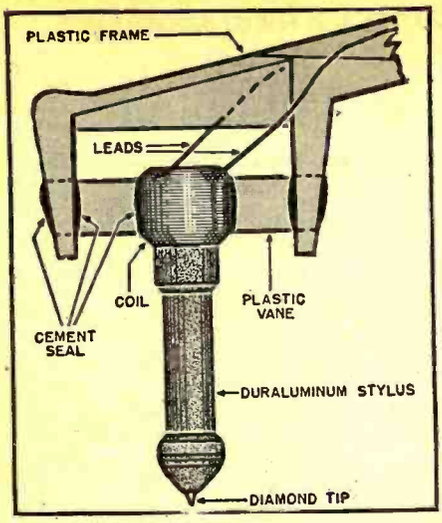


Fig. 12. The Fairchild dynamic pickup. Enlarged view shows assembly of unit.

over a very thin split sleeve of silicon steel mounted around one end of a short duraluminum stylus. The coil, which is wound with number 46 enamel wire, has a d.c. resistance of approximately 35 ohms.

Two thin plastic vanes extend at right angles to the duraluminum stylus, opposite each other and on opposite sides of the coil, then extend up to the towers of a plastic supporting bridge where their ends are anchored. The vanes are lined up with the record grooves and are in the plane of the stylus. Lateral modulation from the record causes these vanes to flex on the center line of the vanes and coil when the jewelled tip of the stylus is placed in the record groove. An oscillatory motion of the coil on its center of gravity results. A small Alnico permanent magnet is included. The positive and negative poles of this magnet are faced with thin cushions of soft synthetic rubber. These cushions are placed in close proximity to each side of the coil. These rubber cushions are necessary to prevent abrasion between the coil and pole pieces and also serve to hold the stylus vertical to the record. The assembly is then mounted on a heavy aluminum plate. The stylus tip is in the form of a tiny diamond pin. This is ground to a ball shape and is highly polished to prevent record wear. Its life, with average discs, is practically unlimited.

An aluminum casting mounts the head on the end of the reproducing arm. A handle is provided to raise or lower the reproducer head and a locking type handle protrudes through a slot in the side of the housing.

The response of this unit is from 30 to 10,000 cycles per second. Features of the lateral dynamic pickup include exceptionally low mechanical impedance of the stylus due to its mounting method, the method of mounting of the pickup cartridge in the arm on a two point suspension in which the entire arm floats at the required height above the disc (the arm being mounted on cone ball bearings which reduce side drag), a permanent dia-

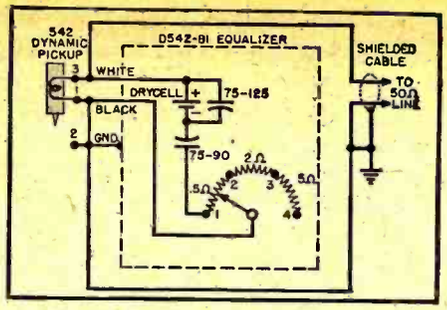


Fig. 13. Equalizer circuit used in conjunction with the Fairchild pickup.

mond-tipped stylus which protrudes about one-quarter inch below the cartridge case making "spotting" easy, a low stylus pressure of approximately 25 grams which results in minimum record wear and combines to make it an almost ideal pickup for dubbing from instantaneous records, and the fact that there is no overhang of the tone arm with consequent inertia which is another cause of difficulty when playing warped records or on uneven turntables.

Equalization of this or any other pickup is afforded through special equalizers usually provided by the manufacturer of the pickup. Such a unit is illustrated in Fig. 13. Four positions are provided: 1. To give approximately orthoacoustic reproduction; 2. Highs attenuated about 6 db. at 10,000 cycles; 3. Flat, and 4. Highs boosted about 4 db. at 10,000 cycles.

Space does not permit a complete resumé of all available moving coil type pickups. It should be pointed out, however, that one of the primary conveniences of capacity and moving coil pickups over magnetic types is that there are no forces inherent in the structures which would tend to displace the stylus and vibrating system. With magnetic designs it is necessary to exert a restoring force sufficient to return the armature to center in opposition to the magnetic attraction to the pole pieces when it swings toward them.

This condition makes it possible to increase the stylus assembly compliance in moving coil types. A low frequency resonance with reasonable tone arm mass may be achieved without difficulty at a sub-audio frequency. In choosing a low frequency for the natural period of a pickup, it is worthwhile to consider the possibility of excitation as a consequence of sub-harmonic effects from various sources such as record hum and motor vibration. Theoretically, then, perfect magnetic and moving coil pickup designs would function so as to provide constant output from constant velocity recordings and equalization is therefore necessary only to compensate for constant amplitude recording characteristics in the lower register.

As mentioned in previous chapters, the theoretical response curve for X-cut Rochelle salt crystal pickups is flat in terms of constant amplitude recording and should normally require equalization to raise the response in

the constant velocity section of the recorded spectrum. Most commercial designs are characterized by a resonant peak in the vibrating system at approximately 3000 to 4000 c.p.s. Advantage is often taken of this condition by broadening the peak and allowing this natural period to compensate for losses in the constant velocity range. Furthermore, since many reproducing systems are deficient in bass response, a rising characteristic in this region may be desirable where cost is a major factor.

Possibly the greatest advantage of crystal cartridges, then, is a very high output voltage obtainable and the consequent reduction in amplifier gain requirements. The customary equivalent circuit for piezoelectric pickups is a generator with no internal impedance in series with a condenser. The shunt capacitance of a cable connection to the input of an amplifier may then be considered in combination with a crystal capacitance as forming a non-frequency discriminating voltage divider.

In conclusion, therefore, we find after examining the many pickups available that our choice will largely depend upon the application for which we intend to use the pickup as well as the price we wish to pay. Like a watch, precision comes at a high price but as far as results are concerned, there is no substitute for quality.

(To be continued)

PHILIPPINE HAM CLUB

TEDDY KALAW, Jr., KA1TK, was elected president of the Philippine Amateur Radio Association at a recent meeting of that organization. Serving with Mr. Kalaw for the coming year are Earl Hornbostel, vice-president, and Elpidio G. De Castro, secretary-treasurer.

Members of PARA may be contacted through Mr. De Castro, KA1RTI, by writing him in care of Radio Training Institute, 345 Palma Street, Quiapo, Manila, Philippines. -30-

A group of Geiger-counter tubes makes a real handful as can be readily seen in the photo. The Geiger-counter tubes shown are, from left to right, for detecting soft x-rays and Beta rays; for use in quartz crystal analysis units; and for special x-ray research work. The tubes are manufactured by the Philips Laboratories, Inc., subsidiary of the North American Philips Co., Inc.

SERVICEMEN'S ORGANIZATIONS

SINCE many of the readers of RADIO NEWS have expressed an interest in servicemen's organizations, through the courtesy of Mr. Dave Krantz, President of the Philadelphia Radio Servicemen's Association, we are presenting a list of such groups in the United States, Canada, and Scotland.

Persons desiring additional information about any particular servicemen's group should write direct to the officer or officers listed. We believe the list to be fairly complete, but should we have inadvertently omitted any organization's name, we will appreciate hearing from that organization so that our file of such groups may be as complete as possible.

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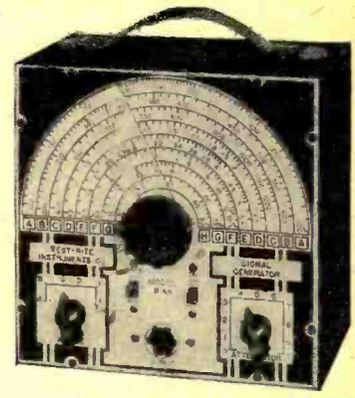

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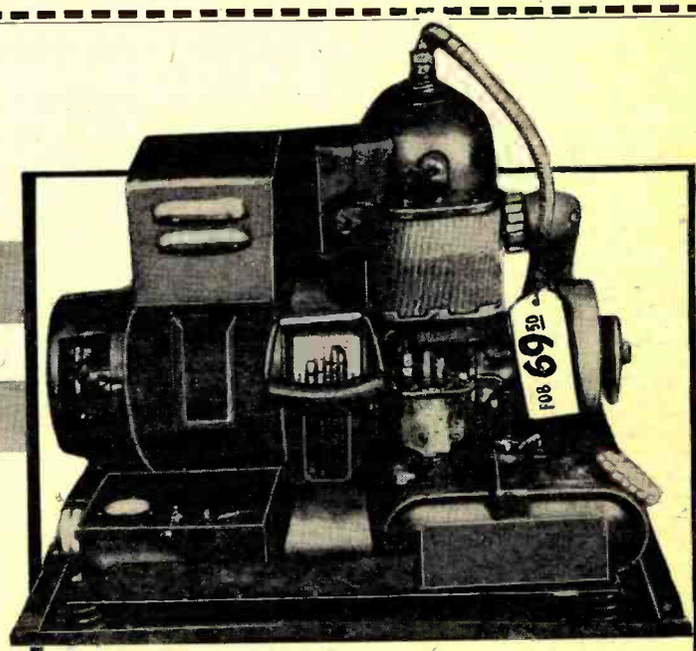

Here's one of the most useful items to come out of war surplus! Known throughout the Air Corps as the Putt-Putt, it's a combination gasoline motor-generator that packs a wallop as a universal power-source and generator of DC current. Each unit is slightly used, in excellent condition and guaranteed operative. Substantially crated for domestic shipment, they arrive complete, ready to operate. Generator is removed by detaching only 4 bolts. Cost to govt.: several hundred dollars. Cost to you: $69.50. *Order now.* Save C.O.D. charges by remitting in full—or send 25% deposit (bal. C.O.D.)

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- Govt. designated HRU-28, Commercial C-10A
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R & M RADIO COMPANY

DEPT. R-11 1426 N. QUINCY ST., ARLINGTON, VIRGINIA

Low-Cost FM Tuner

(*Continued from page 55*)

the bottom portion of the shield can.

The i.f. stage is followed by the new ratio detector which is self-limiting and therefore requires much less "front-end" gain than the usual limiter-discriminator circuit. Both vacuum tube diodes and crystals were tested in this circuit and it was found that there is no appreciable difference in performance wth either tubes or crystals. Since the voltage appearing across the crystals is very low, inexpensive mixer type crystals such as the 1N21 or 1N23 (which net for about twenty cents each) can be used rather than the more expensive germanium units. If desired, a twin diode such as a 6H6 or 6AL5 can also be used without circuit changes other than the additional heater wiring.

The a.v.c. voltage from the ratio detector is applied to the grid of the i.f. amplifier and tends to broaden the response of the i.f. channel with strong signal inputs. The a.v.c, voltage can also be used to actuate a magic eye indicator tube such as the 6E5 to serve as a tuning indicator. This refinement was omitted for the sake of simplicity, since accurate tuning can be accomplished by merely listening to the incoming signal.

The power supply is conventional and uses a 5Y3GT rectifier and an *RC* filter. Any small power transformer capable of supplying several hundred volts at 25 ma. can be used, final voltage adjustments being made by means of the semi-adjustable filter resistor.

Constructional Notes

The main tuning gang consists of two midget variable condensers mounted on a low-loss insulating plate and coupled by a rigid, insulated coupling. A flexible coupling should not be used because the oscillator tuning section is at the rear of the chassis and play in the oscillator tuning shaft will result in annoying backlash. Inexpensive miniature condensers known as *APC's* are available in great quantity on the surplus market and two of these can easily be coupled together to form the necessary two gang condenser. A satisfactory coupling for the *APC* type condensers can be made from a short length of ⅜" lucite or bakelite rod. The condensers are placed "back-to-back" and the insulating rod is drilled lengthwise so that a tight mechanical fit results between the rotor extensions and the rod. The rod is then drilled and tapped to take small set screws which clamp the rotor extensions. In lieu of this arrangement, larger type *Cardwell* condensers with standard ¼" rotor extensions can be used with a standard rigid coupling. *Effective* capacity change from minimum to maximum should be approximately 8 $\mu\mu$fd., although this figure will vary somewhat with various physical arrangements. In gen-

eral, a 10 to 15 $\mu\mu$fd. condenser will have sufficient range to cover the required frequency band.

The 6J6 oscillator and 6AK5 mixer sockets should be oriented to result in the shortest possible lead length to the coils and tuning condensers. Long leads will raise the minimum circuit capacity which, in turn, will reduce the effective tuning range of the condensers.

All bypass connections should be as short and direct as possible, especially in the i.f. and mixer stages. The high transconductance of the 6AK5 makes the i.f. stage prone to oscillation unless care is taken to completely isolate the grid and plate circuits. Some varieties of 6AK5's appear to be inherent oscillators despite all the usual precautions and the only method of taming such tubes is to reduce the screen voltage slightly by increasing the value of the screen dropping resistor. If the i.f. grid and plate leads are kept very short and well separated, oscillation troubles will generally not be encountered.

The ratio detector crystals and condensers are secured to multiple-lug terminal strips which are mounted at the rear of the chassis, well spaced from the i.f. grid circuit. If the 1N21 or 1N23 type crystals are used it will be necessary to mount them with spring clips or other mechanical means capable of maintaining good electrical contact without solder. The germanium units can, of course, be soldered directly into the circuit by their self-supporting leads and they are somewhat more convenient in this respect.

Audio output is fed through the one megohm volume control and terminated at the rear of the chassis by a phono type jack. If a volume control is available on the external audio system which is to be used, the control on the tuner may be omitted entirely. A one megohm, one-half watt fixed resistor should replace the potentiometer to serve as a load resistor.

When the wiring has been completed and checked, the tubes should be inserted in their sockets and the plate supply voltage adjusted to 180 volts by means of filter resistor R_{13}. Screen voltage on the 6AK5's should be approximately 120 volts and the 6J6 plate voltage should be between 25 and 35 volts, assuming that this stage is oscillating. The i.f. stage is aligned by feeding a 7.4 mc. signal into the grid of the 6AK5 mixer and connecting a high resistance voltmeter between the a.v.c. line and ground. The 6J6 oscillator tube should be removed during this procedure to prevent possible spurious beats. The i.f. trimmers C_6, C_{11}, and C_{13} are adjusted for maximum a.v.c. voltage which should be kept in the neighborhood of three volts by attenuating the incoming alignment signal. If the trimmers appear incapable of peaking at 7.4 mc., the signal generator frequency should be shifted slightly either way until maximum a.v.c. voltage is obtained with

the trimmers approximately half-compressed. The exact intermediate frequency is not critical and can range from 7 to 8 megacycles. The 6J6 should now be replaced and the oscillator stage checked for proper operation. If the stage is oscillating, a high resistance voltmeter connected between either grid of the 6J6 and ground will indicate rectified grid voltage which should run approximately ½ volt or more on a v.t.v.m. Another method of checking for oscillation involves temporarily opening the "B+" lead at the junction of RFC_2 and C_{20} and inserting a 15 or 25 ma. milliammeter in series with the "B+" lead. Oscillation will be indicated by a kick in plate current as the oscillator tuning condenser plates are shorted. If an absorption type wavemeter is available, the tuning range of the oscillator should be checked and adjusted to cover roughly 80 to 101 mc. by spreading or squeezing the oscillator coil. Normally the oscillator inductance will require very little pruning if coil dimensions are followed closely and leads are kept very short. With the oscillator operating properly, temporarily connect the antenna tap one turn up from the cold end of L_1. An outside signal should be tuned in and the antenna tap adjusted for maximum a.v.c. voltage. If only one station is to be received, the mixer section can be peaked by adjusting C_2 for maximum a.v.c. voltage. If more than one station is to be received the mixer section should be tracked by squeezing or spreading the mixer coil for maximum a.v.c. voltage at the low frequency end and adjusting C_2 for maximum a.v.c. voltage at the high frequency end. These adjustments are not critical because the mixer circuit tunes quite broadly and a slight amount of mistracking can be tolerated without noticeable loss in signal strength. The position of the antenna tap should be readjusted for maximum a.v.c. voltage after the mixer is tracking properly. Finally, the trimmer on the secondary of the discriminator transformer should be "touched up" for best audio quality while listening to a received signal.

Antenna requirements will vary with receiving locations, transmitter power, etc. Generally, for reception of full-power FM stations within 10 to 20 miles, an indoor dipole made of hook-up wire will provide adequate pickup. The antenna proper should total 55 inches and the twisted lead can be any convenient length.

The tuner was tested in several locations in the Syracuse area and in each case gave excellent results with an indoor dipole. No difficulty was experienced in the three local stations[1] which ranged from 2 to 20 miles from the receiving locations. A final test was made fifty miles from Syracuse and again excellent reception was obtained, although in this test an ex-

[1]At the time these tests were conducted, the three stations were running at the following *effective* radiated power: 3 kw., 6 kw. and 8½ kw.

ternal folded dipole made from 300 ohm twin-lead was required for satisfactory pickup.

Limiting action of the ratio detector appears to be excellent as evidenced by an almost total lack of automobile ignition and other forms of interference. Such amplitude pulses will usually become evident as the outer fringe of reliable transmitter range is approached; limiting effectiveness being reduced as signal strength decreases.

-30-

Television Installation

(*Continued from page* 58)

vision antenna. It is bi-directional, that is, it receives signals best when it is *broadside* to a television transmitting antenna. With proper orientation, the single dipole has enough directivity to receive the direct signal and part of the reflected signals along paths "B" and "D", since the dipole is "almost" broadside to the reflected paths. Reflected signals from paths "A" and "C" would be lost. (See Fig. 4).

If the single dipole (Fig. 5) is turned slightly clockwise, only the reflected path "D" and the direct signal are received (Fig. 3). Similarly, if the dipole is turned slightly counter-clockwise, only the reflected path "B" and the direct signal are received (also Fig. 3).

If the single dipole is turned sufficiently clockwise, a signal from reflected path "C" can be received by the "back" side of the dipole. Thus, a single dipole does not always have enough directivity to eliminate signal from reflected paths, regardless of its orientation and for this single reason it is often inadequate for some television installations.

This seemed to be the case in the actual installation in New Jersey.

With a better understanding of the "ghost" problem, let's return to the "probing" operations on the roof—work which was suddenly interrupted with the discovery of multiple images on the receiver screen.

Obviously, the double image (Fig. 3) was the visual result of a *direct* signal and a *reflected* signal from the same television station, WABD. The appearance of three images (Fig. 4) was the visual result of a *direct* signal plus two *reflected* signals *via two different paths* from the same station.

Greater directivity of the antenna system was necessary to keep the *direct* signal, and eliminate all *reflected* signals.

The "probing" dipole was held upright and moved through various roof locations, in the usual manner. The desirability of each position or site was judged at the receiver in terms of (1) the best possible *direct* or normal image, and (2) the minimum effect of "ghosts" or reflected images.

Considerable patience was required of both technicians. But after an exhaustive search of the roof, the best

site was located along the crest or peak of the roof near one edge.

After attaching the heavy mounting bracket at this point, the entire "probing" dipole assembly was mounted in place. Position of the single dipole was then horizontal, fixed about 6 feet above the peak of the roof, and free to rotate within the mounting bracket.

At this site, the best picture was observed on the receiver screen. The "best," of course, was the "least worst." One "ghost" was still present, but the *reflected* image was of much less intensity than the *direct* image.

Next an attempt was made to eliminate the "ghost."

Any rotation of the single dipole failed to "lose" the unwanted second image, except at such bearings where both direct and reflected signals were eliminated, due to the existing directivity of even the simple dipole.

An increase in height of the dipole was attempted. But this, likewise, had no effect in even *diminishing* the second image.

There was clearly a direct path between the transmitter and the receiving site. The cause of the reflected image was believed to be a large group of factory buildings, located north and east of the installation.

With this in mind, a section of wire mesh screening (size 6 ft. by 6 ft.) was erected on the roof in such a way as to shield the dipole from signals in the direction of the factory buildings *without* blocking or otherwise affecting the direct path from the transmitter of WABD. However, this attempt, as well, ended in failure.

Since no improvement in reception was achieved by these simple efforts, the particular installation clearly required a better antenna—a television antenna with greater directivity than the simple dipole.

Needed was *a directional antenna,* consisting of either a dipole and a director element, or, a dipole and a reflector element, and specifically designed for extreme directivity in only one direction.

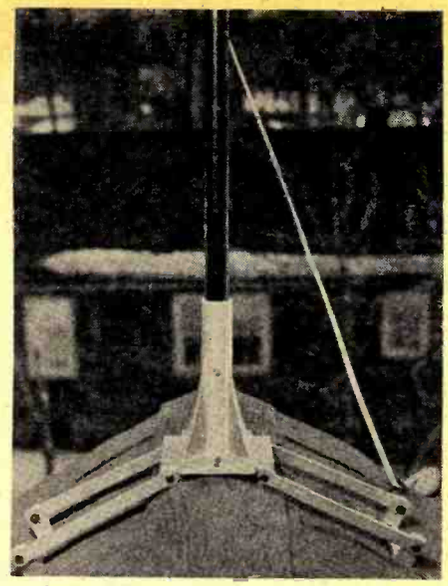
One of the most suitable commercial antennas for this purpose was the *Shur* Interceptor Antenna for Television (Fig. 6). Constructed similar to the "probing" dipole, the directional antenna consists of a dipole element (two fixed metal rods) and a director element (a single rod) mounted *in front* of the dipole. The upper assembly is interchangeable with the "probing" dipole.

Installation

After the "probing" dipole had been removed and dismantled, the actual installation continued.

The directional antenna was assembled and prepared for mounting on the roof *in place of* the "probing" dipole.

Length of each of the two metal rods for the dipole was the same as for the previously prepared "probing" dipole. The two parts of the



9 Close-up view of roof mounting bracket used with the directional antenna.

director rod were screwed together, forming an over-all length about 5 per-cent shorter than the dipole length.

Dipole and director were separately mounted, parallel to each other, by means of a wooden cross-arm.

The same previously prepared lead-in and Matching Section were connected to the two center terminal connections of the dipole.

Then, using the same mounting pole as for the "probing" dipole, the directional antenna was placed in the same heavy mounting bracket previously attached to the roof. The "twin-lead ribbon" lead-in was dropped over the edge of the roof, brought through a window, and connected to the input terminals of the television receiver.

After checking operation of the directional antenna it was found that all previous "ghost" effects had disappeared. Also, reception of the *direct* signal from the transmitter was considerably stronger than before.

The directional antenna was oriented for best reception of both the *Primary* and *Secondary Channels.* Because of the distance (16 miles) that separated the two preferred television stations and the customer's home, signals from both stations seemed to arrive from about the *same* direction. This greatly simplified the procedure of orientation.

With the receiver switched to the *Primary Channel,* the entire antenna assembly was very slowly rotated *in the mounting bracket.* The best position was found with some difficulty, but absolute certainty, evidenced by the "peak" intensity glow when the dipole and director were broadside to the station.

With the receiver switched to the *Secondary Channel,* the process was repeated. Only a slight rotation of the antenna assembly was necessary to determine the best position.

At the second position, reception of WABD was still extremely good—

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because of that station's signal power. For this reason, the directional antenna was permanently oriented in a position for receiving both stations (Fig. 7).

The position was double-checked, by switching back-and-forth between the two preferred channels while observing and comparing the intensity of the two received signals. There was no trace of "ghosts" or reflected signals.

Tuning the Antenna

There are several important tuning adjustments for the directional antenna, and all of them are fairly critical.

With the receiver switched to the *Primary Channel,* the wide spacing between the dipole and the director element was varied by the roof technician, and comparative signal strengths noted at the receiver. The best spacing resulted in the strongest picture signal.

Then the receiver was switched to the *Secondary Channel,* and the procedure repeated. However, the previous tuning was found adequate for reception of this station as well.

This adjustment was only *approximate,* since more critical tuning was to be accomplished later.

Next to be tuned was the center spacing between the two metal rods of the dipole, at the points where the lead-in was connected. This space distance was varied and adjusted for best signal strength as well as picture quality for *both Primary* and *Secondary Channels.*

The same procedure was next applied in tuning the director element, where the over-all length was varied to determine the best length for reception of *both* of the two preferred channels. This length was adjusted by means of a lock-nut at the center point.

After completion of dipole and director adjustments, all set screws were secured firmly.

Returning again to adjustment of the distance separating the dipole and parallel director element, the previous tuning procedure was repeated to obtain the highest possible signal strength and best picture quality for *both* the *Primary* and *Secondary Channels.*

As a check on all tuning, every procedure was repeated before the entire antenna assembly was fixed firmly in position. Clamping screws at each end of the wooden cross-arm were tightened, and all soldered connections were checked for security.

The directional antenna was permanently mounted in place using the heavy mounting bracket (Fig. 8). By means of a single bolt through the bracket and the mounting pole (Fig. 9), the antenna was held in a rigid, fixed position. No guy wires or other supports were considered necessary for the installation.

The "twin-lead ribbon" lead-in was mounted permanently by the roof technician, following a downward

route, and avoiding pipes and large metal objects wherever possible. During this installation, the man at the receiver observed picture images being received, to detect any aberrations or distortion due to unsatisfactory positioning of the lead-in "ribbon." However, none was encountered. At the television set, all slack lead-in was removed. The "twin-lead ribbon" was then *re*connected to the 300-ohm input terminals of the receiver.

After attachment of necessary lightning arrestors and completion of minor construction work, the operation of the television set was given a final test for "best reception" and pronounced very satisfactory.

The owner was furnished with operating instructions. And one of the technicians aided him in the actual operation of the receiver.

Then—and *only* then—was the installation complete!

The important problem of reflected images warrants more disclosures *of a practical nature.* And these will be presented in subsequent articles.

(To be continued)

NEW QTH WANTED

JOHN E. HUBEL of Milwaukee has sent us a clipping of an item which appeared recently in the "Milwaukee Journal" regarding the sad plight of George Halper, W9SUF.

It seems that George's landlord isn't as sympathetic as he might be where George's hobby of ham radio is concerned. Last April the landlord complained that George's CQ-ing kept the rest of the tenants awake at all hours of the night. Peace was restored temporarily on George's promise to transmit only during certain specified hours.

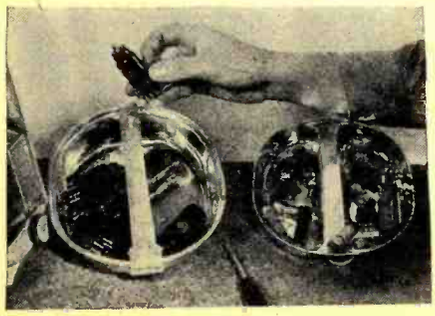
The climax came the other day when Judge Robert C. Cannon found that George had broken the terms of his pact with his landlord and ordered W9SUF to locate elsewhere. In the interim between now and December 1st, when he must move, George's ham gear is in the custody of his attorney. -30-

RADIO PARTS CONTAINER

SURPLUS mess kits are available at all stores handling army or navy supplies.

The two metal sections of these kits serve as suitable containers for radio parts.

When repairing a set, all tubes, knobs and mounting screws may be placed in one of these tins. The other part of the kit may be used for test condensers and resistors ordinarily left lying around the test bench. . . . . H.L.



NEW RECEIVERS for Winter Market

PERSONAL PORTABLE

When *Emerson Radio and Phonograph Corporation* unveiled their new fall line for the company's distributors, their personal portable, Model 560, received its share of attention.

In the low-price field, this maroon

plastic radio has been designed for battery operation and includes an Alnico V permanent magnet dynamic speaker. Small in size, the Model 560 provides good reception for home and portable applications.

Emerson Radio and Phonograph Corporation will supply additional details on this model and other units in the new line upon request to the company at 111 Eighth Avenue, New York 11, New York.

MECK FM CONVERTER

Recently introduced to the trade, the new *Meck* FM converter has been designed to provide FM reception at low cost.

The new unit, which is now available, may be attached to any ordinary radio receiver in FM broadcasting areas. The converter which may be

connected by any radio serviceman in a few minutes, was developed by *Meck* engineers working in cooperation with the *Hazeltine Laboratories*. It uses a new regenerative circuit and a special new tube adapted from wartime radar equipment.

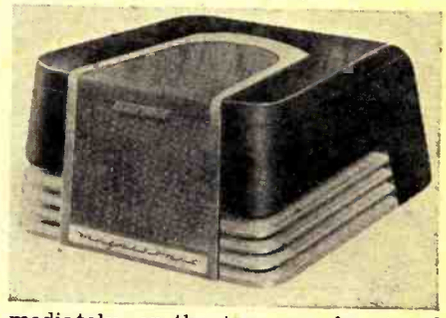
The converter, using the regular amplifying facilities of the AM broadcast receiver for volume, measures 9½" x 7" and is housed in a plastic case. It tunes in all stations in the new FM band.

John Meck Industries, Plymouth, Indiana, will supply additional details on request.

MAGNESONIC TAPE RECORDER

Available for the Christmas trade, *Sound Recorder & Reproducer Corporation* of Philadelphia, has announced the new "Magnesonic," an electronic instrument for home and business which records radio programs, phonograph records, music, and voice on magnetic tape.

The new instrument has a number of newly-patented features and utilizes magnetic tape which comes on reels accommodating up to one hour of recording. The machine and tape can record new programs continually on the same tape by automatically erasing as the new material is recorded. The recording can be played back im-



mediately, or the tape can be stored for an indefinite period for future use.

The unit is housed in a black ebony-finished wooden cabinet suitable for use in the home.

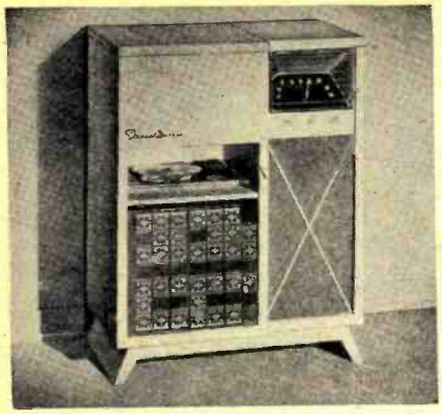
Sound Recorder & Reproducer Corporation, 5501 Wayne Avenue, Philadelphia, Pa., will supply full details on this unit to those requesting them from the company.

MODERN CONSOLE

One of the outstanding units in the *Stewart-Warner Corporation's* new line of home receivers is the "Interpreter," a radio-phonograph console designed to complement modern decor.

Featured in this new line of receivers are the full-dimensional tone reproduction of "Strobo-sonic" sound and "shadow box" dial recessed in the cabinets to provide improved visibility for tuning. The record players with which the line is equipped can handle ten 12" or twelve 10" records or ten of both intermixed. The player shuts

off automatically when the last record is played. The unit also features the "electro-hush" reproducer which eliminates needle noise and automatically retracts the needle point if dropped or pushed down on a record, thus preventing damage to records and assuring longer needle life.



Stewart-Warner Corporation, Chicago, Illinois, will supply added details on this line to those addressing their inquiries to the company.

FM-AM TABLE MODEL

Production on a new FM-AM table model receiver which will sell in the low priced field has been announced by *Olympic Radio & Television Inc.* of Long Island City.

This new model, No. 7-532, features a 6" dynamic speaker, full range tone control, and a power output of about two watts. The unit is housed in a streamlined plastic cabinet and has a large slide rule dial. The circuit employs 5 tubes plus a rectifier and operates on a.c. or d.c. without the use of an outside antenna on either FM or AM.

Prices and shipping information on this Model No. 7-532 are available from *Olympic Radio & Television Inc.,* 34-01 38th Avenue, Long Island City 1, New York.

PORTABLE PHONOGRAPH

Tone Products Corporation of America has recently introduced a lightweight portable electric phonograph that weighs only 8¾ pounds.

Smaller than the average portable typewriter or overnight case, the new model measured only 13" in length, 10¼" in width, and 5¾" in depth when closed. A leather handle is attached to the end of the case to provide additional ease in carrying.

A waterproof cover of python leatherette makes a smart and durable housing for the unit which will play 7, 10, and 12 inch discs.

Prices and shipping dates on the new portable phonograph will be supplied to those writing *Tone Products Corporation of America,* 351 Fourth Avenue, New York, New York.

PERSONAL PORTABLE

Garod Radio Corporation of Brooklyn has developed a new personal portable which weighs only 3½ pounds, can be played in the palm of the hand, packed away in an overnight case, or carried on a convenient shoulder strap.

Reception over the entire broadcast band has been assured by means of a hidden loop antenna housed in the cover. The radio plays instantly when the cover is opened. The tuning dial is of lucite with clear cut markings.

The clear plastic face of the receiver is decorated with a Cloisonné-type inlaid gold design. An oblong panel is reserved for the attachment of initials in metallic letters. The case is available in two-tone color combinations with alligator-grained plastic back and front, including a matching carrying strap.

The receiver is powered by one 1½ volt "A" battery and one 67½ volt "B" battery.

The "Starlet" is 6½" x 3¼" x 4⅛". *Garod Radio Corporation,* 70 Washington Street, Brooklyn 1, New York, will furnish full information on this portable upon request.

RADIO-PHONO-RECORDER

Majestic Radio & Television Corporation has announced the addition of two new wire recorder models to its 1948 line of home receivers.

The table model is housed in a large-sized cabinet and features a high "Q" built-in antenna, beam power output, bass boost circuit, and 5 x 7 inch oval, full response speaker. A 15 minute spool is standard equipment, with hour-length spools available. Radio performance is provided by six tubes and a rectifier and the record player features a wide-range crystal pickup. A switch arrangement allows records or radio programs to be transcribed on the wire.

This model is available in either

walnut or limed walnut finishes. The table model has been designated the Model 7YR753, while the console is known as the 7YR772.

Details on either or both of these

units will be furnished by *Majestic Radio & Television Corporation,* Elgin, Illinois, upon request.

NEW HOFFMAN LINE

Hoffman Radio Corp. of Los Angeles recently held a showing of their 1948 line of home receivers.

Several of the models in the new line are equipped with wire recorders and most of the units are FM-AM combinations.

One of the units which attracted considerable attention from buyers was the Model C-510. This unit is a combination FM-AM with an automatic record player. The C-510 carries nine tubes plus rectifier and features a concert-type 10" speaker. The receiver also has a built-in loop antenna for AM and a folded dipole antenna for FM, push-pull output, and the new *Hoffman* "Sound Expansion System" for broadened tonal range.

Details on the C-510, plus informa-

tion on other receivers in the 1948 line, are available upon request to *Hoffman Radio Corp.,* 3430 S. Hill Street, Los Angeles 7, California.

AM-FM PHONO COMBINATION

The *Receiver Division* of the *General Electric Company* has just announced the new Model 354 console.

This new receiver will tune in both high and low FM bands in addition to providing standard broadcast reception. The phonograph is equipped with the "Electronic Reproducer" and an automatic record changer. The unit

uses a 12" "dynapower" speaker and the newly-developed *GE* "guillotine" tuner which permits accurate tuning of both AM and FM programs. The

model has eight tubes and a rectifier tube.

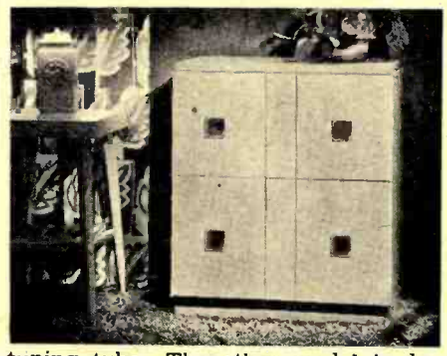
The *Receiver Division, General Electric Company,* Syracuse, New York, has complete details available upon request.

MAGNAVOX COMBINATION

Housed in either a mahogany or a white oak cabinet, the new *Magnavox* "Mayfair" radio-phonograph combination features a 10 watt power output, a 12" "Duosonic" speaker, and eight tubes plus rectifier.

The fully automatic record changer with which the "Mayfair" is equipped has the *Magnavox* pianissimo pickup. The cabinet also contains storage space for records.

This receiver is available in two models, one of which is equipped with genuine Armstrong FM, combining 14 amplifier tubes, two rectifiers, and one



tuning tube. The other model is designed so that an FM chassis may be added at any time.

Additional data on the "Mayfair" will be supplied by *Magnavox Company,* Fort Wayne, Indiana.

TELEVISION UNIT

Designed especially for public places, the new 1948 "Pic" model television receiver developed by *United States Television Mfg. Corp.,* features a 475 square inch screen, measuring 19"x25".

An advanced model of the company's tavern set, the new unit provides for increased brightness and greater visibility for large crowds. It stands 72" high with the screen placed near the

top of the set. The cabinet has a mahogany finish and an improved centralized control panel for easier operation of the set. Sliding doors over the control panel can be locked to prevent tampering with the unit.

The screen is encased in picture frame fashion. Automatic frequency

control is incorporated to prevent or greatly reduce local interference from all forms of static.

The receiver uses thirty-five tubes, including five rectifiers. A *Bausch & Lomb* lens is used in the refractive optical projection system.

Additional information on the "Pic" model receiver will be supplied by *United States Television Mfg. Corp.*, 3 West 61 Street, N. Y. 23, N. Y. –30–

International Short-Wave

(*Continued from page* 140)

resso" or "El Progresso Cubana," and relays medium-wave CMBC. COBQ, 9.236, Havana, has had quite good signals lately; identifies often, occasionally in *English;* slogan is "Emisoras CMCQ, La Voz de Cuba." (Kary)

Czechoslovakia—Prague's OLR5A, 15.23, is widely reported in Eastern U. S., with much improved signals. Beams to North America daily at 1800-1900, in *English,* Czech, Slovak; news around 1840. (NOTE: May have moved time to 1900-2000 as was last winter's schedule.)

The 9.55 outlet is scheduled 1030-1315; 6.010 runs 1315-1900; news at 1445 and 1645 on 6.010, at 1245 on 9.55.

Dominican Republic—HIM, Ciudad Trujillo, moved to 6.20; now signs off at 2100. (Beck) HI1X, Ciudad Trujillo, seems to have settled on a new frequency of 5.998; in Pennsylvania at times it completely covers ZFY, 6.000, Georgetown, British Guiana; announces either "La Voz del Republica Dominicana" or "Radio Oficiales HIX"; news in Spanish 0750-0755. (Kary)

HI27, 11.900 and 9.270, Ciudad Trujillo, heard in Cuba at 1925 with station announcements. (Ogazon)

Ecuador—HC1TR, 6.188, Ibarra, *"Radio Commercial,"* appears to have an irregular schedule, around 2230-0000; has been heard in New York signing off at 0250 in a special transmission; fair to good signals. HC1AC, 6.21, has returned to the air after an absence of several weeks; normal schedule is 1800-2?15. (Beck)

El Salvador—Schedule of YSUA, 6.255, is 1300-0000. Announces "Radio Mil Cincuenta." (Beck) HUB, 4.794, San Salvador, has news in Spanish around 2120; is covered by YV6RU, Venezuela, to 2128 when latter signs off; generally announces "Emisoras de Radio Nacionales YSS de Generales de Radio Comunicaciones en El Salvador, Central America." (Kary)

Ethiopia—Radio Addis Ababa, 15.056V, is sending poor signals around 1215-2000 and irregularly; in Eastern U. S. has bad QRM from WNC, 15.055, Hialeah, Florida, used for contacting Latin America. (Ferguson) Some days is inaudible. Plays many old American recordings. Uses *English* and other languages.

The 9.620 outlet is heard in South Africa around 1030; at 1100 says, "This is Radio Addis Ababa"; then relays BBC news and goes off the air at 1110 without further announcement. (Laubscher)

Finland—OIX2, 9.500, Helsinki, very poor, and OIX4, 15.190, fair in 0715-0730 news. (Peddle)

France—Paris is using 11.845 and 9.55 to South America, 2015-2045. Uses 11.885 at 0000-0015 and 0030-0115. (Balbi)

French Equatorial Africa—Brazzaville's 11.970 heard opening at 0000; news at 0030. (Bishop)

French Indo-China—Saigon, 11.78, 6.165, still has news at 0900. (Balbi) Also at 0500 when 11.78 is generally a readable to good signal here in the East.

A letter from *Radio Saigon* lists frequencies as 11.78 and 6.16, with *English* at 1945-2000, 0500-0545, and 0830-0930. (Pearce)

The French-speaking station on 9.465, formerly announcing as "Viet Nam," now announces as "Radio France in Indo-China" and *not* as "Viet Nam." However, the outlet on approximately 12.020 (I believe this is meant for Pnompenh on 12.364) does announce as "Viet Nam." (Radio Australia via McLaughlin)

French Morocco—A letter from Rabat gives schedule on 9.082V, 25 kw., 0145-0500, 1320-1900; and CNR3, 16.666, 0700-0930. (Pearce)

French West Africa—FHE3, 11.710V, Dakar, is being widely heard in Eastern U. S. around 1445-1659. (Ferguson) Some list opening as 1345.

Germany—Nordwestdeutscher Rundfunk, Hamburg 13, Rothenbaumchaussee 132-134, informs Paul Kary, Pennsylvania, that "short-wave station Hamburg is situated at Elmshorn, about 9 deg. 40' longitude, 53 deg. 48' latitude (30 kilometers northwest of Hamburg); operating frequency is 6.115 (49.06 meters). Programs are radiated from 0600 to 2400 (German Summer Time), or 2300-1700 EST; broadcasts from 0330-0400 EST are temporary. The disturbances from GSL, London, can be noticed even in Europe." Horst Miers, Berlin, informs me that at 0415 Hamburg uses some *English*, French, Danish, Rumanian, and Dutch in requesting reports from all over the world, and that Monday through Saturday at 0200 (with repeat at 0715) there is a school program in which stories and exercises in *English* are sometimes given; has "Lernt Englisch im Londoner Rundfunk" (English By Radio) daily at 1120; interval signal is a melody from Mozart's "Zauberflute."

Current schedule of Leipzig, 9.73, appears to be 2300-1745. (Beck) Measured frequency is 9.733. (Arthur)

U. S. relay stations at Munich are scheduled 1200-1230, 1430-1700, 7.290; 1200-1700, 9.540; 1200-1700, 11.870; 1245-1400, 15.150.

AFN, 6.080, Frankfurt, heard signing off at 1700 with "Star-Spangled Banner"; announced broadcasting 18 hours daily so presumably sign-on is at 2300 again. (Pearce)

Berlin, 6.710, British Forces Station, is scheduled 1400-1700; relays BFN at times; operated by British Army Welfare Unit. (Harrison)

Guadeloupe—A letter from *Radio Guadeloupe* lists schedules on 40.29 meters and 460 meters as 1150-1215, 1600-1915. (Pearce) The s.w. frequency is listed as 7.540.

Haiti—The new HHCN, 5.66, Port-au-Prince, usually signs off at 2030

with a good signal but has heavy aircraft QRM and bad static conditions.

HH3W, 10.135, heard in Cuba with good signals at 1900, musical program. (Ogazon) Good signal in Eastern U. S.

Hawaii—KRHO, Honolulu, is scheduled 0400-1000 to the Philippines and S. E. Asia on 15.250; 0245-0345 (except Mondays) to China (carrying United Nations broadcasts) on 17.800.

Holland—PCJ, 9.59, 6.02, 11.73, has dropped the 2300 news period to North America; the 2130 news period is still heard daily—except Sundays. Temporarily, the *Happy Station Programs* on Wednesdays and Sundays are scheduled to North America on these frequencies at 2200-2330. (Warmington) The Pacific beam of these programs on Tuesdays is announced for 0400-0530 now, on frequencies of 15.22 and 17.77.

Hong Kong—ZBW3 has moved to 9.525; signs off at 0900; on Sundays carries religious services prior to closedown. (Dilg) Has BBC news at 0600. (Balbi) There is very little chance of hearing this station in Eastern U. S. since 9.53 is again occupied around that time by a U. S. transmitter.

Iran—EPB, 15.100, Teheran, has had good signals in the East lately, 0630-0730; news at 0715; announce 31-m. channel in dual, probably is EQC, 9.680.

British radio journals list Tabriz, 12.180, from before 1155 to 1300. (Harrison) Heard in Britain with clock chimes at 1200; news in native language; native music, talks, and after 1230 has Western dance recordings; signs off at 1300 with a march (may be national anthem); has CWQRM. (Pearce)

Ireland—Radio Eireann, 9.595, is again being heard in the Eastern U. S. with news at 1610-1630; signals are improving as the season advances. (Beck) On Sundays I note interference from PCJ, 9.59.

Italy—Radio Italiana, 9.63, 11.810, Milan (relaying Rome), heard with news at 1430-1445. (Peddle) The 9.63 channel is good in 1930 news. (Stark) The outlet reported 15.12 to 15.13 has a musical program daily to 0830 when closes with announcement; on Sundays runs later; excellent signals in Britain. (Harrison) Uses "Nightingale" interval signal (same as EIAR, Rome, prewar). (Pearce)

Japan—WLKS, 6.105, Kure, signs off at 0500, announces moving to the 2 mc. band. At 0600, AFN, 6.015 and 4.88, Tokyo, presents short news broadcast. (Balbi)

Japanese stations use 6.190, 6.005, 4.910, 7.257.5, 9.560, 7.285, 9.505, and others, mornings.

Java—The Indonesian Republic seems now to have a station on about 10.98, heard at 0430-0730, fair to good signal; announcing as "The Voice of Free Indonesia"; *English* at 0530 and 0630 to Australia; also transmits to Malaya, India, and other parts of Asia in tongues of the country to which is directed. Location is unknown. (Balbi)

Radio Batavia has good signal in East at 0530 with news on frequencies of 15.145, 10.365, 9.675V, 9.550. The

15.145 frequency is readable in the 0930-1000 *English* program, beamed to Australia and New Zealand; 11.440, beamed in dual to the U. S., is usually poor to unreadable. The 15.145 channel has been heard on Friday mornings with a request program for listeners in Australia, New Zealand, and Asia; gives call of YDC. (Kary) The 18.600 and 19.345 channels (announced) are inaudible to good at 1145-1200 when transmitting news to Europe.

Ken Brownless, England, reports *Radio Batavia* on 17.630 with Dutch news at 0800; *English* news at 0810; and beamed to Middle East at 0725.

YHN, "Voice of Free Indonesia," 11.001, signs on its *English* program at 1200 by playing "Knightsbridge March"; usually signed off at 1230 but lately has had news again at 1230 and continues; has CWQRM. (Pearce)

Kenya—VQ7LO, 4.885V, Nairobi, is scheduled Monday and Friday at 0500-0600, 1000-1400 (to 1500 on Wednesday); Tuesday and Thursday, 0730-0830; Saturday, 0500-0615, 1000-1500; Sunday, 1000-1400. QRA is Box 777, Nairobi, Kenya Colony. (Brownless) Relays BBC news at 1300; announces, "Nairobi Calling." (Gray) This station is still on approximately 4.860. (Pearce)

Lebanon—Radio Beirut, 8.038, announcing "Ici Beirut," heard through bad CWQRM in Newfoundland, 1530-1600. (Peddle)

Luxembourg—Radio Luxembourg has been heard in Sweden testing at 0510-0540 on 15.350. (Petersson)

Lewis Griffith, Ohio, reports hearing Luxembourg's experimental transmission on 15.350 at 2310-0010. In verifying this reception, times of experimental transmissions were listed 2310-0010, 15.350; 0010-0030, 6.090; 0500-0540, 15.350; 0540-0600, 9.527.5; 1200-1240, 15.350; and 1240-1300, 9.527.5. QRA is Radio-Luxembourg, Compagnie Luxembourgeoise de Radiodiffusion, Luxembourg. Mr. Griffith said the program heard consisted primarily of records with announcements in *English,* French, and German.

Malaya—Singapore's British Far Eastern Broadcasting Service has replaced the 15.278 outlet with a frequency of approximately 9.685. (Dilg, Baxter, Balbi) In announcing this change gave "new" frequency as 9.690. (Pearce) Usually is a good signal in the East around 0600-0700, or later.

Other current frequencies in this service are 15.30, 11.735, 6.77. (Balbi) Usually the 31- and 19-m. channels are in dual, sometimes all four parallel; 11.735 and 6.770 do *not* carry Chinese programs. (Dilg) Normal daily schedule is 0030-0130 and 0330-1200. (Brownless)

Martinique—Radio Martinique has moved to 9.700. (Beck) Heard in Texas on this frequency around 1735-1845 or later. (Stark)

Mexico—XEBT, 9.625, XEFT, 9.545, XEUW, 6.02, all sign-off at 0100. (Beck)

Mozambique—CR7BJ, 9.65, Louren-

co Marques, is still heard on West Coast at 0000-0100, but with much weaker signal than some weeks ago. (Balbi) Is also heard in East.

CR7BJ, 9.645, is used in the Portuguese program at 1100-1500 now; seems the CR7AA, 6.137, channel has been dropped. (Laubscher)

New Zealand—ZLT-10, 6.105, Wellington, contacts ZMFQ daily at 0300. (Gray)

ZL2, 9.54, ZL3, 11.78, Wellington, have been heard testing around 0400-0500, best signal is the 31-m. outlet. During tests, relayed 2YC, Wellington. (Balbi)

Radio Australia reports that New Zealand DX-ers now believe that ZLO is a "pirate" station. (Arthur) ZLO was first reported to me by Arthur Cushen, New Zealand, as using a call of *Radio Waiouru* on 6.800 from as early as 0145 to after 0430. It was first thought the transmitter might be the old ZLT7, 6.715, of the Post and Telegraphs Department in Wellington which was used at 0430 daily during the war.

Nicaragua—YNBH, 6.54, signs off at 2305; is "Radio Panamericana." (Beck) YNEX, 8.323, Managua, is definitely the location; slogan is "Radio Managua," but call is questionable; at 2040 one night a man announced in *English* and asked for reports, promised verification; QRA was given but was not readable due to ship QRM. (Kary)

Northern Rhodesia—ZQP, 9.710, Lusaka, is heard daily on West Coast with fair signal, best around 1000-1030. (Balbi) Weekday sign-on is 1000, Sunday at 1030. (Dilg)

In the 41-m. band, ZQP is now actually operating on 7.220. The station management wrote Mervyn Laubscher, our South African ISW monitor:

"You are, of course, perfectly right in all you say about our 41-meter transmission. We have no monitoring station as yet, and up to a week ago (August), we had no reliable wavemeter. We now possess an accurate Marconi precision job and our first move, as soon as it was unpacked, was to check our frequencies. We found that our 41-meter channel was, in fact, 7.285 and, on investigation, discovered a faulty crystal. This was replaced and, as you confirm, we are now radiating on 7.220. The 31-meter transmission is on 9.710."

Norway—LKV, 15.175, LKQ, 11.735, are being heard in New York in the 0545-0735 transmission; LKV is also heard throughout the 1100-1700 period, while LKQ is heard from 1500 fade-in to 1700 sign-off. (Beck)

LHH, 14.925, Jeloy, heard in Pennsylvania at 1715 with A2 telegraphy and then in very poorly modulated voice. (Kary)

Palestine—Swedish radio journals list these calls for the Jaffa stations: ZJM3, 3.320; ZJM4, 6.135; ZJM5, 6.170; ZJM6, 6.790; and ZJM7, 11.720. (Kortvagsnytt)

Jaffa is heard in New York beginning at 2245 on 6.135 and 6.790. (Beck)

The 11.720 outlet heard in Pennsylvania as early as 2235 with tone, then 18-note Arabic tune, 6 pips at 2245, and man announces "Mahattat Asharq-Al-Adna"; has setting-up exercises in Arabic, and news in Arabic is at 2300; has severe QRM after 2325. (Kary)

Panama—HP5B, 6.03, Panama City, signs off at 0040. (Beck)

Peru—OAX4V, approximately 5.907, Lima, is being heard in New York with improved signal to 2345 sign-oq. (Beck)

Philippines—On 11.840, "The Voice of America, testing from Manila," has been widely heard lately in various sections of the U. S. It was first reported to me by Paul Dilg, California, as heard to 1000 sign-off with "Star Spangled Banner." Balbi, California, has heard it testing 0400-0630 and later. In the East has been heard best around 0815-0900; between 0700-0815 at times. However, it has caused heterodyne to Australia's VLC7, same frequency, used at that time to Eastern North America. Sometimes I have noted extremely poor modulation. Is probably beamed on Asia.

KZPI, moved to about 9.505, is a fair to good signal in the East around 0600-0700. (Kary) At 1000 announces in *English* as the "Voice of the Philippines"; fair signal. (Balbi)

The sister-station, KZOK, on about 9.694, uses some *English;* probably changes from Tagalog (Philippine national language) around 1000; uses commercials in *English* after that time. (Dilg) Peak in New York is around 0500. (Beck)

KZRH, 9.64, is being heard in New York with much improved signals; peaks there around 0500. (Beck) I have recently heard this one at readable level as late as 0730-0745. Is scheduled with news at 0600 and seems to have news at 0730. Uses commercials.

KZOK, 9.694, has been heard in South Africa around 1400-1500 with dance music and *English* announcements; asked for reports. (Laubscher)

Poland—Experimental transmission from Warsaw on approximately 7.170 has been heard in Sweden at 0450-0530. (Fredriksson)

Portugal—CSX, 6.380, Lisbon, is heard in New Zealand around 1430. (Gray) CSX, 12.750, is fair in Newfoundland at 0600-0800; CSW6, 11.035, good signal, 1500-1700; CSW7, 9.730, 1915-2045, excellent. (Peddle)

Rumania—Radio Bucharest, 9.250V, is heard in New Zealand at 1415 with news. (Gray) Is heard in Britain. (Brownless) Has German news at 1345; French news, 1400; *English* news, 1415; signs-off 1430; six piano-like notes used as interval signal. (Gillett)

South Africa—Capetown, 5.885, is again being heard on West Coast from daily sign-on at 2345; good signal. (Balbi)

A new station is to be operating soon from Pretoria; will be a South African Air Force Station, will use 5 kw. on 7.400. (Laubscher)

Spain—Madrid's 9.368 has news at 1500. (Peddle)

Trinidad—VP4RD, 9.625, Port-of-Spain, is back on the air; heard in Massachusetts at 0600; a few minutes after opening, signals become unreadable due to severe QRM. (Sternfelt) Stark, Texas, reports that while the station is announcing either 9.625 or 9.635, it is actually heard by him on 9.650; reception reported at 1700-1800 but weak with severe QRM.

Official schedules just received from VP4RD are 0600-0800, 1100-1300, 1500-2200, on 9.625 and on 1.295 kcs. in the medium-wave band. It was stated that the call will be changed soon to a "Z" one. Carries many BBC relays daily.

Uruguay—CXA19, *Radio El Espectador,* Montevideo, has been reported on 6.160; former frequency was 11.835. (Ogazon)

U.S.S.R.—On Saturdays on 15.17 (and parallel channels in the North American Service), Moscow has been heard at 1855 ending a "Letterbox" program in which letters from U. S. listeners were acknowledged. (Ferguson) This program is so listed to me by the U.S.S.R. Embassy in Washington, D. C., but so far I have had no report that Moscow has sent (written) replies to any letter.

Moscow's North American programs are announced for 0745-0815 on 11.75, 15.11, 15.17, 15.23, 17.83, 21.55; 1820-1930 on 11.88, 11.89, 15.17, 15.23, 17.83; 1930-1950 on 11.89, 15.17, 17.83. (Bishop) Confirmed in printed schedules from the Soviet Embassy.

Moscow is being heard in New York in the European Service on 15.38 and 11.78, afternoons; 15.36 parallels Leningrad, 11.63, afternoons, while 15.17 appears to carry a third European Service. (Beck) I note news from Moscow's 15.36, 11.63, and 9.71 (best) at 1500.

The 15.34 frequency is being used for *(English)* service to India and other parts of Asia beginning 0700; "Moscow Newsreel" is scheduled for 0715.

Sverdlovsk, 15.27, Moscow, 15.34, 15.23, 11.89, 11.74 begin the Home Service at 2200; 15.17 and 15.36 join this service one hour later (2300); 15.41 carries a separate program (in Russian). (Beck)

* * *

Last Minute Tips

A most interesting QSL card has been received by Paul Dilg, Monrovia, California, from the *Jungle Network,* Biak, Netherlands New Guinea (NEI). The card is homemade with call letters—KNIL—drawn in large block letters in lead pencil; on one side was typewritten, "The Jungle Network," KNIL, Radio Biak, Neth. New Guinea, NEI, and Mr. Dilg's QRA; it said, "Many thanks for your letter of 28th of June 1947 regarding our broadcasting station. We are very pleased to receive your report, especially from the USA. This broadcast station is run voluntarily by some of our Airforce men. The call-sign is 'KNIL Radio Biak,' but is better known as the Jungle Network. Hoping to receive more reports from you, we remain, Most sincerely," (signed) C. H. C.

Ronkes, Sgt. On the other side of the card (with the large block letters, "KNIL") was this: "TXM: *Collins* BC 401B; output: abt 400 watts; antenna; Marconi; times of transmission, at present daily from 1000-1130 GMT (that is, 0500-0630 EST); remarks: Thanks for report, OM; hope you heard us talking to you over our station; if our staff increases, we might run a longer period daily." Mr. Dilg reports this station, operating around 7.198 to 7.200, has a good signal with fine quality on West Coast, program is mostly records.

British listeners report Port Louis, 7.295, Mauritius, at 0315-0430, 0745-0955. (ISWC)

Swedish listeners report an unidentified station on about 5.960; call sounds like "Hona Medina"; heard from 1300 to closing at 1500. (Skoog) *Radio Australia* reports that this Arabic-speaking station is heard 1400-1500, and is believed to be Damascus in Syria. (Arthur)

GBSS, 13.185, the *Queen Elizabeth,* heard in Pennsylvania at 0750, very strong signals, calling WOO. WRA-11, 18.520, reported *RCA* in Tangiers, has been heard calling New York around 1519-1552. VPO-2, 20.580, Bridgetown, Barbados, heard calling GPZ, London, at 0740, woman operator, very strong signals; frequency is approximate. (Kary) WRA-11, 18.495, heard at excellent level at 1600. (Arthur)

Stations on 15.410, 15.440, heard around 0915-0957 in Chinese are Russia in its Far East Service, directed to China. (Dilg)

KZRH, Manila, has been reported on 15.420, announcing as "The Voice of the Philippines." Time of reception was not indicated by informant. (Radio Australia)

Radio Australia has asked listeners to watch for *Radio Malaya* around 0230-0330, 0830-0930 on 6.120; reported with test transmissions.

Latest word from Cable and Wireless, Ltd., Athens, Greece, is: "We have three frequencies—all about the same—SVQ, 13.640, SVR, 13.670, SVS, 13.725, and we find that all these suffer from QRM at different times. We usually change to one that is clear, but on the night in question we appear to have been unlucky. We now have our third 200-ft. mast erected, and we hope to have a new SVS antenna erected with eight 200-ft. uniform aerials and sixteen 200-ft. reflectors, although this will not be completed before another two months or so. When it is completed, however, it should produce a good increase in field strength over our present dipole. We are also using SVU, 19.885, during the daytime now for telegraph purposes to New York, usually to WQR or one of their stations, but we have not used this allocation for telephone work so far." (Kary)

GST, 21.550, London, is now used to North America 1215-1600. (Welch)

These tips are just in from Bob Park, British Columbia, Canada: JKD, 6.015, Tokyo, relays WVTR, 800 kcs., with AFRS programs to 0900, when gives

news and signs off; good level. *Radio Saigon's* 11.78 channel ends the *English* period at 0930 and signs off at 1015 with "La Marseillaise." XLRA, 11.490, Hankow, signs off at 0930; closing announcements by woman, when call, location can be plainly understood. XRRA, 10.260, Peiping, signs off between 0930-1000; usually plays Chinese opera during last hour. The station on 9.125, listed first as XGOUS, Nanking, is heard well to 0930, though some days goes much later, with press dispatches; usually signs with a commercial call-sign of XOL2. RV15, 5.940, Khabarovsk, U.S.S.R., comes through well mornings to fade-out around 0930-1000. *Radio Makassar,* 9.265, signs off daily at 0930 with "The End of a Perfect Day" and *English* announcement.

* * *

Acknowledgment

Many thanks for the excellent reports received. Send them to Kenneth R. Boord, 948 Stewartstown Road, Morgantown, West Virginia, U. S. A. . . . . K.R.B.

RMA EXPORT

BECAUSE of the postwar expansion of radio exports, RMA has recently enlarged its Export Committee. In addition to encouraging export trade in radio receivers, the committee is charged with the responsibility of combating the recently imposed foreign barriers against this type of import in order to preserve dollar credit balances.

The enlarged committee is headed by James E. Burke, export manager of Stewart-Warner Corporation, and E. E. Loucks of Zenith Radio Corporation is serving as vice-chairman of the group. Members of the committee include: Max Abrams, Emerson Radio & Phonograph Corp.; Ad. Auriema, Ad. Auriema Inc.; Ernest W. Beyer, Olympic Radio & Television, Inc; Wesley S. Block, Jr., Wesley Block & Company; Meade Brunet, RCA International Division; R. E. Burrows, Westinghouse International Company; Hugh J. Casey, Tung-Sol Lamp Works, Inc.; Walter A. Coogan, Sylvania Electric Products Inc.; James A. Finn, International Detrola Corporation; E. L. Hall, Pilot Radio Corporation; Edward L. Harris, Sonora Radio & Telcvision Corp.; Frank Harris, Farnsworth Television & Radio Corp.; A. D. Keller, Federal Telephone & Radio Corp.; Tye M. Lett, Jr., Crosley Division of Avco Mfg. Corp.; V. A. Mameyeff, Raytheon Manufacturing Company; Hans Mannheims, International Resistance Company; C. V. del Mercado, Majestic Radio & Television Corp.; H. O. McClumpha, The Sparks-Withington Company; D. W. McIntosh, Philco International Corporation; M. Ortiz, The Hallicrafters Co.; A. Prosdocimi, Solar Manufacturing Corporation; Arnold P. Roberts, American Steel Export Co., Inc.; Chas. G. Roberts, International General Electric Co.; Arthur J. Rocke, Rocke International Corporation; Norman Simons, The M. Simons & Son Co., Inc.; Howard Spellman, RCA Victor Division of RCA; W. L. Urquhart, Hytron Radio & Electronics Corp.; James F. Weldon, Sperti, Inc.; and Carl Wynne, Motorola, Inc.

-30-

Transmitter-Receiver

(*Continued from page* 61)

proached by the dial, the directly driven knob of C_4 may be used to clarify it. Fine calibration is easy since both a rough and a secondary reading may be logged. Because of its very low capacity, the setting at the time of calibration will have little influence when relocation is desired.

Construction of the transmitter section is started in the same manner as with the receiver. Exact dimensions of the Masonite sub-panel will have to be ascertained by the constructor since there may be some variation in coil placement. Irrespective of the size, two holes are needed for the tube and crystal sockets. A hole must be cut in the panel for the milliammeter. Although of heavy gauge, the aluminum panel will be found easy to work with a circle cutter.

Lacking a cutter, a series of hand drilled holes and some smoothing with a half round file will be found satisfactory. Mount the keying jack under the meter and the two feed-through insulators for the antenna transmission line. Another lug strip, this with five terminals, is employed in the same manner as the one in the receiver. RFC_2 is likewise the choke found in this section of the tuning unit. The heavy-duty switch should be retained as it provides an excellent means of shorting out the meter when keying—always a wise practice.

After completion of the transmitter the final step towards getting on the air is the construction of the antenna coupler, L_3C_{15}. Among the surplus parts, the condenser and coil removed from what is now the receiver section will do very nicely. The coil and condenser may be mounted on a Masonite base and fastened to the wall at the point of antenna lead-in. Because of its heavy duty construction and generous air gap, the variable condenser might be better employed in the amplifier section of a higher powered rig. A condenser of lower rating will do as well.

In tuning up the transmitter there are no exceptions to the conventional procedure. With the antenna coupler detuned, the plate voltage is applied and the tank circuit tuned for the point of lowest dip as indicated by the milliammeter. When this point is found the antenna may be loaded to draw somewhere in the neighborhood of 75 mils. Before shorting out the key, a few test signals should be tried. If, when keyed, the milliammeter shows a state of non-oscillation by jumping beyond its previous reading, the antenna may be too heavily loaded. If an annoying hum is heard in the receiver, even when the key is up, it may be necessary to kill the transmitter power supply by cutting the high voltage center tap. The switch to accomplish this may be mounted conveniently on the transmitter panel.

Operation on 40 meters is obtained by use of the proper crystal and shorting out a portion of the tank coil. A short piece of flexible wire to which an alligator clip is attached is used as a shorting bar. A piece of # 14 bus wire soldered to the coil winding provides a terminal for the clip. The exact position of the terminal will be subject to a small amount of experimentation but will, roughly, be found about half way down from the end of the coil. This may not produce peak efficiency but it is effective and in this case more convenient than the use of plug-in coils. For operation on 80 meters the shorting lead will be safely disposed of if it is tucked down inside of the coil form.

Where space is limited and the "shack" may be no more than a small corner of the living room this transmitter-receiver will fit well and in no way detract from the decorative motif. Portable operation is also a possibility. Very enjoyable contacts have been made with this rig, with favorable reports on its signal strength, surely a sufficient recompense for the time devoted to its conversion. -30-

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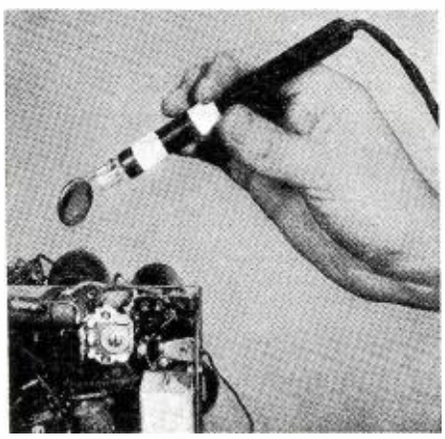
DENTAL MIRROR FOR PROBE LIGHT

THE markings on condensers and other parts are often difficult to distinguish when such markings are towards the chassis.

A small magnifying dental mirror when taped to a probe light as illustrated will be of great assistance in checking these markings. . . . H. L.



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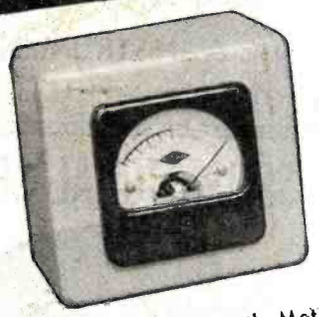

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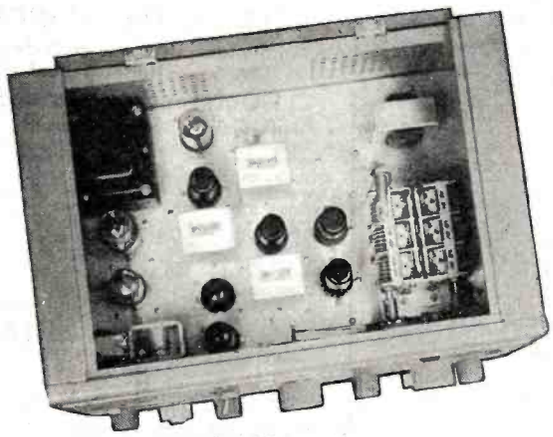

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