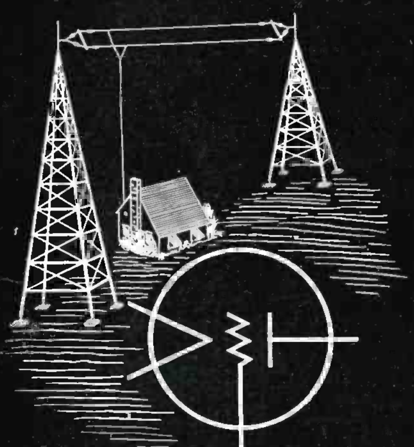
NOVEMBER, 1933

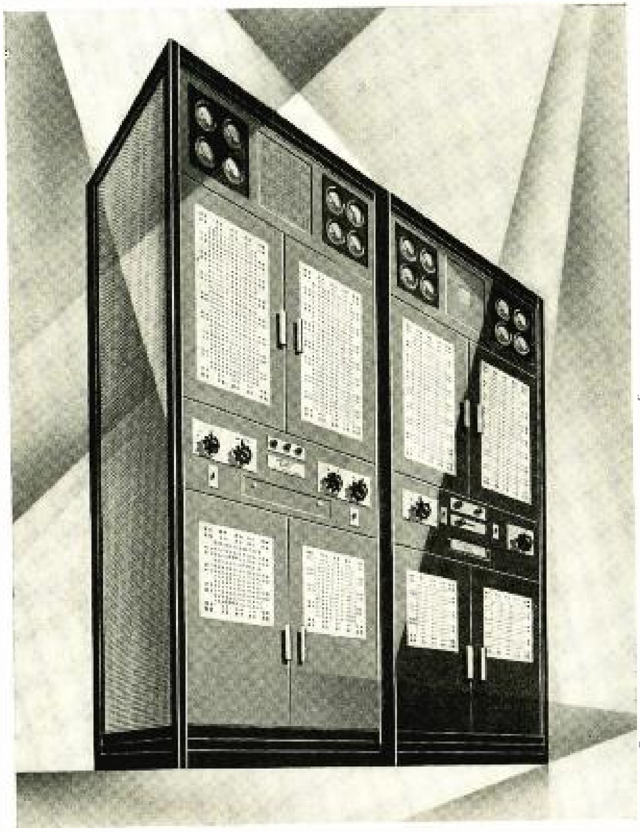
Radio Engineering



IN THIS ISSUE

NRA MEMBER U.S. WE DO OUR PART

The Journal of the Radio and Allied Industries



The MODERN RCA VICTOR

One K. W.

TRANSMITTER

Type "1D"

RADIO HEADQUARTERS takes pride in introducing this advanced-design one-k.w. broadcast transmitter, in anticipation of the great improvements being made in broadcast receiving sets, and the general trend towards extended audio frequency range of microphones and remote pickup telephone lines.

NOTE THESE OUTSTANDING FEATURES:

ECONOMICAL—EFFICIENT

Uses Efficient High Level Class B Modulation, Low Installation Cost. Lowest Operating Cost of Any Standard Transmitter, Air-Cooled Radiotrons Only.

COMPLETELY EQUIPPED

Built-in Cathode Ray Modulation Indicator, High Fidelity Speaker, Dummy Antenna, Radio Harmonic Suppressors.

HIGHEST FIDELITY

Uniform Frequency Response, Minimum Audio Harmonic Content, Even at 100% Modulation.

SIMPLE TO INSTALL and OPERATE

No Generators or Water Cooling Equipment, Entirely Self-Contained and AC Operated, Unitary Line Voltage Control, Complete Metering, Automatic Starting.

ADVANCED MECHANICAL DESIGN

Complete Shielding, Plug-in Crystal Units with Heater Chamber, Relay and Oscillator in Duplicate, Centralized Controls.

MODERN APPEARANCE

Designed According to Dynamic Symmetry, Finished in White Metal and Tones of Gray.

A Deluxe Transmitter at Low Initial Cost and Low Operating Cost

RCA VICTOR CO., INC.

Camden, N. J., U. S. A., "Radio Headquarters"

New York: 153 E. 24th St. Chicago: 111 N. Canal St. San Francisco: 235 Montgomery St.
Dallas: Santa Fe Bldg. Atlanta: 144 Walton St. N. W.

BRANCH OFFICES IN: Rio de Janeiro — Yokohama — Shanghai — Buenos Aires — Santiago (Chile)

RADIO ENGINEERING

Reg. U. S. Patent Office

MEMBER AUDIT BUREAU OF CIRCULATIONS

Editor
DONALD MCNICOL

Managing Editor
F. WALEN

Vol. XIII | NOVEMBER, 1933 | Number 11

Contents

Departments

N B C MOVES TO ROCKEFELLER PLAZA

THE above headline announces a change of address, but the subject will not likely be thus lightly dismissed. The transfer of the great institution, NBC, to the new RCA Building at 30 Rockefeller Plaza, New York, carries a significance to the radio industry and to radio engineers that will be analyzed and disseminated in every language and in no end of public prints the world over during the next half year.

The tribe of Fessendens, De Forests, Logwoods, Gowens, Weagants, Crafts, and others who bore the veiled ridicule of doubters two decades ago, and who knew a radiophone transmitter as a temperamental assembly of improvised gadgets, would be those most likely to comprehend, to envisage the present NBC plant in terms of technical progress and service achievement.

Modernity in a broadcast station studio implies the replacement of a ganglia of open wires by cabled conductors in concealed floor ducts; the replacement of Brobdingnagian knife-switches by hidden, silenced automatic circuit-breakers controlled by tiny push-buttons; replacement of clanging bells and the shouted orders of attendants by a polychromatic landscape of blinking miniature lights. It implies the employment of every electrical and mechanical device known to the arts which conduces to silent, swift and efficient operation of a multitude of local and remote studios in association with broadcast channels and national chain hookups.

NBC's New York studio operating plant is the last word in radio broadcast installation. It establishes standards which will serve as a guide for some time to come.

BRYAN S. DAVIS
President

JAS. A. WALKER
Secretary

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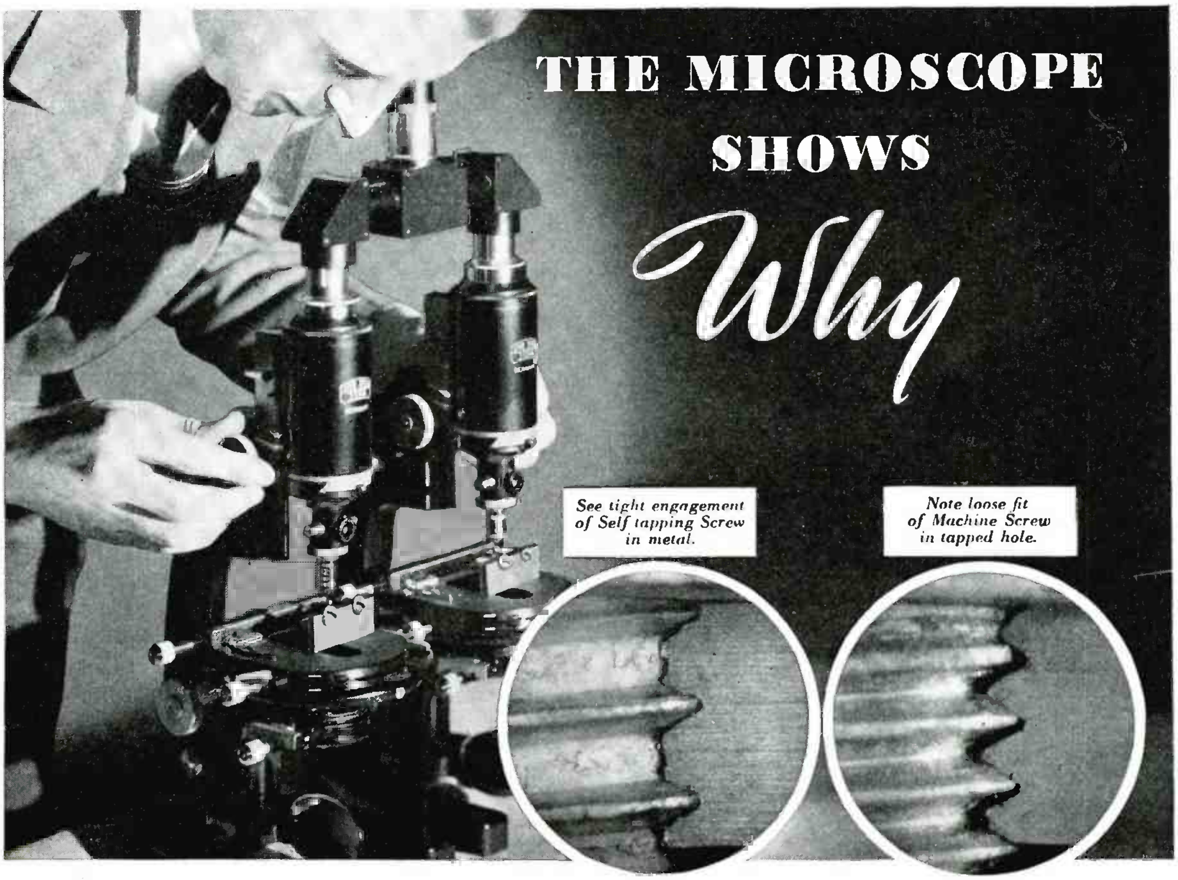
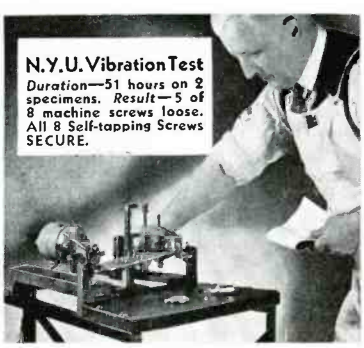


Assemblies made with Self-tapping Screws *safeguard auto radio circuits against vibration*

Because the proper functioning of auto radio circuits depends to such a large extent upon the mechanical supports in the receiver, leading engineers are favoring assemblies made with Parker-Kalon Hardened Self-tapping Sheet Metal Screws. *Vibration won't loosen fastenings made with these unique Screws.* Under the most severe shaking, radio parts will stay secure . . . safeguarding the electrical operation of the receiver.



It's easy to see why these Screws make stronger fastenings. Just look at the microphotographs above. The threads of the Self-tapping Screw are firmly embedded in the metal, while the threads of the machine screw actually are loosely engaged. Tests—one is pictured here—made by unbiased laboratories *prove* that Self-tapping Screws hold better under vibration, and also under tension and shear stresses.

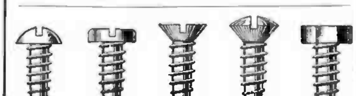
In making assemblies with these Screws, radio manufacturers are able to reduce costs, as well as strengthen fastenings. For no other device offers such ease, speed and economy. Practically all prominent makers of receivers for home use long ago adopted Self-tapping Screws, and most of them have saved from 30 per cent to 50 per cent of assembly costs.

Write for free samples of these famous Screws. Try them...see how much better they are for most fastenings.

PARKER-KALON CORPORATION
Dept. L, 190-198 Varick Street, New York, N. Y.

PARKER-KALON
HARDENED
Self-tapping Screws
PAT. IN U.S. AND FOREIGN COUNTRIES

Where and How to use them
Parker-Kalon Hardened Self-tapping Screws
For making fastenings to sheet metal up to 6 ga., aluminum, die castings, Bakelite, etc. Turn Screw into drilled, pierced or molded hole. It forms a thread in the material as it turns in. Can be removed and replaced. Available in a full range of diameters and lengths, and 5 styles of heads as shown below.



Editorial

NOVEMBER, 1933

FACSIMILE BROADCASTING AND TELEVISION

THE upward struggle of cinema entertainment was long retarded because of theatre show established standards which it was said would have to be equaled or closely approached before the screen could compete with the stage. Then in 1920 along came commercial radio broadcasting of sound, which caught up with and passed screen entertainment with sound, capturing public acceptance of the transmission of sound effects.

The immediate universal acceptance of radioed entertainment in two respects cleared the way for mechanized entertainment in the theatre; through radio the public became accustomed to loudspeaker reproduced voice and music, and accruing technical advances in radio reproduction made practicable the incorporation of reasonably satisfactory sound effects in visual screen showings.

A parallel to this situation may exist in the case of television. For ten years past there has been continuous attack upon the development of television systems. But, the public has become accustomed to the grade of visual-sound productions presented in picture houses. The exploiters of television are confronted with a situation wherein the grade of what they are expected to produce has been established by talking pictures.

From the viewpoint of the inventors it is not reasonable to require them to send into a million homes, simultaneously, a television-plus-sound product measuring up to the grade of like entertainment presented from a projection room to a few hundred persons seated within sound of the purring film.

With television at a standstill because of this impasse it is possible that facsimile broadcasting may run around television to pave the way for the latter's acceptance as, ten years ago, radio broadcast ran around the early movie-talker efforts, modifying the public's notions of what to be satisfied with.

The Hogan System of facsimile broadcasting has various useful applications on its own account, but it would not be surprising should its extension and use nurse television out of the cradle.

RADIO RECEPTION BETTERMENT

IN the I. R. E. paper presented in New York on November 8 by Stuart Ballantine there was an informative analysis of frequency and amplitude distortion in the successive links between the broadcast microphone and the output sound field. It is indicative of the present trend of radio engineering thought that the term "high fidelity" has become current in receiver terminology. The term was employed a year or two ago in the talking picture field in connection with the performance of microphones, audio amplifiers and loudspeakers. Also, in the paper presented at the Rochester meeting of the I. R. E. by Dr. A. N. Goldsmith the subject of receiver fidelity was treated constructively.

In these timely papers the situation at the transmitter is not overlooked in the overall analysis. Dr. Goldsmith lists the reduction of harmonic distortion of broadcast transmitters as an early step to be taken as a contributing element in improving the quality of reception.

◆

WIDENING THE BROADCAST BAND

AT the annual convention of the National Association of Broadcasters, held at White Sulphur Springs, October 8-11, there was discussion of the future development of television and facsimile broadcasting. A special committee was appointed to study these subjcts and report.

At this meeting the chairman of the Federal Radio Commission, Eugene O. Sykes, called attention to the availability of a widened broadcast band under the recent agreement reached at the Mexico City Radio Conference. This makes possible the early extension of the broadcast band from 1500 to 1600 kilocycles after removal of a few facilities temporarily using frequencies between 1500 and 1600 k.c.

Donald McNicol

Editor

NRA
MEMBER
U.S.
WE DO OUR PART

For Dependability, of course

CLAROSTAT
Resistors and Controls

No matter how rigid the test or how exacting the requirements, Clarostat Resistors and Controls are found standing the gaff day in and day out.

For automobile radio receivers, Clarostats have been standard equipment since the days when auto radio was a novelty.

Clarostats are in daily service in aerial communication, with its demands for non-failing, dependable operation.

In marine work and even in submarines Clarostats are being used under trying conditions of temperature change—with unfailing dependability.

Set Manufacturers, Engineers, Consultants and Purchasing Agents are invited to communicate with us. If it's a problem, we welcome it. Send us your specifications for samples or standard production samples will be furnished upon request.

Clarostat Manufacturing Co., Inc.
285-287 North Sixth Street, Brooklyn, N. Y.

CLAROSTAT

A chronological history of electrical communication —telegraph, telephone and radio

This history began with the January 1, 1932, issue of RADIO ENGINEERING. The items are numbered chronologically, beginning at 2000 B.C., and will be continued down to modern times. The history records important dates, discoveries, inventions, necrology and statistics, with numerous contemporary chronological tie-in references to events in associated scientific development. The material was compiled by Donald McNicol.

Part XXIII

1895 (*Continued*)

(900) Union College, Schenectady, N. Y., establishes a course in Electrical Engineering.

(901) Common battery telephone exchanges are introduced, replacing earlier systems where talking battery was installed at each subscribers' station.

(902) Roentgen, in Germany, discovers X-rays.

(903) The first electric power is delivered from plants operated by Niagara Falls. The current is 25-cycle, alternating.

(904) The Edison Pearl Street station, New York, is abandoned.

(905) Louis Duncan is elected president of the A.I.E.E.

(906) Guglielmo Marconi, in Italy, experiments with Hertz' oscillator and Branley's filings tube.

(907) The Baltimore and Ohio Railroad inaugurates electric haulage of trains through tunnels.

1896 (908) The electron is identified and determinations made relative to its physical characteristics.

(909) The International Telegraph Convention is held in Budapesth, Hungary.

(910) The replacement of electrolytic meters by mechanical meters is begun by the Edison Electric Light Company.

(911) Dr. W. W. Jacques, in Boston, invents a primary battery.

(912) Nikola Tesla and D. MacFarlane Moore, exhibit vacuum tube electric lights without continuous filaments.

(913) E. Y. Young and C. D. Warner, at the University of Nebraska commence experiments in electric heating.

(914) William Robert Grove dies. (Born in England 1811.)

(915) German government lays a submarine telegraph cable from Germany to Vigo, Spain.

(916) William F. Bossert, New York, invents a type of "knockout" box for electric wiring.

(917) Marconi arrives in England, from Italy, to exhibit his experimental wireless telegraph system (February) and files a provisional patent (No. 12,039) June 2.

(918) Westinghouse Electric and Mfg. Co., and General Electric Co., enter into an agreement, to continue until 1911, whereby overlapping patents owned by them may be used by either company.

1897 (919) Marconi gives a demonstration of his wireless system on Salisbury Plain, near London, (March) and files a complete patent specification.

(920) Oliver Lodge, in England, on May 10, files a provisional patent application covering inventions in wireless signaling.

(921) F. B. Crocker is elected president of the A.I.E.E.

(922) In May, trials of Marconi's system are made over water, between Lavernock and Flatholm, a distance of three miles. On the 13th, communication is established between Lavernock Point and Brean Down, a distance of eight miles. Professor Slaby, a German scientist, was present at these demonstrations.

(923) The Wireless Telegraph and Signal Company, Limited, is organized, in England, with a capital of £1,000,000, to acquire Marconi's patents in all countries except Italy and her dependencies.

(924) Professor Slaby gives a lecture (August 27) at Potsdam, before the German Emperor and Empress, on the subject of wireless telegraphy.

(925) The first Marconi station is erected at the Needles, Isle of Wight. A distance of fourteen and one-half miles is bridged by wireless telegraphy.

(926) In December the Marconi station at the Needles communicates with a ship eighteen miles at sea.

(927) The Synchronograph, by means of which high speed alternating-current telegraphy is possible is invented by Albert C. Crehore and George O. Squier.

(928) The National Electrical Code is first issued, governing the installation of wiring systems in buildings.

1898 (929) The Leeds and Northrup Company, Philadelphia, manufacturers of electric measuring instruments, organized.

(930) Simon, in Germany, develops the speaking arc.

(931) The Curies, in France, announce the discovery of radium.

(932) 4,600-volt generators are built in the United States.

(933) An additional French Atlantic cable is laid from Brest to Cape Cod.

(934) Latimer Clark dies. (Born in England 1822.)

(935) W. D. Dudell in a technical paper describes the oscillagraph.

(936) A telegraphers' tournament is held, May 14, in Madison Square Garden, New York.

(937) B. G. Lamme is granted (June 21) U. S. Patent 606,015 covering means for satisfactory operation of the inverted rotary converter—d.-c. to a.-c.

(938) A. E. Kennelly is elected president of the A.I.E.E., continuing in this office throughout the years 1899 and 1900.

(939) Oliver Lodge, in England, files a complete specification covering inventions in wireless telegraphy.

(940) Moore tube electric lights are exhibited at the Electric Show in Madison Square Garden, New York.

(941) Aluminum as an electrical conductor is commercially introduced.

(942) At Purdue University a 150,000-volt transformer is built.

(943) The Provo Canyon, Utah, power plant is built. Hydro-electric service is supplied at 40,000 volts.

(944) Jagadis Chunder Bose, of Calcutta, India, at a British Association meeting at Liverpool, exhibits and gives an account of "A Complete Apparatus for Studying the Properties of Electric Waves."

(945) The steamer *Flying Huntress*, equipped with Marconi apparatus, follows the yachts at the Kingstown Regatta, Dublin, July 20-22, and reports results of the race.

(946) Wireless telegraph apparatus is installed on the East Goodwin Lightship and at the South Foreland Lighthouse, England, December.

(947) City of Chicago organizes a Department of Electricity.

1899 (948) M. I. Pupin reads an important paper before the A.I.E.E., New York, March 22, dealing with the mathematical theory of wave propagation over metallic conductors.

(*To be continued*)

BROAD-BAND

New Standards of audio quality are being established by the latest RACON REPRODUCERS, designed to cover the broad audio spectrum from 30 to 12,000 cycles.

Illustrated: **Dynamic High-Frequency Loudspeaker.** An efficient and precision-built unit. Will reproduce faithfully all components present in the source from 3000 to 12,000 cycles, uniformly, without peakiness, shrillness or over-accentuation. This unit is not a modification of a low-frequency unit nor is it intended to introduce "psychological highs" that are not present in the source. It is a true high-frequency loudspeaker.

Supplied with horn, in one assembly, as shown. May be used in conjunction with a suitable low-frequency speaker of either the horn or cone type **and** the RACON Filter Network, which divides transmission at 3000 cycles for wide-range, high fidelity reproduction. Six volt or 110 volt field. 15 ohm voice coil impedance. Weight 3 lbs. Also available special tube rectifier field exciter for one or two units.

Low-Frequency Reproducers—Where dynamic cone-speakers are used for low-frequency reproduction the type of baffle and mounting is important. RACON Flared Baffles are the highest development in sound projectors for use with cone speakers. They are free from boominess, sturdy in construction and simple to mount.

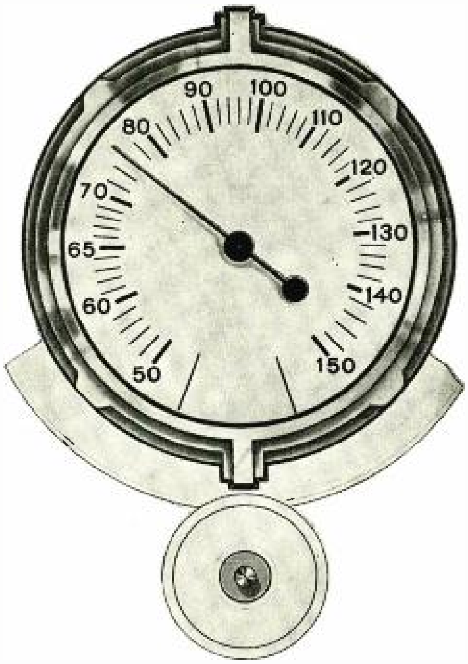
A Flared Baffle of the type illustrated (1) increases the sound output efficiency of the speaker unit, (2) gives uniform and broad sound distribution without "squashing" of the waveform at low-frequencies, (3) aids in acoustic balance by establishing a definite cutoff.

Flared Baffles are available in a wide variety of sizes from 18" x 30" to 8 feet x 10 feet, in single, two and four unit types. Openings accurately molded to fit cones from 8" to 15" diameter. Back enclosures furnished on order.

Write for catalog RE-11.

RACON ELECTRIC CO., INC. 52 EAST 19th STREET, NEW YORK CITY
LONDON, ENGLAND TORONTO, CANADA

Sales Offices in Principal Cities



No. 125 ACTUAL SIZE

Friction drive. Knob travels in opposite direction to condenser, but pointer travels with the condenser. Drive is through a pyralin disc actuating the pointer and is driven with the friction discs of No. 25 or No. 97.

CROWE

AIRPLANE TYPE of TUNING CONTROLS

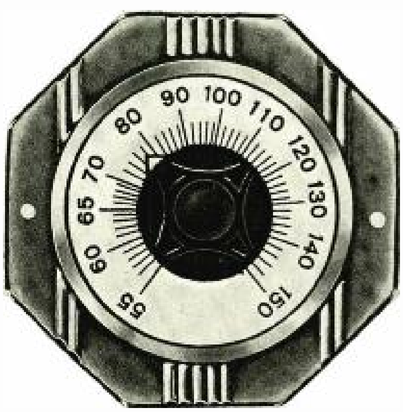
Made in several sizes and styles and in different speed ratios.

•

See also our 101-102 Remote Controls for Automobile Radios

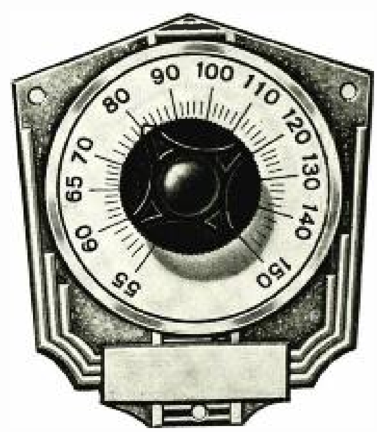
•

Send for New Catalog No. 50



No. 111

EUROPEAN TYPE OF AIRPLANE DIALS FOR COMPACTS



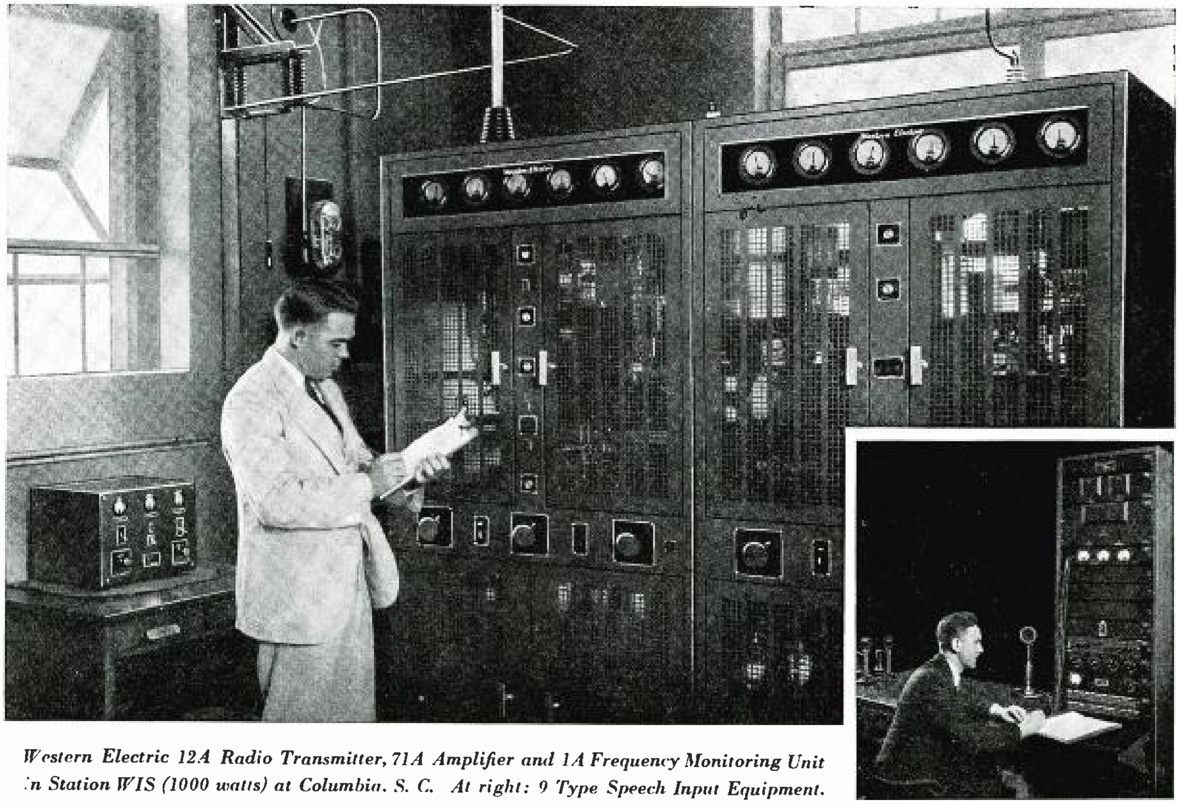
No. 113

These dials may be used in pairs—volume and selector if desired, or singly if preferred. They may be used with the drive mechanism of No. 97 friction drive, with shadow lighting of the scale.

Many variations in their installation may be used. Finishes recommended—oxidized silver, chromium—two-tone, and chromium and black enamel, or bronze.

CROWE NAME PLATE & MANUFACTURING CO.

1759 GRACE STREET CHICAGO, ILL., U.S.A.



Western Electric 12A Radio Transmitter, 71A Amplifier and 1A Frequency Monitoring Unit in Station WIS (1000 watts) at Columbia, S. C. At right: 9 Type Speech Input Equipment.

"Super-Station" Quality

. . . for stations of 100-1000 Watts!

The Western Electric 12A Radio Telephone Broadcasting Transmitter puts highest quality transmission within reach of stations ranging in power from 100 watts to 1000 watts. Rated at 100 watts, the 12A—used with the 71A Amplifier—delivers 250 or 500 or 1000 watts.

Unusual compactness is a notable feature of this equipment—each cabinet requiring only 25" x 36" floor space. Installation is easy—connections are made directly to power supply mains. Push button control simplifies operation.

Other features: No rotating machinery—all transformers, rectifiers and control apparatus built in—apparatus fully enclosed, all high voltages eliminated when any door is open—all tubes radiation cooled—unusual frequency stability—100% grid bias modulation.

The 9 Type AC-operated single rack Speech Input Equipment, including the Moving Coil Microphone, when associated with this Western Electric transmitter, represents the most modern installation. The transmitter is recognized as the standard of excellence among those of small rated output. Send the coupon for full information.

NRA MEMBER U.S. WE DO OUR PART

GRAYBAR ELECTRIC CO. RE-11-33
Graybar Building, New York, N. Y.
Gentlemen: Please send me full information on the Western Electric 12A Radio Transmitter, 71A Amplifier, and 9 type Speech Input Equipment.

NAME ____________________

ADDRESS ____________________

CITY ____________ STATE ____________

Western Electric

RADIO TELEPHONE BROADCASTING EQUIPMENT

Distributed by* GRAYBAR *Electric Company

RADIO ENGINEERING

FOR NOVEMBER, 1933

Of interest to all in the industry

RADIO PROGRESS WEEK

THE widespread success of Radio Progress Week, in October, appears to have been such that already there is demand for further promotional activities of a similar character, to be participated in by the RMA, broadcasting interests, and the trade. Let it not be a belated discovery that still there are gratifying results to be obtained by sales promotion.

◆

EXPORT

NOTWITHSTANDING high import duties, it appears that European buyers still prefer American radio receivers and tubes. When American products are not available the next preferred equipment is that which most closely resembles this merchandise. This attitude reflects a recognition of superior performance.

It develops that in France and Italy, for instance, domestic receivers have been redesigned for American type tubes. American tube bases are accepted as standard.

Various American receiver manufacturers are well represented in Europe. Taxes, fees, permits and duties so add to retail costs that the extension of radio is limited compared to coverage in America. In time, it is believed that the European market will expand, cultivating additional sales both for domestic and American radio products.

◆

TELEVISION

THE renewal of NBC's experimental visual broadcast license at 2750-2850 kc., 5 kw., from New York; of Sparks-Withington's visual service license 2000-2100, 42,000-56,000 and 60,000-86,000 kc. from Jackson, Michigan, and Western Television Research Corporation's renewal, by the Federal Radio Commission, on October 31, presages continued experimentation in television.

On November 1, W6SX, the Don Lee station on the Pacific Coast, changed from 2150 kc. to 2800 kc. in order to lessen side band cutting heretofore experienced.

In practically all radio manufacturing laboratories television is a live subject. The continuous attack being directed toward the correction of television's shortcomings will in time bear fruit.

RECEIVER SALES FEATURES

THE slight sacrifice in sensitivity in receivers employing automatic volume control will not lessen the demand for the latter convenience. In new models on the way through the laboratories improved gain in the audio stages will no doubt compensate for the loss. Also, the inclusion of resonance indicating neon type lamps in a larger spread of the forthcoming models will constitute a sales feature attractive to the public interested in the medium price receivers.

◆

END OF ISOLATION

WITH radio communication maintained between W2XAF and Admiral Byrd's base on the Bay of Whales during the coming months, there will be a constant reminder before all who contact the transmission from Schenectady that radio has actually rendered unnecessary the isolation of human beings, no matter where they may be situated on the earth's surface or in proximity thereto.

◆

ZONE QUOTAS

SECTION 9 of the Federal Radio Act of 1927 has come to the rescue of Philadelphia in the 1020 kc. allocation case. In granting the Westinghouse Company a permit to locate a new 10 kw. transmitter near Philadelphia, Penn., the Federal Radio Commission says: "Of the metropolitan areas of the four cities from which come the applications for 1020 kc.—Detroit, Pittsburgh, Chicago and Philadelphia—the latter has fewer transmission facilities in proportion to population and the number of receiving sets than any of the others."

◆

CODE FOR RADIO INDUSTRY

WITH NEMA the general code authority covering the radio industry, initial operation as directed by Arthur T. Murray, E. T. Cunningham, B. G. Erskine, H. W. Harper and Leslie F. Muter, of the RMA, is progressing with a minimum of difficulty. Questionnaires are in circulation among radio manufacturers. Industry betterment is predicted when the code is in full operation.

TRENDS IN RADIO

THERE are 88 notes on the usual piano, and 84 characters on the standard typewriter. The piano has a separate key for each of its 88 notes, and they are of just the right size to permit striking several of them at the same time, the octave being just about long enough, on the keys, so that it may be struck by the thumb and little finger of one hand. On the typewriter there is no requirement to strike two keys at once, but they must be struck in rapid sequence, so they are large enough to permit one finger to strike while another is preparing to strike. Both the piano and the typewriter are the result of considerable experiment, and much practical experience in actual use. They both seem to work out very well.

There are 96 channels on a broadcast receiver. They are listened to one at a time, and there is no requirement for very rapid sequence. In order to find a particular station, one turns a small knob. There is no uniform method of designating the stations or the channels on the instrument itself, the usual device being an arbitrary scale reading from zero to 100 for 180 degrees of motion. One has to know the reading of the desired station in order to adjust the instrument to it without first passing through several other stations. If the instrument has automatic volume control, as many modern sets do, all the undesired stations will come in just as loud, as the instrument is tuned through them, as the desired station, when it is finally found. If there is no automatic volume control, some of the stations will be very faint, which is a blessing, but others will be uncomfortably loud. The snatches of speech or music which are heard during this process of tuning can hardly be otherwise than unpleasant, if not to the one who is doing the tuning, certainly to the others who may be listening.

The dial readings on the arbitrary scale are only very roughly in agreement between one radio set and another. I may have a headful of dial readings for my own instrument, but this does not mean that I will be able to tune my neighbor's radio easily and successfully. It is as though everybody's telephone number was different in a neighbor's house from that at home.

The usual 100 division scale on the radio set can not possibly match, except by accident for a very small number of stations, with the actual positions at which the stations are heard best. The correct reading for each station on these dials would probably include a decimal fraction with several figures after the decimal point. And even if this exact reading were known, it would be quite impossible to set the instrument to it, because the dial divisions themselves are too small.

In this article Mr. Langley draws attention to opportunities for betterment in the design of receivers to meet markets now developing.

You can readily imagine how impossible the situation would be if the best information you could get about your friend's telephone number was that it was somewhere around 2,000. As things are, you can read this number, exactly, in the telephone book, or get it with equal precision from the information operator. And you can get the exact frequency of the broadcasting station whose program you wish to hear from the daily newspaper, or from numerous lists. The frequencies are just as exact, and are changed just as infrequently as the telephone numbers, but, unfortunately, they do not do you nearly so much good.

There used to be a number of very good reasons for this obvious imperfection in broadcast receivers, and perhaps some of them still have a measure of validity. Nevertheless, one might be pardoned for a feeling that after twelve years of hard work in the laboratories and on the drafting tables, the engineers who have produced over seventy-five hundred different models of broadcast receivers might have done a little better with this particular problem.

Transmitted Frequencies

The first reason that stood in the way of any really convenient control arrangement was the fact that the broadcasting stations did not adhere to any particular frequency, but varied up and down the scale. This was partly at the whim of the operator, and partly because no one, at that time, knew how to make them stay put, no matter how carefully they were adjusted. The radio spectrum at that time was very much like a piano with every string changing its pitch up and down, quite without regard to what the other strings were doing. It was just about as hopeless and impossible as that. But no longer can the engineers take refuge behind that situation; it ceased to exist soon after the Federal Radio Commission came into being, and today the frequencies of the broadcasting stations are just as definite and just as exactly tuned as the strings on a good piano. And the operators, under penalty of a revoked license, see to it that they are kept in tune.

You might reasonably have expected that, after the broadcasting stations got straightened out, along would come some real improvements in the tuning arrangements on the radio set. Such, unfortunately, was not the case. There were other hurdles to jump, and the fact is that the dials and knobs of today find their counterpart way back in the days when all the broadcasting stations were working on one or two frequencies, or pretending to, long before they got the bright idea of looking all over the spectrum for a comfortable frequency of their own.

Tuning and Dials

The variable condensers which are commonly used to perform the actual tuning, have the bad habit of crowding the stations at one end of the dial and spreading them out far too wide at the other. In order to give one a chance to actually read the frequency on the dial, with condensers of this type, the length of the dial itself would have to be 15 to 20 inches. This was a pretty good reason, so far as most of the engineers and executives could see, but there was the further fact that such a long

RECEIVER DESIGN

By

R. H. Langley
Consulting Engineer

dial, with the frequencies actually marked would have been an open admission that something inside was queer, and really ought to be better. Today there are better devices to put inside, that really do spread the stations evenly over the dial, just as nicely as the notes on the piano.

There remained, however, another and possibly more important difficulty. The tuned circuits of receivers have had the unfortunate property of being much more selective at the lower frequencies. A station at the high-frequency end of the dial covered many more channels than one at the low-frequency end. This defect was pretty well masked by the fact that the tuning device in the circuits crowded the high-frequency stations close together, so that the selectivity of the receiver *seemed* to be about the same all the way across. One difficulty very conveniently covered up another, but to remove only one of them would have left the other much too apparent. So the good tuning device never came into general use, because the circuit difficulty seemed to be inherent and incurable. All sorts of compromise tuning devices were proposed and many of them are in use today.

Superheterodyne Revival

The difficulty in the circuits themselves was swept away when the superheterodyne system of reception came into general use. In this system the selectivity is practically uniform over the tuning range, and the last reason for sticking to the old uneven spacing of the stations on the dial disappears. Several of the better grade receivers take advantage of this fact, and provide a dial that does show the actual frequencies, or so-called "channel numbers," which are nothing but the frequencies with the last zero left off. Even on these receivers, however, the dials are still far too small, and the channels far too close together for easy reading.

Beyond these electrical difficulties there has been a group of mechanical problems. It took some time to find out just how to arrange all the tuned circuits in a receiver so that they could be adjusted simultaneously with a single handle. In the early days of three and four-dial receivers, it really didn't make much difference whether all the condensers and all the coils were precisely alike or not. With the advancement of the single control idea, it was found a difficult matter to make them exactly alike, and still more difficult to make them so accurately that all receivers of a certain type would tune to the same frequencies and broadcasting stations at exactly the same points on the dial. This was necessary, of course, if the receivers were to have dials reading accurately in frequency and therefore easy to set to a desired station. If each receiver were separately calibrated before it left the factory, there would be a considerable increase in cost. And so only a few manufacturers have attempted any such procedure and then only on the higher priced models.

Electrical Versus Mechanical

Radio engineers, in general, are more skillful in electrical than in mechanical matters. In many cases, a problem that might easily have been solved by a clever mechanical device, has been solved electrically. As a simple illustration of this tendency of the engineers, it is more usual to run wires to a volume control on the front of the receiver, where the knob can be attached directly to it, than it is to run a shaft back to the same volume control located where it would be electrically convenient to have it. The most striking result of this deficiency in mechanical finesse, however, has been the relatively crude and inadequate arrangements for tuning.

It has been the attitude of a good many executives and sales departments that the public really did not want anything better in the way of tuning devices. The acceptance of those improvements that have been offered has been such as to discourage any increase in cost for such a purpose, they say. Any one family, in their view, only listens to a few nearby stations, anyway, and some one in the family soon learns how to tune these stations in, so that a real calibration in frequencies or channel numbers would not be worth the cost.

Accurate Tuning

Well, perhaps that is true, but I doubt it. The engineers have always stressed the importance of tuning the receiver exactly to the station, and they still insist that that is the only way to get the best quality the receiver is capable of, and there can be no dispute that this is the case. The better the receiver is, the more necessary accurate tuning becomes. The best program ever broadcast could be completely ruined by not being properly tuned. And the sad fact is that in a great many cases it probably was. Not that these people didn't want to hear it as well as they could, but the tuning means provided made it all too easy to mistune.

The manufacturers have a greater responsibility than they realize, perhaps, not only to the public and to the industry, but to the future of their own individual businesses. The American family buys a radio with small chance of comparison, and no knowledge of just how the instrument they buy might be made better and more satisfactory. They accept it as being wonderful anyway, and the results they get are the sum total of the meaning of the word "Radio" as far as they are concerned. The defects and imperfections that have been built into the receiver through a lack of skillful design, or the ever present desire to cut the cost, are accepted as the best that can be done. The blame, if there is any, is lodged against the whole radio industry, and not against the particular receiver or the manufacturer who built it. Thus the art and the industry suffer.

There are those who will say that criticism of modern receivers is not well founded, that they really do have adequate tuning devices. These will be those who see only a part of the national picture, and who do not realize, for example, that what the public was asked to buy in 1932 was the product of 135 manufacturers who offered a total of over a thousand different models. Nor have these conditions changed materially in 1933. If anything, they are worse.

The Midgets

The whole story, I'll admit, would have less validity, were it not for the fact that the great bulk of the sales today is in the so-called "cigar-box" type. These little receivers are admittedly attractive, not only for the beauty of their cases, and the convenience of easy portability, but also for the marvel that so much can be put in so small a space, and can be sold for so little. But they represent a complete reversion to the types of years long past, so far as tuning arrangements are concerned. In many cases the dials and the knobs are so small that even a watchmaker would have trouble in adjusting them. Even the arbitrary scale has disappeared on most of them, so that they are cruder, in this respect, than the clumsy three-dial models of a decade ago. With those it was at least possible to make a record of where each station had been heard.

The entire industry is anxiously looking for improvements that will mean more sales. In 1932, in an effort in this direction, over 50 different types of vacuum tubes were used, without, in my opinion, making any particular impression on the buying public. The manufacturers have staged a veritable stampede of price cutting. They have thrown performance, convenience, wages, profits, dividends, to the winds, to find out who could sell the most radios for the lowest price. They haven't found out, but the sales, individually and collectively, in units sold, and in dollars volume, have continued to fall.

Let them give some thought to the piano and the typewriter. Even a violin has to have room for the performer's fingers. And the dials on an automobile panel are large enough so they can be comfortably read from the driver's seat. When you turn the wheel on your car you can judge pretty accurately just what is going to happen. Nor do you have to chase up half a dozen wrong roads before you can get on to the one you want. Why should it have to be so hard to steer a radio receiver?

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The Technique of Transcriptions for Broadcast Use

By James E. Dickert

◆

UNTIL the advent of the new noiseless recording system no record could be reproduced without the constant audible hissing background, or needle scratch, characteristic of the lateral method of cutting the wax master. Since in long-playing records it is necessary for adjacent grooves to be very close together and since in lateral cutting the side-to-side variation of the groove during modulation tends to reduce the thickness of the side walls, it is necessary, in order to minimize the danger of the reproducing needle cutting through the walls altogether, to reduce the recording level at the low frequency end of the sound spectrum. At the same time in order to minimize the needle scratch it is necessary to filter out the high frequencies by special design of the pickup unit. This leaves a lateral reproduction much restricted in frequency range and tone quality.

According to reports as applied to telephone communication practice ninety-five per cent of the intelligibility of the human voice lies in the band of higher frequencies and harmonics. Whereas the same percentage of the actual *power* of the voice is included in the band of low, or fundamental, frequencies. It is due to good reproduction in the higher bands that one is enabled to tell the difference between the spoken letters "f" and "s," or "d" and "g," or "th" and "sh."

It is agreed that most recording systems will successfully reproduce a very "high" piano which is of the order of four thousand cycles or less. However, the reason that the difference in quality between a high note from a violin and the same note from a flute can be recognized is that the harmonic content, overtones, or "timbre" of each is different. These harmonics may extend the actual frequency range of the instrument many, many times, so that in order to retain the original timbre of the sound, it is necessary to both record and reproduce these ultra-audio frequencies. By the same token, one human voice is distinguished from another by the harmonic timbre contained in each.

The new noiseless recording system, or vertical recording, eliminates difficulties in attaining faithful reproduction by correcting the fundamental method upon which to base a complete system of sound reproduction.

Groove Cut

In order to eliminate the possibility of one groove cutting over into the next one, or the breaking down of the side wall, vertical modulation is cut up and down instead of from side to side. This means that on the final pressing, a series of essentially straight grooves vary only in depth. In this way, since the danger of side wall wear has been eliminated, grooves may be spaced closer together allowing a greater length of time to be recorded than on a similar size disc of lateral recording. There has been no need for attenuating the low frequencies, and because of the extraordinary characteristic of the recorder system amplifiers and the cutting machines, the all-important high frequency range is extended several times beyond the highest note of the piano.

For coating the soft wax master in preparation for plating, so as to have "negative" copper masters and stampers, pure gold is "sputtered" on the surface, making an almost perfectly homogeneous base. This gold, substituted for the less expensive, but comparatively granu-

(*Concluded on page 26*)

NORTH AMERICAN BROADCASTING ALLOCATION

By Dr. Alfred N. Goldsmith*

DR. ALFRED N. GOLDSMITH

THE international radio conference recently held at Mexico City has disbanded after agreeing to disagree. The meeting was suspended when it appeared evident that any generally acceptable allocation of frequencies for broadcasting on the North American continent was unlikely. The conference had been called in part to adjust the conflicting claims of Canada, Mexico, the United States, and other countries to specific frequencies in the present broadcasting band or in possible extensions of this 550-1500 cycle band. The conference reached some minor agreements of a helpful nature, but left practically untouched the fundamental problem of assigning broadcasting frequencies equitably and rationally to the various countries involved.

It must be conceded that the problem is indeed a difficult one. On the one hand, the number of channels is limited by physical laws. On the other hand, nations insist upon their sovereignty, which, translated into terms of radio engineering, means the right to utilize the available frequency domains in the space over their territory entirely according to their own needs and desires. The problem is further complicated by the fact that no nation has as yet been able to erect along its border a wave screen against which foreign radiation shall impinge and collapse, unable to enter the forbidden territory. In other words, the nations are alike insistent upon the absolute nature of their rights and equally unable physically to enforce such rights. Under such conditions there seems little hope for any solution save one based exclusively on sound engineering principles, a fair consideration of the rights of all persons wherever located and substantially regardless of nationality, and a willingness to forego political advantage or mere grandiloquent gestures.

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Factors Which Have a Bearing

From the technical viewpoint, the problem of North American allocation can be attacked with some hope of fair success provided the necessary considerable volume of statistics is assembled and systematically analyzed as a prelude to the drawing of conclusions and the formulation of recommendations. It is useless to depend entirely upon general principles for the solution. We can gain many useful hints by considering the electrical disturbance conditions on various frequencies and in various geographical regions. Further hints come from the transmission characteristics of the message waves of various frequencies. The terrain in various parts of North America gives further clues. The population density and the number of local stations in each vicinity add to the available data.

If a group of technicians under the leadership of a competent engineer of broad vision and wide experience were to attack the problem, it is believed that their recommendations would be practical and constructive. Given information on the geographical conditions, the distribution of population, the reception conditions, and other pertinent circumstances over the North American continent (perhaps in the form of specially prepared maps and tables), and given the complementary data on wave propagation, and the local intensity of natural and man-made disturbances, together with other relevant information, it should be possible to formulate a series of general recommendations and specific allocations which, with a minimum disturbance of the existing broadcast structure, would nevertheless give equitable service to the listeners over the entire continent.

A Problem for Those Properly Informed

It is necessary again to emphasize several points. The purely political method of handling these problems is unlikely to be successful in view of the complexity of the technical matters involved and the conflicting claims of various nations. The establishment of a suitable technical group under capable leadership should be carried forward at an early date, preferably by the leading engineering and commercial organizations interested in the orderly solu-

(Concluded on page 26)

In this review, Dr. Goldsmith, Past President of the Institute of Radio Engineers, presents constructive ideas bearing on the widely discussed problem of broadcast frequency allocations in North America.

RECEIVER DESIGN AND DEVELOPMENT

As Affecting Broadcast Allocation Problems

By J. H. Barron

Radio Engineer, Federal Radio Commission

BROADCAST receiver design is directly related to the service available to the listener at any particular location. In order to arrive at a satisfactory solution of interference problems arising before the Federal Radio Commission in connection with applications and hearings, a thorough study has been made of the selectivity characteristics of receivers, with proper weighing of the different types of receivers purchased in order to determine a selectivity curve representing what is believed to be an approximate average receiving set. Upon such basis a dividing line between objectionable and unobjectionable interference was determined upon.

Fig. 1 indicates the necessary ratio between the desired and undesired signals for all frequency separations between 0 to 40 kilocycles. These curves are not extended beyond the 40 kilocycle limit due to the fact that a study of receivers and other factors, substantiated in practice, has proven that a frequency separation of 50 kilocycles is the maximum necessary to avoid objectionable interference to receivers of average selectivity characteristics provided the transmitters of the stations involved are suitably located; that is, in an area not too heavily populated within a few miles of high power transmitters. (The so-called "blanket area.") This 50-kilocycle separation between local stations has been applied and found to permit of satisfactory service in many cities particularly those large cities such as New York and Chicago, where many stations operate simultaneously with other stations the frequencies of which differ by but 50 kilocycles.

Stations operating on frequencies differing by 40 kilocycles or less must have ample geographical separation to prevent unnecessary interference and permit each station to serve satisfactorily its normal service area. The ratios required are shown as ordinates and the frequency difference as abscissae. This curve indicates a number of ratios necessary for certain types of operation for stations operating on the same or the approximate frequency. However, the scope of this article does not include a discussion of interference between stations assigned to the same frequency. Attention is therefore directed to the curves lying between 10 kilocycles and 40 kilocycles. It will be noted that four curves are shown. The dotted curve D B indicates the selectivity characteristics of the average receiver used as a reference. Curves A E B and D F B indicate the limits to which this average curve is modified as applied to particular allocation problems, further discussion of which will be made later. Curve I B indicates a highly selective 1931 receiver of the superheterodyne type. Upon inspection, it will be seen that this receiver is considerably more selective than the average receiver.

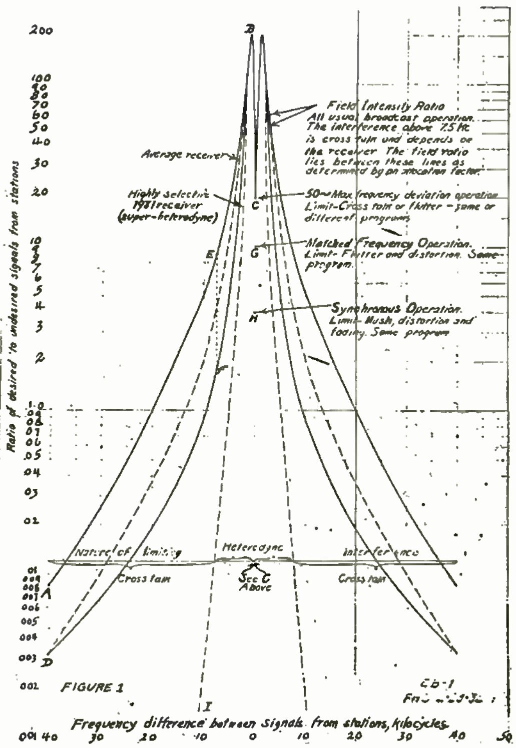


Fig. 1. Interference spectrum between broadcast stations.

As clearly disclosed in this timely paper the allocation of broadcast facilities must be based on existing receivers in use and not on the most modern equipment available.

Allocation Factor Adopted

In order to obtain a workable set of figures, it was found necessary to adopt an allocation factor to be applied as a modification to the receiver selectivity curve when applied to a specific problem. Fig. 2, Curve 2, shows this allocation factor plotted against what is termed the "nuisance radius" of the station in miles. Curve 1 is an allocation factor applicable to allocation problems involving stations operating on the same frequency which, as before mentioned, is not considered herein. The "nuisance radius" means the distance at which an arbitrary amount of interference is to be expected.

This allocation factor was necessary because of the numerous factors involved in the tuning and design of radio receivers, some of which are as follows:

1. The *average* field intensity over any limited area or territory is considerably less than the *maximum* in the same area and as interference is determined by maximum signals allowances must be made so as to protect all receiving sets throughout the area.

2. The average broadcast listener does not tune his receiving set so as to obtain the maximum selectivity of the set; therefore, due allowance must be made for this.

3. The average antenna of a broadcast receiver has certain undetermined directivity characteristics for which allowance must be made.

4. The average selectivity of receiving sets is greater on weak signals than on strong signals and therefore compensation must be made for this.

5. The average broadcast listener tuning a weak signal uses more care than when tuning a strong signal and therefore obtains nearer the maximum selectivity capabilities of the receiver on weak signals.

6. The general noise level is higher when listening to weak signals than strong signals and therefore the standard of reception is lower on distant reception.

7. The fading and inconsistency of signals as the distance becomes greater make it possible to materially reduce the ratio with distance and still make an engineeringly or eonomically sound allocation.

8. As the distance becomes greater between stations the principle of the number of listeners receiving improved service by adding more stations to the number of listeners deprived of service must be considered in any sound plan of allocation.

All of these factors are combined to produce the allocation factor shown in Fig. 2.

Referring again to Fig. 1, for purposes of broadcast allocation, it is required that the ordinate be plotted in the ratio of desired to undesired signals for convenience and rapid reference, rather than the usual type of receiver selectivity curve wherein the input at resonance is compared with the input to the setting off resonance required to produce the same loudspeaker output. The figures obtained from the curve in Fig. 1 may be converted to this system by dividing 20 by the signal strength ratio obtained from the curve, 20 to 1 being the ratio adopted for avoiding interference between stations operating on the same frequency. It will be seen that Curve I B representing the highly selective superheterodyne shows that this receiver is many more times selective than the average receiver and has a greater selectivity at 10 kilocycles separation than the average receiver has at 40 kilocycles. If all receiving sets had this approximate selectivity, there would be a great reduction in the crosstalk interference noted. However, the Federal Radio Commission has no jurisdiction over radio receivers and therefore cannot require the usage of more selective apparatus. It must base its findings of interference upon an assumed average receiver.

Performance of Average Receiver

It is therefore apparent that the average receiver selected is not capable of separating stations which are operating on adjacent frequencies and which are received with the approximate same signal intensity. The fact that the Commission receives many letters from the public complaining of this type of interference indicates that there are many receivers in use which do not have such selectivity, and therefore deserve consideration.

The trend of receiver design in the past year has apparently been towards the development of receivers capable of high quality audio output combined with greatly improved automatic volume control which will smooth out the most extreme fading in 90 per cent or more of the areas wherein listeners must depend entirely upon such service. As far as the selectivity characteristic goes it appears that a satisfactory limit has been reached beyond which it is not necessary to proceed. Many of the medium priced receivers on the market today will tune out a powerful station, the transmitter of which is located within a few miles, and receive satisfactory weak signals from stations operating on the next channel.

Some receivers have been designed which in fact are unnecessarily selective, resulting in non-uniform reproduction of the audio band, resulting in a loss of the high frequencies contained in music and voice which are so necessary to obtain good fidelity. On the other hand, the past year has seen many receivers placed on the market, large numbers of which were sold at an extremely low price, which do not have a selectivity characteristic as good as the average receiver determined upon. The use of such receivers has, in many cases, been disappointing to the purchaser, requiring that their use be confined to the reception of local stations and in some cases these receivers are not even capable of satisfactorily separating such stations.

Some criticism has been expressed that the average receiver characteristics selected are much too mediocre, but an analysis of the mail received by the Commission and reports received from the field personnel indicate that there are still large numbers of receivers in operation which are less selective than the assumed average. The allocation of broadcast facilities must be based on existing receivers in use and not on the most modern equipment available.

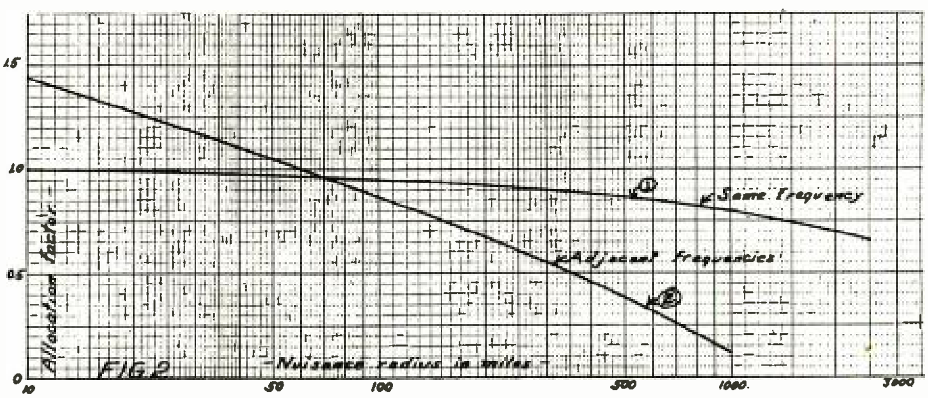


FIG. 2.

ALLOCATION FACTOR FOR BROADCAST STATIONS

Multiply the average receiver selectivity ratio (see Fig. 1) by these factors to obtain the average field intensity ratio that must exist between the desired and undesired stations.

J. V. L. Hogan Talks About

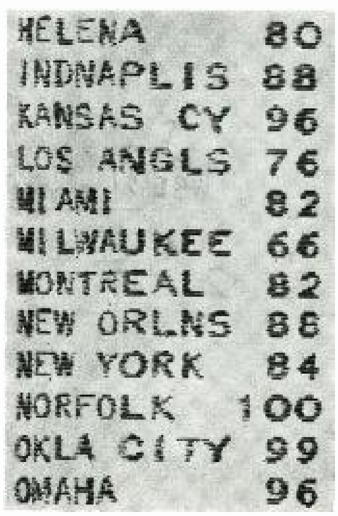
VISUAL

At the eleventh annual convention of the National Association of Broadcasters held at White Sulphur Springs, Va., recently, J. V. L. Hogan, well-known consulting engineer of New York, discussed the now important subject of visual broadcasting, as developed in his laboratories. In his address Mr. Hogan said, in part:

"WE should begin by considering what visual broadcasting comprises. Broadly, it simply means the distribution, by radio, of entertainment and information that reaches the brain and the emotions through the eye of the distant observer rather than through his ear. There are at least four types of visual broadcasting. First we may take television, which presents transient images that are capable of motion, as in the moving picture. I emphasize the transient nature of the pictures, for television requires the attention of the observer if he is to get anything appreciable from it. When the television transmission is ended, the pictures vanish. Nothing is left for the observer except his recollection of what he has seen.

"Second, let us consider facsimile, or still picture transmission. It cannot give the illusion of motion or living sight, as does television, and what it produces are pictures or text that are obvious copies of some original picture or text. On the other hand, this form of visual broadcasting has a number of highly advantageous characteristics. One is that its use in the home or school does not require the constant attention or even the presence of the observer, for the text that the receiver writes out or the pictures that it draws may be allowed to accumulate and looked over at any convenient time. Again, it leaves with each observer a permanent record of what has been received, and these recorded pictures or messages may be kept for any future reference or use. Further, and in common with television, facsimile is not limited in the scope of its material. Pictures of all sorts may be reproduced; display text, handwriting, types of various sizes and forms may be used.

"Let me say a few words as to the possibilities of competition between the new arts of practical visual broadcasting and the now-well-established art of aural or sound broadcasting. The basis for such competition does exist, both as to television and as to facsimile. If television should develop independently of sound broadcasting, it could stand on its own feet by relying upon "titles" for explanations much as did the old silent movies. If facsimile broadcasting should be developed independently of sound, it would have an even better chance than television to work out its own salvation in its own way. That is because facsimile provides text and pictures which may be entertaining or instructive in themselves and without the aid of any sound accompaniments. Illustrated books, magazines and newspapers do not require sound in order to serve their purposes, and in somewhat the same way it is possible for facsimile to make its way alone.



Specimen of letters and numerals as received.

"There is, however, an important reason why broadcasters should themselves foster the growth of visual broadcasting rather than allow the services to grow up without their interest and guidance. This is because the visual and sound services are in fact complementary, one to the other, and both are of maximum service and value when they are coordinated.

"Present-day sound broadcasting needs an accompanying facsimile service for at least the following items:

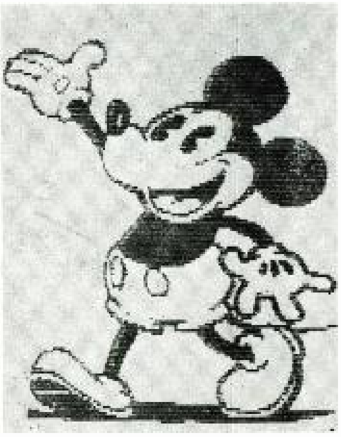
"(a) To illustrate various talks which can thus be made shorter and more emphatic.

"(b) To record recipes and save the listener from hunting a pencil and writing laboriously from the speaker's dictation.

"(c) To supply written quotations, weather reports, etc., which are easily confused when received by sound alone.

"(d) To provide a definitely meas-

Specimen suggestive of diagram and sketch transmission.



BROADCASTING

urable index of station coverage and programme popularity.

"Similarly, I should point out that the facsimile service needs a coordinated sound service. This is largely because simple home facsimile apparatus will handle only from thirty to sixty words per minute, and it takes too long to tell more than the high spots of a story in recorded text. Thus the sound programme can carry four or more times as much information in the same time, but the facsimile recorder can keep up with it by running essential topical notes, memoranda and illustrations. As with sound and television, though for different reasons, the combination of sound and facsimile gives a service of far greater value than either alone.

"For a good many years, facsimile broadcasting has been possible, and point-to-point picture transmission services have been available. However, the terminal apparatus has been complicated and costly, and its operation has required considerable attention and skill. From other angles also, the systems would be expected to have little public appeal.

"Several years ago I set down a series of requirements which I felt should be met by any facsimile reproducer that would be satisfactory for the home end of a broadcasting system. These requirements are:

"1. Simplicity of design permitting sale at a price level approximating that of broadcast receivers.

"2. Simplicity of operation permitting unskilled users to handle the device, and allowing it to run for long periods without attention.

"3. Recorded pictures and text on plain paper, avoiding the nuisance and expense of photographic processes.

"4. Visible recording, so that the user can be sure at all times that his receiving conditions are correct.

"5. Continuous paper feed, so that it is not necessary to reload the machine for each picture.

"6. Inked recording, for permanence and ease of handling of the resulting pictures.

"7. High speed of operation, so that long waits for finished pictures are not necessary.

Specimen of facsimile broadcast reception.

"8. Adequate detail of reproduction to carry text at telegraphic speeds.

"We set to work on the solution of these problems, and, I am glad to report, have succeeded in meeting each of the eight requirements. As in everything else, further improvement is possible. Nevertheless, we believe that we have today the transmitting and receiving apparatus that will support an acceptable facsimile broadcasting service.

"We have chosen a balance between speed and refinement of detail which seems to meet most situations, namely, a paper speed of about ten square inches per minute with a resolution that reproduces clearly from five to eight letters per linear inch. This gives a text speed from thirty to sixty words per minute, the lower speed having of course the maximum legibility. Any other balance between these factors might be selected, and it may be desirable to provide for normal operation at either of two speeds, one for fast, sketchy reproduction and the other for subjects in which higher detail is useful.

"Our paper is fed from a continuous roll and is about 3½ inches wide, the picture or text line itself covering a 3-inch width. There are some advantages in using a six-inch or even a nine-inch width, but the approximation of a single newspaper column, provided by the three-inch paper has met with a good deal of favor.

"The recorder is operated from an ordinary radio receiver working through a simple coupling unit. The modulation-band requirements are substantially less than for the transmission of sound, and the home user may switch his receiver back and forth between the loudspeaker for sound reception and the "Radio-pen" for pictures. Better yet, for he thus gets a more nearly complete service, he may supplement his every day broadcast receiver with a somewhat simpler second receiver for simultaneous operation of his facsimile recorder.

"There are no wave channels assigned exclusively to facsimile services today, so far as I know. Point-to-point fac-

(Concluded on page 30)

Notes on PROPAGATION OF ULTRA-SHORT WAVES

By L. C. Sigmon*

Mr. Sigmon reports on the results obtained in 56 mc. tests in the metropolitan district of Boston. Stationary, automobile and airplane reception was experimented with.

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ULTRA-HIGH frequency radio equipment was installed recently atop the United Shoe Machinery Building located at High and Federal Streets, Boston, Mass. (second highest building in Boston at that time, 340 feet above sea level).

The purpose of the 56 megacycles tests was to study the usefulness and characteristics of ultra-high frequencies in a metropolitan area. These tests were carried on over a period of months and under varied conditions.

The equipment consisted of an ultra-high frequency transmitter capable of a high percentage of modulation, and so constructed as to vary the carrier power output from approximately five to twenty-five watts. The audio amplifier feeding the modulator tube was of the resistance-coupled type. A one-thousand cycle oscillator was used to modulate the transmitter. This was to give a steady tone for the purpose of determining variation in signal level. Fig. 1 is a picture of the ultra-high frequency transmitter. Fig. 2 shows the audio amplifier and one of the receivers used on top of the building.

The antenna consisted of two half-wave copper rods fed at the center as shown in Fig. 3. The antenna itself was constructed on a 2" x 4" support in order that it might be tried in various positions. The vertical position of the antenna was found in the first week of the tests to give much better results, an increase of several decibels over the horizontal position.

The transmitting equipment was located in a room at the top of the building, and the antenna was supported partly by the flagpole as shown in Figs. 1 and 5. This gave unobstructed radiation in all directions.

Sigmon Laboratories.

Fixed and Mobile Reception

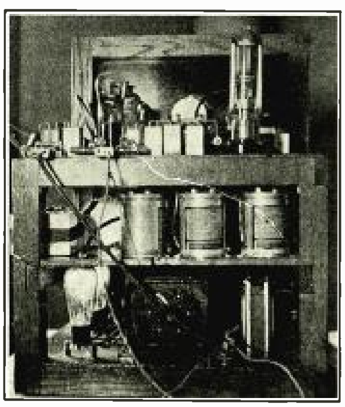
An ultra-short wave receiver was installed in an automobile with an output meter to determine radiation characteristics. This setup was used most in determining signal strength at various locations. Other receivers were installed at fixed points away from the transmitter to check the signal. The receivers used in the tests were of the superheterodyne and super-regenerative types.

Reception of amateur signals was almost impossible during the week days because of a very high noise level. The noise was caused by electrical devices within the shoe building. When this interference was not encountered receiving conditions were ideal, and checked very closely with transmission results.

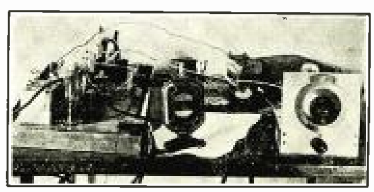
Fig. 4 shows the variation in ground elevation above sea level. This was plotted in three directions on a straight line from the transmitter as indicated by the three projecting lines in Fig. 5 (a), (b), and (c). The formula to determine visibility was also checked against results. The formula being

$$X = 1.32\sqrt{h}$$

X = distance in miles, h = height in feet. According to the formula, and if ultra-high frequencies follow optical ranges, the limit of transmission should be approximately twenty-five miles at sea level. The greatest distance actually checked was twenty and three-quarter miles, air line from the transmitter. A very strong signal was received at that point.



At left: Fig. 1. Makeup of ultra-high frequency transmitter.



At right: Fig. 2. Audio amplifier and one of the receivers used on top of the building.

From these results it would indicate the signal checked fairly close to the above formula. The shaded lines in Fig. 4 (c) and (b) show a decrease in signal strength, and at some points within the shaded lines it was impossible to detect the signal at all. This would lead one to believe the wave is diffused in a manner very similar to light striking an object.

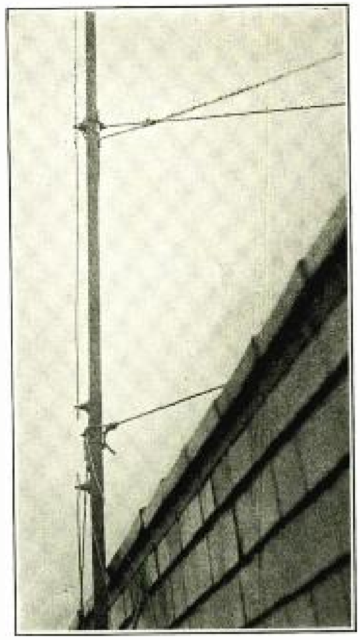


Fig. 3. Antenna and its support. Two half-wave copper rods fed at the center.

Effect of Fog and Mist

In varying the transmitter's carrier power output from a few watts to approximately twenty-five watts no noticeable difference in signal strength was found on a clear day. However, a peculiar thing noticed was the variation in signal strength in a heavy fog and on a misty day. The signal strength dropped several decibels under such conditions, and an increase in carrier power was then very effective. The effect noticed varied considerably with the density of the atmosphere, and the distance the receiver was from the transmitter. This particular effect proved most interesting during the tests.

Several flight tests were made with an airplane. The plane was equipped with a small transmitter and receiver for the tests. It was found that the reception of the signal from the plane's transmitter decreased rapidly as the plane descended below 1,000 feet. The reception being from the penthouse of the shoe building.

Other tests were made to determine the effect of buildings on reception. These tests were made in an automobile. The signal strength varied considerably as the car was driven in the congested streets of Boston, but very few places were found where the signal was entirely lost.

This is remarkable, but in keeping with tests made in other areas where there appeared to be absorption factors likely to seriously limit reception. Actually, when a spot is encountered where reception is not practicable a shift of the car in almost any direction, even if but a few yards, results in reestablishing operating conditions.

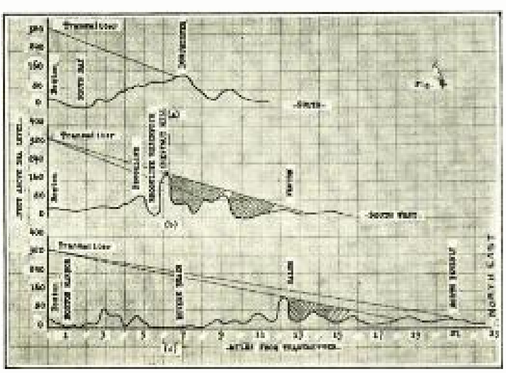
As might have been anticipated, the reception of signals from amateur station sources was not practicable during hours when household, store and factory electrical services were in operation. The noise level incident to these devices prohibits reception except in the early morning and on Sunday.

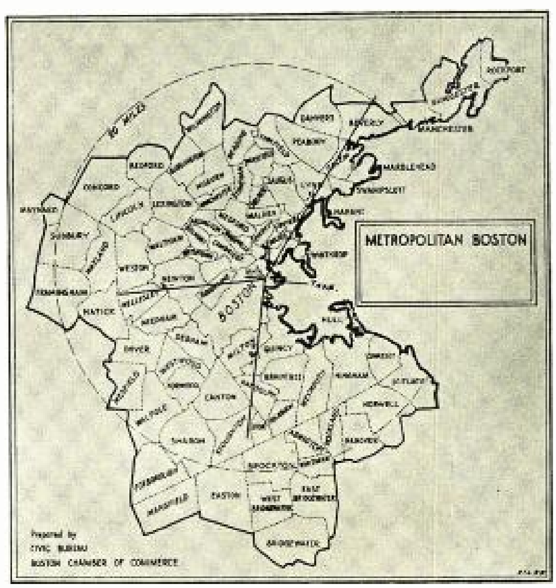
Although the greatest distance at which reception was actually checked was twenty and three-quarters miles, obviously there are points beyond this at which the signals would be found to be commercial, as the signal at the outer limit of the tests was quite strong.

The author wishes to express his appreciation for the coöperation of the United Shoe Machinery Co., Incorporated, W. B. Gagnebin, and the Short Wave and Television Company.

At right: Fig. 5. Map of area covered and directions in which tests were made.

Below: Fig. 4. Chart showing range and signal strength.





Dr. A. N. Goldsmith Discusses

CONDITIONS NECESSARY FOR AN

In a timely paper presented at the Rochester, N. Y., meeting (Oct. 13-15) of the Institute of Radio Engineers, Dr. A. N. Goldsmith, consulting engineer, New York, discussed various requirements for what might be termed ideal radio reception. It is Dr. Goldsmith's view that any plan for the progressive improvement in the quality of reception should be an undertaking of a co-ordinating committee made up of representatives of all groups concerned.

Among the factors discussed by Dr. Goldsmith are those set forth herewith.

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"IN his laudable attempts to improve the fidelity of broadcast receivers, the experimenter has occasionally concentrated on the thought that the best possible receiver was that having the highest overall fidelity. On this theory the wider the band of audio frequencies accurately reproduced, the better the receiver and, as a result, the more pleased would be the listener. It is taken for granted in this discussion that what may be crudely termed the "goodness" of a receiver is measured by the satisfaction which it will give to the listener, acceptable programs being assumed. In the strictly scientific sense the best receiver is, of course, that approaching the scientific ideal of perfect fidelity; but under existing conditions the goodness of a receiver must be judged by the engineer as being a measure of the adaptation of the receiver to the conditions encountered, using as a criterion the production of the greatest possible listener satisfaction. More specifically, the engineer cannot accept in advance the viewpoint that the best receiver under all conditions is the receiver having maximum fidelity.

Conditions for High Fidelity

"To cover the question definitely, there will be outlined in the following a number of conditions precedent to the successful utilization of receivers of high fidelity. As a result of this discussion it will become evident that nothing less than an orderly and progressive campaign, over a considerable period of time, would enable the conditions in question to be met. To simplify the problem, let us assume that we desire to reproduce in the home, or rather in the mind of the listener, precisely the impression which would be created were the listener actually present in the studio or concert hall. In other words, there is sought the "illusion of reality." Among the necessary conditions for the attainment of this illusion are the following:

"(1) It is assumed that the transmitter will be free from obviously objectionable and eliminable results of incorrect design and unsatisfactory operation. For example, there must not be present in the modulation of the transmitting station hum of an amount either audible at the receiving station or capable of modifying injuriously the quality of the received music. Noise modulation, resulting from circuit conditions or from studio noise and the like should be avoided, particularly since high-fidelity reception discloses the existence of corresponding defects in an obvious fashion.

"(2) The overall audio-frequency characteristic of the transmitting station should be flat over the entire range of audible frequencies to within the minimum noticeable deviation (say, 1 db.). That is, the envelope of the modulated carrier wave should be identical, so far as frequency response is concerned, with the waveform of the sound impinging on the studio microphone. Parenthetically it may be stated that the type of microphone required, the placing of the microphone or microphones in the studio, and the audio characteristics of the studio itself cannot at this time be quantitatively and exactly defined for maximum fidelity of pickup and the best "illusion of reality" to the listener in the home. The microphone response, the audio-frequency amplifier response, the impartiality of the modulation method toward modulation of all audio frequencies, and the capability of the antenna system of radiating the carrier and the full sidebands without noticeable attenuation of the edges of the latter are all involved in meeting accurately the condition referred to herein.

"(3) The transmitter must not introduce objectionable amounts of harmonic components into the audio-frequency modulation. That is, if a fundamentally pure tone excites the microphone, the envelope of the radiated wave should contain only this tone or, at worst, harmonic components of only negligible amplitude. As a general rule, in terms of good current practice, harmonic distortion (expressed in terms of the total harmonics spuriously produced) should be limited to a few per cent.

Circuit Elements

"(4) It should also be remembered that a transmitter may initially meet the preceding requirements and yet, after a period of time, no longer deliver an identically high fidelity output. Various circuit elements, such as transformer cores, grid leak resistors, vacuum tubes and the like are not permanent and invariable devices. Accordingly, transmitters must be not only adjusted to high fidelity initially but, if high fidelity receivers are to be advantageously used, transmitters must also be systematically and rigidly maintained in their optimum operating condition.

"(5) In view of the inevitable presence of receiver noise arising from such causes as irregular leakage currents, and the "shot effect" or the discontinuous nature of an electric current (which, strictly speaking, is, of course, an electron current), it is found that the field strength of the signal, the antenna dimensions, the coupling of the antenna to the receiver, and the amount of radio-frequency amplification must all be so related that no audible background noise exists when the unmodulated carrier is radiated and received (assuming, of course, the absence of any audible amount of static). Quantitatively this requirement does not necessitate as high field strengths as are required in view of the next considerations to be mentioned.

"(6) Natural and man-made disturbances of reception should be absent. The greater the fidelity of the

INCREASE IN USABLE RECEIVER FIDELITY

receiving set, the more rigorously must this requirement be fulfilled. It is well known that the acoustic spectrum of music or speech shows relatively little energy radiated in the higher audio frequencies. On the other hand, the abrupt disturbances corresponding to static of most types have a relatively high percentage of their energy in the upper regions of the audio spectrum. Accordingly it is quite possible in the presence of static to receive a more pleasurable if not more accurate signal from weak or distant stations if the receiver is naturally or artificially arranged to be relatively insensitive to the higher audio frequencies. Conversely a high-fidelity receiver tuned to such stations under the mentioned conditions produces a more accurate but relatively unpleasant effect. We thus encounter a natural limitation to the utility of a high-fidelity receiver based on the ratio of the field strength of the receiver signal to the field strength of the random atmospheric disturbances and dependent upon the acoustic quality of each of these.

"This apparent anomaly produces confusing effects in connection with tests of high-fidelity receivers. Unless the fidelity of the transmitter is known, as well as the ratio of the signal field strength to the disturbance field strength, no valid analysis can be made of the reason for the apparent quality of the signal nor can any convincing explanation be offered for the utility or lack of usefulness of a given type of high-fidelity receiver under the specific receiving conditions in question.

Channel Separation

"(7) It is common practice to space telephone broadcasting stations on channels separated by 10,000 cycles. This separation is obviously inconsistent with the requirements of high-fidelity transmission and reception. Assuming the radiation of 15-kilocycle sidebands from a high-fidelity transmitter and the provision of a 5-kilocycle guard band between the outer edge of each side band of a given station and the outer edge of each side band of the nearest adjacent stations on higher and lower frequencies, a channel separation of 35 kilocycles or even more is required. Unless the listener is so situated that a given and desired station has a field strength far greater than the field strength of the stations on the adjacent channels, there is little possibility of successful reception of frequencies above 4,500 cycles approximately, on the basis of the present 10-kilocycle channel separation. As a practical conclusion, if stations become capable of modulating their carriers accurately up to 10,000 or 15,000 cycles, with all that this implies in the way of improvement of equipment and methods of operation (and with the assumption that the Governmental authorities will permit such high-fidelity radiation on the present broadcasting wave lengths), it would even then be necessary to confine the use of high-fidelity receivers to a region in the immediate vicinity of the station wherein the field strength of the desired station signal would far over-ride that of the stations on adjacent channels. Otherwise stated, universal high-fidelity reception is incompatible with 10-kilocycle channel separation. "Side band collision" cannot co-exist with the satisfying use of high fidelity in a receiver.

"(8) The requirement of overall high fidelity in the receiver is of course necessary for accurate audio-frequency reproduction. This implies either that every element in the receiver shall leave unchanged the envelope form of the received wave or alternatively that mutually compensatory effects shall be introduced in the receiver system so that any excessive response toward certain audio frequencies in one part of the receiver shall be balanced by a correspondingly deficient response to the same audio frequencies in another part of the receiver. The term "receiver" in this connection includes the loudspeaker system.

Harmonic Distortion

"(9) The receiver should similarly be free from harmonic distortion due to overloading and non-linear characteristics of the tube circuits. It is to be noted in this connection that the harmonic distortion introduced in the receiver is, roughly speaking, additive to that produced in the transmitter, thus adding to the undesired effect.

"(10) When we enter the realm of sound reproduction through the use of loudspeakers, it is found that a number of outstanding problems remain unsolved. If a single loudspeaker is used in a receiving set, and if the directional characteristics of the loudspeaker for various audio frequencies are not identical, the quality of the reproduction heard by the listener (in the open air) will depend upon his position. In a room the results will be complicated by wall reflections which, in turn, may be selectively favorable toward certain ranges of audio frequencies. A person listening to a loudspeaker which has an exaggeratedly narrow or concentrated directional characteristic for the higher audio frequencies will experience an unpleasantly sharp effect when he sits in the "beam" of the speaker, particularly in a room which has hard walls capable of reflecting to advantage the high frequencies in question. It has been mentioned by numerous listeners that they cannot enjoy radio music of the same loudness as that which they would cheerfully accept from a symphony orchestra in a concert hall. One of the reasons for this discrimination is the nature of loudspeaker radiation into a living room of average acoustic characteristics.

Receivers of high fidelity should be periodically checked to make sure that their fidelity has not been reduced by change in the circuit elements and tubes.

"(11) We are thus led to a consideration of the acoustics of the room in which the broadcast listener receives his programs. In the absence of published data covering exhaustively the optimum living room conditions for most natural reproduction of sound, there is little that can be done beyond pointing out the existence of a problem and the desirability of the systematic investigation aimed at its solution."

Broadcast Transmitter Location

By Lawrence C. F. Horle

In this review of the coverage geography of broadcast stations a well-known radio engineer gives views based on his experience in the radio broadcast field.

IN these days of "new deals" with the appraisal of our institutions and customs on every hand, a critical examination of the pattern of our national radio broadcasting system is in keeping with the spirit of the times. Such an examination, however, reveals comparatively little that justifies any extended criticism or forceful effort for its modification.

There is, however, one anomaly in the organization of our national system of radio broadcasting stations that shouts for notice and for correction. This will be evident to any one who will examine a large scale map of the nation noting the location of the broadcast transmitters with respect to the densely populated areas which they are provided to serve. In all too many cases it will be noted that the transmitting equipment is located so remotely from the nearby audience-area and that the irrational distribution of that most costly form of electrical power—the radiation from the broadcasting transmitter antenna—is to the extent of fifty to seventy-five per cent wasted on areas in which the population density is so low as to justify little consideration in the economic scheme of things. In addition, this power is delivered in such attenuated form to populous areas in which it must compete for attention with many forms of accidental radiation, unavoidable accompaniment of modern electrical adjuncts to community life, as to most seriously reduce the usefulness of the intentional forms of radiated power.

It is probably not important to trace the causes of this absurd arrangement, but it is of interest to note that the broadcaster on the one hand, ambitious for greater power as the obvious means of expanding the area and usefulness of his transmitter and, on the other hand, the listener bent on retaining the serviceability of his relatively non-selective receiving equipment, brought this condition into being. The anomalous removal of the transmitting station from the area it was to serve appears to have been the only tenable position for the governing body to have assumed in the solution of an obviously impossible problem.

Conditions Changing

The justification, if any, for this detail of regulation has long since disappeared in that the broadcaster now knows that it is the medium in which this planet rolls along that is coordinated with the power of his transmitter in determining the range of its operation. The listener has learned that, in the main, the remote transmitter can give him little that his local station cannot supply—unless it be a continuous demonstration of the vagaries of radio transmission—and that, in fact, modern receiving equipment, even that of modest cost, is capable of such selection as to give him the opportunity of hearing all stations that are available to him above the local noise level.

But the wasteful pattern of broadcast station locations appears frozen into immobility through a combination of economic and psychological paralysis and it is now high time that consideration be given to the rationalization of this fallacious arrangement. It will, of course, be argued that even the most selective of the modern receivers is not proof against the irregularities of the modern transmitter when operated at its highest levels. It need only be pointed out that the location of the transmitter at the center of the area which it is to serve and its operation at conservative levels would not only provide far better service in the congested areas that are now only indifferently served, but would also eliminate the transmitter irregularities that are offered as the reasons for the impracticability of this rational arrangement.

Equality for All

Those of legalistic tendencies will, of course, point out that such an arrangement might well violate that fundamental tenet of the radio law which purports to assure equality of opportunity for radio listening to all the people of our land, often alleged as the outstanding characteristic of the present layout of broadcasting stations. While, as a matter of fact, the location of the radio transmitter at the point of highest noise level in a congested community along with the natural and highly desirable continuous attenuation of the signal radially outward from the transmitter, thus paralleling the progressively lower noise level in this direction, is obviously the only sound arrangement to approximate the desired equality of signal effectiveness to such degree as is economically possible.

It must, of course, be admitted that the use of highly directionalized radiators have in the writer's experience been found to be useful in offsetting to a considerable degree the irrational distribution of radiated broadcasting power with respect to the population distribution. But such expedients are merely that, and leave the fundamental unsoundness, both technical and economic, undisturbed.

The complete solution lies in the replacement of many of our broadcasting transmitters to the very hearts of the cities which they now purport to serve; their operation at conservative power levels, with the primary motivation in their operation the desire for highest quality of transmission with the magnitude of the transmitted power of not more than secondary importance.

A Two-Way POLICE RADIO SYSTEM

By John Dunsheath

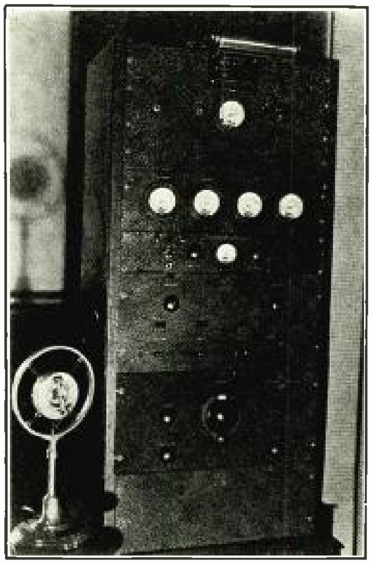


Fig. 1. Five-panel control board at police headquarters for both transmitter and receiver.

IF the engineers who designed the two-way mobile radio system here described desired to learn at the beginning how the system would perform under difficult conditions, they could not have selected a more trying location than Bayonne, New Jersey.

In this city, four miles long by two miles wide, are located the maze of mammoth steel tanks used for storage by the large oil producing companies. The city has its share of steel overhead and underpass bridges, and of high steel buildings. Police patrol cars travel on roadways which wind in and out among steel tanks, high iron guard fences, through underpass bridges and short tunnels and through the business section of the city.

The installation at Bayonne consists of a central headquarters sending and receiving station and ten radio patrol cars equipped for two-way communication with headquarters and with each other. All transmitters and receivers are locked at a frequency of 34,600 k.c. (8.6 meters).

The headquarters transmitter operates at 25 watts output, the patrol car transmitters at 4.5 watts.

The transmitting and receiving equipment at police headquarters are mounted on a five-panel rack. A double button microphone is located on the radio sergeant's desk. A thumb switch provides for instantaneous transfer from "send" to "receive." Incoming transmission from patrol cars is reproduced by a loudspeaker mounted on the wall of the room.

Patrol cars are equipped with small size short wave transmitters, receivers and power supply systems, each housed in separate units. The power supply unit is of the motor-generator type, operating from the regular car 6-volt battery. The control unit and the loudspeaker are mounted on the steering column. No batteries other than the single 6-volt car battery are used. The transmitting antenna on cars is a short steel mast. Receiving antennas in sedans are mounted in the roofs, while in touring cars antennas are under the chassis.

Each car is equipped with a hand mike, each mike fitted with a special rubber mouth-guard to insure satisfactory use even when cars are moving at high speeds.

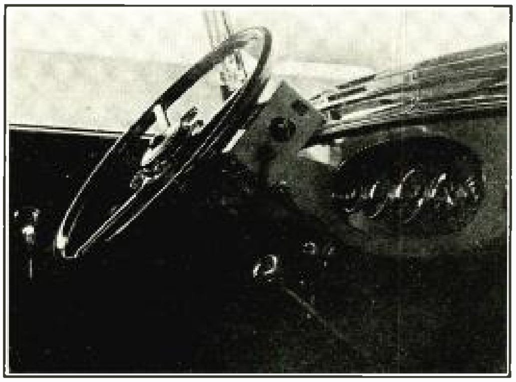
The Bayonne installation has been in service for several weeks and there is no difficulty in communication at all times between headquarters and the cars, and vice versa, and also between any one car and all the others.

Obviously this police radio system experiences no interference from police radio systems operating on 2,400 k.c. (125 meters). Being in the quasi-optical region, the 8.6 meter wavelength employed does not spread far beyond the actual horizon range from the transmitter antennas.

In the occasional instances when a patrol car is shielded in a pocket surrounded by steel tanks, it is practicable for another of the cars to relay to this

At left: Fig. 2. Close-up of one of the police cruisers in operation. The antenna for transmission is shown at the rear, right of the car. The officer at the wheel is talking into the microphone.

Fig. 3. Steering post control unit mounted in position. Contains main power switch, volume control, send-receive switch, microphone jack and loudspeaker.



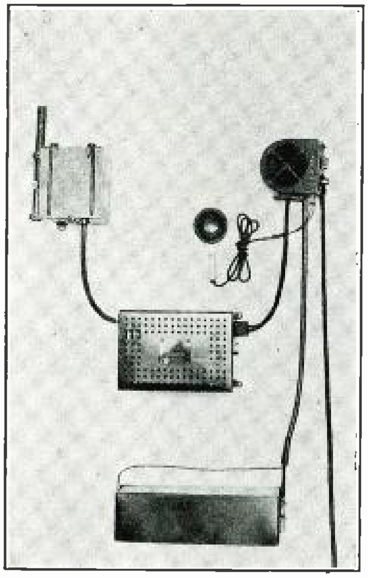


Fig. 4. General view of patrol car radio equipment. The steering post control unit is shown in the upper right. The radio-frequency portion of the transmitter with the antenna is shown in the upper left. The modulator and receiver is shown in the center, and the power supply unit is shown at the bottom. This entire equipment operates from the present car storage battery. The current drain is about 2¼ amperes in the receive position and about 7 amperes in the transmit position.

car information transmitted from headquarters, and in the reverse direction.

At headquarters a forty-foot wooden mast, erected on the top of the headquarters building, supports a simple transmitting antenna, which is a brass rod about eight feet long. In the cars the antenna is a similar rod sticking out of the rumble seat in the case of the two-seater patrol cars, and just above the left fender in the case of the five-passenger squad cars.

Transmitting and receiving radio equipment for police car use must be designed for the purpose. The equipment here described is rugged, and before final design of the various elements was determined upon all possible weakness was eliminated. The result is that the installations in the ten cars so far equipped are, in operation, found to be free from interruptions such as otherwise would be experienced with mechanical and electrical assemblies bounced around over all sorts of road surfaces, at high speeds, and where frequent sudden stoppages are the rule.

With the regular six-volt ignition battery serving as the primary source of power for both transmitter and receiver, economy and low maintenance cost is evident.

Usually police departments are averse to being burdened with facilities which impose possible additional work and responsibilities upon policemen. In the case of this two-way radio police service every member of the force at Bayonne, from the chief down to the probationary patrolmen are enthusiastic about the use of the new facility.

This interesting installation was engineered and installed by the Radio Engineering Laboratories, Long Island City, New York. At the present time the company is engaged in installing similar police radio equipment at Eastchester, N. Y., and at Union City, N. J.

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THE TECHNIQUE OF TRANSCRIPTIONS FOR BROADCAST USE

(*Concluded from page* 14)

lar, graphite used in lateral processing, partly accounts for the almost entire absence of surface noise in the reproductions, and insures complete transfer of the highest frequencies recorded on the wax, invisible even through a microscope.

Expensive cellulose acetate has been found to be ideal as material for commercial disc pressings. It, too, is practically homogeneous and adds its share toward noiseless recording. Originally, acetate was used in thin sheets only for the surface, and laminated with paper pulp, shellac, and other materials to add bulk. Although this construction was superior to the ordinary shellac pressings, and the pressings showed the qualities desired, there were still serious disadvantages and objections to their use. They blistered and warped permanently soon after manufacture, and sometimes actually wore out after only one or two playings. Practically, the laminated laterals merely substituted difficulty with wearing quality and warping for the high noise level of the original shellac.

The World Broadcasting System took advantage of the good qualities of acetate but eliminated the objections by using, for all pressings, solid acetate; pliable, durable, unbreakable, light weight, and possessing all the properties desired from both the engineering and practical standpoints.

The extra cost of gold sputtering and the use of solid acetate is found to be entirely offset by the saving in production cost because of the positive operation of the recording equipment.

The finely balanced vertical pickup stylus pressure on the disc is approximately one-third that of the normal pressure of the lateral reproduction needle. Uncertainty as to whether discs will outwear test playings previous to broadcast has been eliminated, and entirely satisfactory pressings are available which have been played well over a thousand times. It is not necessary to change needles, as permanent jewel styluses are employed.

The equipment is simple and easy to operate, and the characteristics of the reproducing apparatus are matched with the complete system.

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NORTH AMERICAN BROADCAST STATION ALLOCATION

(*Concluded from page* 15)

tion of the problems which have been encountered.

The calling of a further conference to consider frequency allocation in North America is inadvisable until such a technical group shall have prepared its definite plan and such a plan shall have received a good measure of sanction from those directly involved.

And, finally, it should again be stressed that no permanently satisfactory plan is to be expected unless national boundaries, as such, are subordinated to the principle that the men and women residing in every country are entitled to their quota of radio service in accordance with their needs and the physical and commercial possibilities of the situation, and on the basis of an impartial but sympathetic consideration of their needs regardless of their national affiliation. The attempted subordination of physical facts to political theory cannot but be injurious to American broadcasting.

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TALK ON RADIO HISTORY

On the evening of December 6, an address will be delivered to a group of two hundred professional and business men in the auditorium of William Sloane House, 356 West 34th St., New York, on the subject, "The Evolution of Radio." The talk will be delivered by Donald McNicol, past president of the Institute of Radio Engineers, and editor of RADIO ENGINEERING.

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CORRECTION

In the September, 1933, issue of RADIO ENGINEERING, page 23, next to the last paragraph the sentence should read:

"In the case of the y cut crystal the frequency change will be approximately 100 parts in a million per degree Centigrade temperature change and the frequency will increase with an increase of temperature."

This is in the article on crystals by E. H. Rietzke.

A voltage doubling power supply for the cathode ray oscillograph

By C. Bradner Brown*

THE problem of high voltage supply for a cathode ray oscillograph is one that calls for considerable thought on the part of the radio engineer. Most of the newer model tubes such as the Dumont type 34, utilize from 800 to 1,000 volts on the accelerating electrodes with some 200 volts of focusing bias on the Wehnelt cylinder. This necessitates a maximum of 1,200 volts for the operation of the cathode ray tube which forms the basis of the oscillograph.

The percentage of variation in the power supply allowable is quite small as any change in accelerating voltage causes a modulation of the beam with resultant deflections on the screen. This effect is caused by the nature of the accelerating electrode structure which consists of a pair of plates. Thus, the faster the electronic stream travels, the shorter the length of time any one electron is traveling between the deflecting plates and the less the total deflection. Care must be taken therefore that the electron stream travels at practically a constant velocity which in turn demands a constant accelerating voltage. If the focusing voltage to the Wehnelt cylinder changes, the size of the spot on the screen will vary which makes for blurred images and unsatisfactory operation of the tube as an oscillograph.

Chief Engineer, Experimental Division, First National Television Corporation.

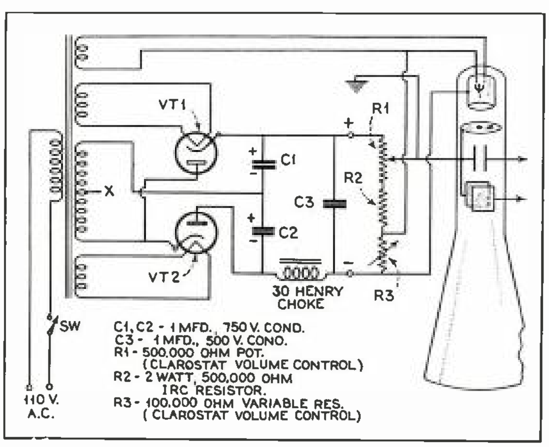

Fig. 1.

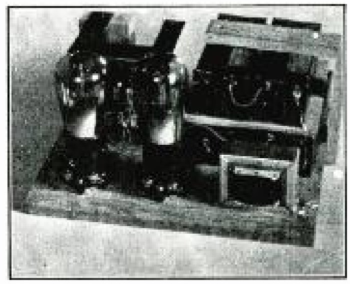

Fig. 2. The experimental set-up of the rectifier-doubler.

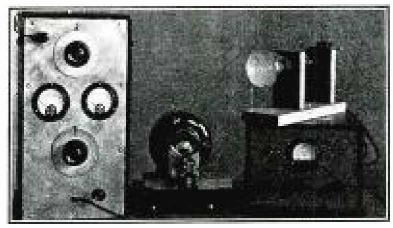

Fig. 3. The complete power supply housed in a wooden cabinet. The a-c. ammeter reads filament current. This equipment is being used by the author to make side-band measurements at W9XAL, the television transmitter of the First National Television Corporation.

Since one of the major advantages of the cathode ray oscillograph is its flexibility and portability, the power supply must be of small size and light weight so as not to interfere with these desirable characteristics.

The power necessary for operation of the tube itself is almost negligible, as the accelerating electrode draws only .2 milliampere which represents a power consumption of .2 watt. The rectifier system must be designed therefore to supply a steady high voltage at a very low current. Full-wave rectification is almost necessary if the filter system is to be limited in size, and the economic aspect of the filter condenser situation practically demands this type of rectification.

A preliminary survey of the conditions which must be satisfied showed that voltage doubling would prove valuable. This is especially true in any case where low current-high voltage supply is necessary. The circuit used is shown in Fig. 1. A low voltage supply transformer feeds a pair of 27's in a doubling circuit. These tubes were chosen because of their small size and low gas content. Furthermore, the cathode could be isolated from the filaments discouraging any local action to the emitting surface during the reverse or back-up cycle. The action of the circuit is as follows:

During one half cycle, current flows through VT-2 to charge condenser C_2. During the other half cycle, current flows from the transformer through VT-1 to charge C_1. The output is taken across the series condensers C_1 and C_2 and is therefore twice the voltage of one. It will be noticed that separate filament supply is necessary for each tube as the cathode of VT-2 is operated at transformer potential. The action of the circuit is quite simple and so long as the current drain is low, the regulation will be excellent. The output will be full wave and twice the voltage of a single half wave supply. The transformer must be fairly well insulated and condensers C_1 and C_2 must withstand the peak voltage of a half wave, at the transformer potential.

(*Concluded on page* 30)

The decibel and its uses

By D. C. McGalliard*

PROBABLY no other technical term in talking motion picture work is so frequently used and so little understood by the non-technical man as is the unit by which sound intensity is measured—the decibel. To the technical man accustomed to electrical units and mathematics, it presents little difficulty, but to others it is apt to be confusing, not because it is complicated but because little has been written concerning it for the non-technical man.

The word "decibel" (abbreviated "db.") was formed by combining "deci," meaning one-tenth, with "bel," the fundamental unit named in honor of Dr. Alexander Bell, the inventor of the telephone. It is the direct outgrowth of communication engineering practices and meets the need for a unit by means of which one amount of energy, which may be either in the form of electricity or sound, can be compared to another. In making such a comparison, we could say, for instance, that one energy is twice as great, ten times, a thousand times, or a hundred million times as great as another. Such large numbers are obviously inconvenient to use. For instance, the energy of the loudest sound the human ear can tolerate is greater than the energy of the faintest sound the ear can detect by several million million times. A more simple system of working with these large numbers is therefore desirable. The decibel furnishes such a system.

The Ear's Response

Before discussing the matter further, it will be helpful to consider briefly how the ear responds to sounds of different intensities. That the human ear is a remarkable mechanism is apparent from the figures given above. The reason for the peculiar ability of the ear to handle such wide ranges of sound energy is that the impression of intensity is, fortunately, not directly proportional to the amount of sound energy reaching the ear. What is meant by this can perhaps best be illustrated by considering two glass water tumblers of about the same capacity, one the conventional cylindrical tumbler, and the other shaped like a funnel or an inverted cone. If we now fill these tumblers with water a spoonful at a time, the level of the water in the cylindrical one will rise by the same amount each time a spoonful is added. The level of the water in the funnel-shaped tumbler, however, will rise very rapidly at first, but as it becomes more nearly filled the increase in level resulting from the addition of a spoonful can scarcely be noticed.

The human ear responds to sound in much the same way as the water level in the funnel-shaped tumbler does to water. As the sound energy is increased in equal amounts, the added sensation of intensity (loudness) resulting from these increases becomes less and less. If, however, each time the sound energy is changed it is increased by the same percentage of its previous value, the result will be equal increases in the sensation, that is, it will appear to get louder in equal steps. This is indeed a wise provision of nature since it makes the ear sensitive to weak sounds and at the same time protects it from the loud sounds. It is important that this principle be constantly kept in mind, as it will be of considerable aid in obtaining a clear understanding of the subject.

Without going into the mathematics of the subject, let us examine the following table of numbers:

Column A (Ratios)	Column B (Bels)	Column C (Decibels)
1	0	0
10	1	10
100	2	20
1,000	3	30
10,000	4	40
100,000	5	50
1,000,000	6	60

A brief consideration of these figures makes it evident that there is a definite relation between the figures in these three columns. The figures in Column B obviously represent the number of times the number 10 must be multiplied by itself to give the larger figures shown in Column A. The figures in Column C are ten times the corresponding figures in Column B. Since there is this definite relation between Columns B or C and Column A, evidently we can make unnecessary the handling of the large numbers shown in Column A if we work with the figures in Columns B or C instead.

If now we consider Columns A, B and C, not as simple figures but as power ratios, bels and decibels, respectively, the relationship involved is apparent. By "power ratio" we mean the number of times the larger of the two powers being compared is greater than the smaller. Thus, if we are comparing a power of 2 watts with one of 20 watts, the power ratio is

$$\frac{20}{2} = 10.$$

Aside from avoiding the handling of large numbers, there is another advantage, perhaps even more important, in using bels or decibels in Columns B or C instead of the power ratios in Column A. In combining two power ratios, we must multiply or divide them, whereas the corresponding bels or decibels need only be added or subtracted. For example, if one amplifier increases the sound energy 100 times and a second amplifier takes the output from the first one and increases it 10,000 times, the total increase has been 100 x 10,000 = 1,000,000 times. From the table we see that power ratios of 100, 10,000 and 1,000,000 correspond respectively to 20, 40 and 60 decibels. It is evident therefore that the total increase could have been figured much easier by simply adding the decibels corresponding to 100 and 10,000 $(20 + 40 = 60)$ and then referring to Column A for the answer. Unfortunately in actual practice power ratios do not often come out round fig-

In this directly useful article Mr. McGalliard explains the working of the decibel in language understandable to projectionists and public-address technicians.

*Instruction Manager, Electrical Research Products, Inc.

ures such as 100 or 10,000 as used in the example given; they are much more likely to be uneven figures, such as 96 or 9,585. The advantages of using decibels are usually much greater, therefore, than would appear from the example given, and by their use we are enabled to greatly simplify many calculations which would otherwise be very tedious.

There are two principal uses of the decibel:

1. To compare one sound intensity to another. For instance, if the energy of one sound is one hundred times as great as another, we say that the first sound is 2 bels, or 20 decibels, greater than the second. Thus, if the output of an amplifier is 6 watts, while the input is .06 watt, a power ratio of $\frac{6}{.06}$ or 100 to 1, we say that the amplification, or "gain" of the amplifier, is 20 decibels.

2. To measure the absolute value of sound energy by comparing it to some generally accepted standard energy value, either implied or expressed.

For comparison purposes, acoustic experts usually refer sound intensities to "minimum audibility." "Minimum audibility," or "threshold of hearing," as it is sometimes called, may be defined as the weakest sound which can be heard under absolutely quiet conditions. The power of such a weak sound is inconceivably small, being only of the order of one ten thousand millionth of a microwatt (a microwatt is a millionth of a watt)—another indication of the sensitivity of the ear.

Thus, when the acoustic engineer refers to a sound as having an intensity of 50 decibels, the statement is actually incomplete; it should be said that the intensity is "50 db. above minimum audibility," or "50 db. above the threshold of hearing," or, simply, "50 db. above threshold."

"Minimum audibility" is much too small to be used as a reference intensity for relatively loud sounds, such as those coming from the ordinary loudspeaker. Another reference intensity generally known as "zero level" has, therefore, been generally adopted by communication and sound engineers. An idea of the intensity of sound at "zero level" may be had if it is remembered that speech from a telephone receiver held tightly against the ear is about zero level when it is just too loud to be comfortable.

Engineers have agreed that, expressed in electrical power, this "zero level" should be taken as .006 watt. Thus, compared to "zero level" of .006 watt, the 6 watt output of the amplifier mentioned under (1) above would correspond to a power ratio of $\frac{6}{.006}$ or a ratio of 1,000 to one. From the table it is seen that this ratio represents 30 decibels. Hence it is said that the output level of the amplifier is 30 decibels above zero level or, simply, 30 decibels. Just as room temperature is commonly expressed as, say, 70 degrees without specifying that it is 70 degrees *above zero,* sound engineers commonly refer to the output of an amplifier as being, say, 30 decibels without specifying that they mean 30 decibels *above zero level.*

Care should be taken not to confuse the output level of the amplifier with the gain of the amplifier referred to under (1). Each is commonly expressed in decibels, although as explained the output level should, strictly speaking, be expressed as decibels above zero level. Thus, while the *output level* of this amplifier is 30 decibels (above zero level), its *gain* is only 20 decibels, as figured above. This will be more readily understood when it is considered that the input (.06 watt) is already 10 decibels above zero level. This is figured from the power ratio of $\frac{.06 \text{ watt}}{\text{zero level}}$ or $\frac{.06}{.006}$ or 10 to 1, which, from the table, corresponds to 10 decibels. If the input of 10 decibels above zero level is increased by the 20 decibel gain of the amplifier, the output level will, of course, be 30 decibels above zero level. This is also in accordance with what we said earlier about the addition and subtraction of decibels.

The table given shows the approximate power ratios corresponding to from 1 to 30 decibels. There are two convenient relations to remember in dealing with decibels. The first of these is that ten decibels correspond *exactly* to a tenfold change in power. The second relation to be remembered is that in order to make a sound louder by 3 decibels it is necessary to *approximately* double its power. What this means can be more easily pictured when you consider that if the Niagara Falls power plant output were in the form of sound energy, it would be necessary to construct another power plant of the same capacity in order to increase the sound output by 3 decibels. In the same way for 6 decibels increase, the power would have to be about four times as great, for 9 decibels about eight times as great, and so on.

Power Ratios	*Decibels*
1.25	1
1.6	2
2.0	3
2.5	4
3.2	5
4.0	6
5.0	7
6.3	8
8.	9
10	10
100.	20
1,000.	30

One cannot learn to drive an automobile by reading the instruction book. The same is true in studying the use of the decibel; it is necessary to actually apply the principles outlined to specific problems before they will be thoroughly understood. It is suggested, therefore, that the reader take advantage of any opportunities which may arise to to make practical applications of the tables and explanations given. A little practice along these lines will convince him that the decibel is an extremely simple and useful unit.

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C. M. JANSKY ELECTED PRESIDENT OF I. R. E.

At the November meeting in New York, of the Institute of Radio Engineers, President L. M. Hull, announced the result of the recently conducted election of officers for the year 1934.

These are: For President, C. M. Jansky, Jr.; Vice President, B. Van Der Pol, Jr., and to fill vacancies for directors, A. N. Goldsmith, Arthur Bacheller and William Wilson.

BOOK REVIEW

Short Wave Wireless Communication, by A. W. Ladner and C. R. Stoner, 348 pp. Cloth. John Wiley & Sons, Inc., publishers, New York. Price, $3.50.

Here is a timely book that will be of real value to professional communication engineers in all radio services, as well as to the amateur short-wave enthusiast. The book contains a history of short-wave radio development; theoretical engineering and technical material, and twelve chapters dealing with the practical problems of short-wave signaling, both telephone and telegraph. There is a chapter on ultra-short waves which contains useful information on this subject of present importance.

Although the book is technical in nature, it is so well and clearly written and so well illustrated with diagrams that it will be a valuable addition to any engineer's or experimenter's library.

Important Advances in AIRCRAFT PLANE-GROUND COMMUNICATION

THE influence of aviation on radio is emphasized in three important inventions and developments in recent months, including a device to enable the ground operator to talk with a plane by dialing the right wavelength, and an installation to change the ground station from one wavelength to another instantaneously, eliminating a twenty minute delay previously required for a manual changeover, and the latest development, a device which results in the airport transmitter sending out words of uniform volume, whether they are whispered or shouted into the microphone, thus insuring a proper reception by the pilot aloft.

United Air Lines, which announced the above improvements, tells an interesting story of the importance of radio to aviation.

Space and weight are precious commodities in aviation, and air transport operators jealously guard against any undue encroachment on the payload of the airplane. This factor blocked the use of wireless telegraphy which required a special radio operator aboard the plane to transmit and receive the code signals. Further, code wasn't speedy enough for aviation's purposes.

Communications engineers of United Air Lines, operator of the New York-Chicago-Pacific Coast and other mail-passenger airways, pioneered the field of two-way plane-ground radio telephony in 1927 when they began the development of an experimental apparatus that proved successful. In cooperation with the government and equipment manufacturers, this was perfected and installed on planes more than four years ago. The original installations have subsequently given way to highly improved apparatus.

One problem concerned the elimination of delays occasioned by changes from one frequency to another. Planes flying from Chicago to New York operate on a certain day frequency and another frequency for night use. Planes west of Chicago on the same mid-continent airway employ different wave lengths. As ground stations communicate with planes on both divisions, it is necessary frequently to shift from one wave length to another, a manual process that involved costly delay.

Changing Frequencies

The United Air Lines laboratory staff developed a device, known as the "Rube Goldberg" because of its complexity, to enable a radio operator to change his transmitter from one frequency to another instantaneously by turning a dial. This eliminated the manual change that took nearly 20 minutes, during which the station was off the air.

As receivers at airports are located from three to twenty miles from the field stations because of static interference, a dial system was perfected whereby the radio operator changes his receiver from one wavelength to that of another plane merely by dialing the proper number. The dial system, similar to the ordinary telephone dialing mechanism, automatically causes the set to be properly tuned and the volume to be adjusted correctly.

Devices of similar nature have been developed and installed on the planes so that at dusk, when a pilot must change from day to night frequency, and at dawn, when it is necessary to shift back to the day frequency, the operation is accomplished automatically by the turn of a switch. Previously pilots either had to remain on one frequency until landing, or come down to an airport where a radio technician could make the change.

Uniform Voice Volume

Another difficulty was encountered when a variance was discovered in voice strength among radio operators. Some had overly strong voices, others were weaker. Strong voices distorted the signals, and the weaker voices were inaudible in the planes. Now, whether the operators shout or whisper into the microphones, their conversations are equally audible to pilots in flight. The United Air Lines radio laboratory developed a device that automatically controls the volume of the operators' voices, amplifying weaker voices and reducing the volume of the louder voices so that all signals are broadcast at a uniform volume.

Landing Planes in Fog

United Air Lines engineers are at present engaged in several projects utilizing radio beam signals to bring planes to safe landings on fog-obscured airports, and tests are now being conducted with the localizing radio beams.

It is predicted by air transport officials that radio will serve as the potent weapon to defeat unfavorable weather conditions, and constant progress is being achieved in this direction.

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A VOLTAGE DOUBLING POWER SUPPLY FOR CATHODE OSCILLOGRAPH

(*Concluded from page 27*)

In the experimental setup, a small radio receiver transformer having two 2.5 volt windings was used. Two turns of heavy wire were taken around the core and used to supply the necessary voltage for the filament of the cathode ray tube used which was a Dumont type 34. A pair of 750 volt condensers were used in the doubling circuit, while one 1,500 volt or a pair of 750 volt test in series were used as the output capacity. The transformer delivered about 450 to 500 volts and when rectified and doubled the power supply put out about 1,200 volts of pure d-c, without any appreciable ripple. The eqipment was arranged so as to be easily shielded with an iron case to prevent the electrostatic and magnetic fields from affecting the cathode ray tube.

The type 27's withstood the 1,200 volt back-up potential without any trouble and have been operated several months without a sign of failure. This power supply far exceeds the former design which it replaced using an 80 and a high voltage transformer both in percentage of ripple in the output and in weight. From the author's experience, it seems entirely possible to construct the entire power supply and sweep circuit in a space no larger than that generally used for the power supply alone. This would greatly improve the portability of the oscillograph without interfering with its efficiency.

VISUAL BROADCASTING

(*Concluded from page 19*)

simile services are carried on normal communication channels, I am informed, but there is no present provision for facsimile broadcasting. Obviously, a facsimile service should not be carried on the sound broadcasting-channel from 550 to 1500 kc, except possibly in the hours between 2 and 6 a. m. Equally it should not be carried in the television channels, for since its signal is of a different type and it uses a different design of receiver. interference would be likely to result. The proposed clearing of the 1500-1600 kc band, however, offers the opportunity of setting aside a block group of channels totalling from twenty to forty kilocycles, exclusively for facsimile broadcasting.

PUBLIC BROADCASTERS' SALES GAIN

Public Broadcasters, Inc., owners of broadcasting station WJJD, in a statement issued October 25, by John F. Ditzell, president, stated that business has increased each month for the past three months. This represented a fifty per cent increase in net revenue over any corresponding period in the past two years. Mr. Ditzell further stated that a continued increase in revenue is expected throughout the fall and winter months.

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GATES ISSUES THREE NEW BULLETINS

The Gates Radio & Supply Company of Quincy, Illinois, have released three new bulletins for the broadcast station, theatre and recording laboratory, which will gladly be sent by requesting them on your own letterhead. Bulletin 11A describes a new twin speed transcription unit for broadcast stations with many improvements. Bulletin 5C describes a new low-priced remote control unit using dry cell tubes and being all self-contained, and bulletin 19B describes a new rectifier to take the place of all storage batteries in every existing manufactured talking picture system.

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CASES FOR RADIO RECEIVERS

The Gotham Case Creators, Inc., 111 West 20th Street, New York, makers of cases and boxes for radio receivers and amplifiers, have leased enlarged quarters at the above address. The company was formerly the Gotham Trading Syndicate, located in the Flatiron Building. The company has in production amplifier cases in fabrikoids and leathers as well as carrying cases for Universal radio receivers and cases for portable phonographs.

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DU MONT REPRESENTATIVES

Allen B. Du Mont Laboratories, 9 Bradford Way, Upper Montclair, N. J., have appointed the following companies as their representatives: Paul W. Koch and Company, 20 N. Wacker Drive, Chicago, Illinois; General Engineers, Inc., 2201 Laws Street, Dallas, Texas; R. C. James Company, 2319 Second Ave., Portland, Ore.; Burkholder and Kelley, Ltd., Jarvis and Richmond Streets, Toronto 2, Canada.

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AVIATION COMMUNICATION EQUIPMENT

A highly developed radio telephone communication system for airplane service with ground stations and between planes in flight, is described in a new bulletin published by the Western Electric Company, Inc., New York. The types of equipment described are the 208A and 208B.

The weight of the 208A equipment is approximately 140 pounds, the 208B, 158 pounds. The latter outfit may be employed in operation while the plane is on the ground in case of forced landing.

Copies of the bulletin may be procured by writing to the company.

TELEVISION DEVELOPMENT

The Ray-O-Television Mfg. Corp., in Long Island City, has completed its initial production and development plans.

As chief engineer, Ivan Bloch, formerly chief engineer of the General Television Manufacturing Corp., directs the research, development and production activities of the organization. It is his aim to continually investigate, develop and to hasten that "date" of home television.

A. C. Matthews, well known in radio circles for his work on automatic volume control, superheterodyne design, formerly chief engineer of Electronic Radio, Inc., Freed Television and Radio Corp., United Research, etc., is assistant chief engineer in charge of radio and electronics.

Roy-O-Tel is particularly pleased to announce as the Head of its Research Division, Dr. P. C. Goldmark, formerly head of the television laboratories of Pye Radio, Ltd., Cambridge, England.

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BRUSH BERYLLIUM OXIDE

Beryllium Oxide is becoming recognized as one of the satisfactory available single refractory substances for the manufacture of extruded insulators for radio tubes. It will also have many applications in special incandescent lights, etc. Some of its outstanding characteristics are:

Ability to operate indefinitely in contact with a tungsten filament at 2,000° C.; melting point of 2,570° C.; lowest electrical conductance at high temperatures of any of the refractory substances; low specific gravity (3.0); low heat capacity (0.261 per grain at 50° C.); low coefficient of linear expansion (7.5 x 10-6); resistance to thermal shock of the same order as that of fused silica.

This material can be extruded without the aid of clays or other plastics, by using a solution of Beryllium Chloride or Beryllium Nitrate. In order to develop its ultimate properties, Beryllium Oxide should be used pure, but when mixed with other refractory substances even in small amounts it confers good qualities upon the whole mass.

Beryllium Oxide 99.9 per cent pure is manufactured by The Brush Beryllium Company, 3715 Euclid Avenue, Cleveland, Ohio.

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CROSLEY REPORTS GAINS

A production in radio receiving sets during the six months ending September 30 greater than that of any similar period in preceding years and an increase in employment payroll of approximately 100 per cent during the two-month period ending September 30, has been announced for the Crosley Radio Corporation by Powel Crosley, Jr., president, following a final analysis of production and employment records during this period.

These figures show, according to Mr. Crosley, that during the month of September the number of radio sets built and shipped exceeded by more than 25 per cent that of the highest September production in the history of this Cincinnati manufacturing concern.

Since August 1, when the Crosley company began operation under NRA codes, 1,310 persons have been added to its payroll, bringing the total, as of September 30, to 2,737. Further additions are being made daily.

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ELECTRICAL INSULATING MATERIALS

The A.S.T.M. has issued a booklet, Electrical Insulating Materials, containing all of the 32 A.S.T.M. specifications and test methods covering electrical insulating materials. The 1933 report of Committee D-9 on Electrical Insulating Materials is also included. There are four standard methods, fifteen tentative methods of test and two specifications prepared by Committee D-9, and in addition, ten specifications are given covering certain rubber and textile materials and a method of testing slate which are of direct interest.

Several of the test methods and specifications are new ones issued since last June as tentative standards. They cover flexible varnished tubing, black bias-cut varnished cloth tape, asbestos roving and thickness tests for sheet and tape.

Standards which were adopted this year and which are given in their latest form cover molded materials, insulating oils, asbestos yarns and tape, tests for resistivity and tolerances and tests for electrical cotton yarns.

Test methods given in the book in which revisions were made this year cover sheet and tape insulating materials (dielectric strength and thickness), compounds used for splicing cables and filling potheads, untreated paper, varnished cloths and cloth tapes and grading natural mica (size, commercial quality and thickness).

Other widely used A.S.T.M. standards are given relating to electrical porcelain, varnishes, tests for power factor and dielectric constant, laminated sheet materials, pasted mica, friction tape, rubber insulating tape, rubber gloves and matting, etc.

The 1933 report of Committee D-9 explains the changes in the standards under its jurisdiction, points out the need for the new tentative specifications and methods, and details the many research activities sponsored by the several sub-committees.

Copies of this publication, in heavy paper cover, aggregating 242 pages, can be obtained from the A.S.T.M., 1315 Spruce Street, Philadelphia, Pa., at $1.25 per copy.

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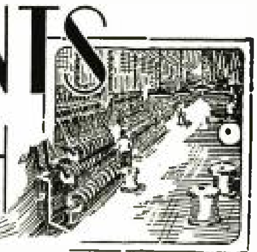
MAJESTIC CONTINUES TO SHOW GAIN

October will represent the fifth consecutive monthly increase for Majestic radios and the best month since 1931, according to John F. Ditzell, assistant vice-president and general sales manager of the Grigsby-Grunow Company.

Mr. Ditzell states that daily orders received at the Majestic factories are now better than 50 per cent of the total daily production, which is running between 4,000 and 5,000 sets per day.

NEW DEVELOPMENTS OF THE MONTH



KING SOLDERERS

The Electric Heat Control Co., 9123 Inman Ave., Cleveland, Ohio, are manufacturing the new King solderers, which may be used for nearly every kind of jig soldering, sweating terminal lugs, motor leads, commutator bars, instruments and other radio uses. Size 5⅜"x4¼"x5". Weight 9½ lbs.

◆

NEW TYPE G-M PHOTOELECTRIC RELAY

A new photoelectric relay using the Visitron F2 photoelectric cell which operates without external source of voltage and without amplification is announced by G-M Laboratories, Inc., 1735 Belmont Ave., Chicago. The complete unit, designated as the FSE photoelectric relay, incorporates a Visitron F2 cell, a sensitive relay and an auxiliary electromagnetic relay housed in a small, compact cast aluminum case 6¼ x 5 5/16 x 4 inches. The cell can be mounted behind a glass window in the front of the case or externally at any point within hundreds of feet of the sensitive relay. The FSE unit can be completely weatherproofed.

Because the Visitron F2 photoelectric

cell requires no external voltage and no amplification, the FSE unit can be used in locations not served by electric power lines, and since there are no tubes to necessitate replacements it will operate for long periods without attention.

The F2 cells, the auxiliary relays, or the two relays in combination, can be supplied either assembled or individually as required for various electrical or photoelectric applications.

◆

UNIVERSAL TWO LAPEL MICROPHONES

The Universal Microphone Co., Inglewood, Cal., now furnishes two lapel microphones corded together with a special line. One of the tiny, delicate instruments goes on each lapel.

No matter how the speaker or announcer turns his head or twists around, the new lapel arrangements make it possible to maintain a constant volume.

LOW RESISTANCE CONTACT AND CONVENIENT DESIGN OF SUPPRESSORS

Solid, one-piece construction to withstand severe vibration is a feature of IRC motor radio suppressors made by the International Resistance Company, of Philadelphia. Recent refinements in manufacturing and design have also resulted in unusually low resistance contact between terminal and resistor element, thus avoiding sparking under high ignition voltages and eliminating one of the most common causes of suppressor failure.

Another important development is that

electrical contact is made direct from the one-piece terminal to the resistor element. There are no springs, steel wool or other intermediate elements.

There are no parts that can be mechanically changed by moisture and no cement to be softened by high humidity. Resistor elements are embedded in a high-grade ceramic which is non-combustible and which is not affected by heat. A special moisture-proofing compound serves as a further safeguard against this unfavorable element of motor car operation. Exceedingly low temperature coefficient makes IRC suppressors practically unaffected by high temperatures while their low capacity—less than ½ micro-microfarad—is assurance of absolute noise suppression.

A feature of the IRC line is that units have been designed to fit practically all makes of cars.

◆

STUDIO TYPE CONDENSER MICROPHONE

The Shure Model 40C condenser microphone, a product of Shure Brothers Company, 215 West Huron St., Chicago, has been especially designed for broadcast studio service, where a finished modern appearance is desired along with excellent performance and rugged mechanical construction.

The chromium plated transmitter head is of the air-damped, stretched diaphragm type and each unit is thoroughly aged before shipment. The frequency characteristic, according to the manufacturer, is excellent from 40 to 10,000 cycles and the noise level is so low as to be negligible. The case, which houses the integral two-stage preamplifier, is made of cast aluminum, finished in baked rubber-black enamel, and is compact in size and pleasing in appearance.

CODE PRINTER RECEIVER FOR MOBILE RADIO

A patent, 1,932,579, was, on October 31, issued to W. G. H. Finch of New York, covering the invention of a novel and simple telegraph printer for mobile radio uses particularly. There is a plurality of disc-shaped type wheels secured on a shaft, each disc carrying a number of individual embossed characters. The type wheel is directly selectively operated by a two-unit code, each unit consisting of a combination of long and short impulses. The long impulses of one unit selectively shift the type wheel shaft to select a type wheel disc and the long impulses of the second unit selectively rotate the type wheel shaft to select a character of the selected type wheel disc.

The mechanical assembly of the printer is designed to meet the needs of recorded communication in automobiles, trucks, airplanes and moving vessels.

A proposed use of the system is for a central commercial transmitting station to engage in the business of forwarding messages to moving vehicles equipped with recording receivers.

◆

NEW BATTERY CHARGER FOR AUTO RADIO

General Electric has just announced a new simplified Tungar battery charger, which makes it practically as easy to charge an automobile battery as plugging in an ordinary floor lamp in the home.

With this new charger, no switches, no adjustments, no lifting of dirty floorboards are required. With the charger there comes a receptacle which is permanently attached to the terminals of the battery with a convenience outlet to the floorboard of the car. Once installed, it is necessary only to plug in to this receptacle with one lead from the charger and into a light socket with the other lead.

This new Tungar charges at the rate of five amperes but tapers off when the battery is full charged, thus eliminating the danger of an overcharge.

◆

HEAVY DUTY TRANSMITTING CHOKES

These chokes manufactured by the Hammarlund Mfg. Co., 424 W. 33rd Street, New York City, are ideal for use in the plate circuits of high-power transmitting tubes where the continuous plate current does not exceed 500 milliamperes. For intermittent operation this value may be exceeded. The self-inductance of this choke is 5.3 millihenries. Its distributed capacity has been held to the extremely low value of 1.5 micromicrofarads. Thus it is suitable for use in transmitters operating in any of the short wave bands.

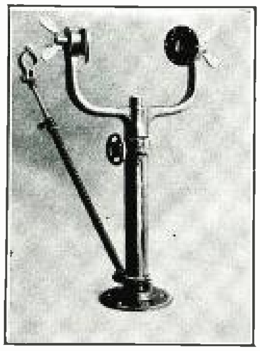
Overall size (without brackets) 1 5-16" diameter by 2⅜" long. D. C. resistance, 12 ohms.

NEW ADJUSTABLE MOUNTING BRACKET

Macy Engineering Company, of 1451 39th St., Brooklyn, N. Y., announces a new mounting bracket adaptable for all horns of their manufacture.

The bracket permits a horn to be swung in a complete circle and tilted up or down. After adjustment it may be locked in position by means of hand screws.

This bracket terminates in a 1¼ inch



flange which may be substituted with standard pipe of any length, permitting a wide range of uses such as ceiling suspension or a mast type installation.

◆

NEW CATHODE-RAY OSCILLOGRAPH

The newly announced General Electric Type HC-10-B1 cathode-ray oscillograph is a low-priced, high quality instrument for the study of recurring waves from power frequencies to several million cycles per second. A high degree of portability has been attained, and the design is such that the instrument is readily adapted to switchboard mounting or general classroom demonstration. The complete oscillograph requires only 200 watts, and can be operated from any 110-volt, 50- or 60-cycle source.

The G-E Type FP-53 cathode-ray tube, used in this oscillograph, is of the hot-cathode type, highly evacuated and permanently sealed. As the tube is operated at a cathode-beam voltage of 3,000, a brilliant image is produced on a large screen. Demonstrations can therefore be made before large audiences without darkening the room, and permanent photographic records of the image can be made with standard cameras.

The complete oscillograph equipment consists of two units, the cathode-ray oscillograph and the time-axis oscillator.

In the cathode-ray oscillograph unit the cathode tube is fastened horizontally on the top of the power-supply housing by means of an adjustable bracket. The tube is within a sheet-iron holder, in a socket mounting fastened to one of the brass end covers. This sheet-iron holder provides electrostatic as well as magnetic shielding. Within the power supply housing are mounted the necessary filament transformers, a high-voltage transformer, and the rectifier tube and capacitors for operation of the cathode tube at 3,000 volts.

The unit is a complete cathode-ray oscillograph, with a high beam-voltage, a sharp clear spot on the fluorescent screen, and two sets of deflecting plates at right angles to each other for deflection voltages. Measurements of voltage and current amplitude and reentrant patterns, known as cyclograms or Lissagous' figures, can be obtained with this unit. These figures have been found valuable in studies of relative wave shapes and phase relations. For example, particularly good use of them has been made in frequency power factor, and corona-loss measurements.

In many cases where wave shapes are being studied, a time axis is necessary. Such a time-axis voltage is provided by the time-axis oscillator unit. Suitable circuit adjustments are provided to give a range of time-axis oscillation from 30 to 20,000 cycles, and by means of a special interlocking connection the time-axis frequency and the unknown wave frequency are held at a fixed ratio.

◆

CELLOPHANE SOLVES BROADCASTING PROBLEM

Cellophane has now come to the aid of the broadcasters. It has always been difficult to get a really good reproduction of a coloratura soprano voice on the radio. Strange things happened to such voices on the air. Then the idea to mute the voice came to Phil Boutelje, chief music adviser of the Paramount theatres. A hood of the transparent material was made into which a singer can stand and sing her highest notes without fear of microphone vibrations. The hood does for the human voice what the mute does for a cornet or violin. It was first used in the broadcast feature "Back Stage with Boris Morros."

◆

NEW CONDENSER MICROPHONE

A new condenser microphone is announced by the Shure Brothers Company, 215 West Huron Street, Chicago, and is designated as their Model 40A. The transmitter head is a precision product in every respect and has an excellent response characteristic from 40 to 10,000 cycles per second. The head amplifier uses two special dome-top, non-microphonic type '30 tubes, requiring .06 amp. at 6 volts and 3 ma. at 180 volts which may be obtained from dry cell "A" and "B" batteries or the Shure Model 41A power supply unit. A removable back provides easy access to the case for inspection of tubes. A special output transformer, with terminals appearing in the tube chamber, makes it possible to change output impedance from 200 to 50 ohms according to circuit requirements. The output level is minus 30 decibels

which is considerably higher than that of the average two-button microphone.

The Shure model 40A condenser microphone is furnished complete with a 12-foot, shielded color-coded cable. The head is chromium plated and the case is finished in attractive crystalline black.

PYRANOL IMPREGNATED HIGH-VOLTAGE CONDENSERS

Because of a reduction in cubic volume and weight by more than 50 per cent as compared with previous types, with further advantages by way of lowered cost without sacrificing life, a non-inflammable impregnator permitting use in hazardous locations, operation at high ambient temperatures destructive to former ordinary types, and a leakage resistance and power factor change for less at high temperatures than with type currently employed, the pyranol impregnated high-voltage filter condensers now introduced by the Cornell-Dubilier Corporation, New York City, are of exceptional interest.

The Cornell-Dubilier pyranol impregnated condensers are available in three standard d-c. working voltages and the following range of capacities: 1,000-volt, 1 mfd. to 10 mfd.; 1,500-volt, 1 mfd. to 6 mfd.; and 2,000-volt, 1 and 2 mfd. These units can be operated continuously at voltages up to 10 per cent above rating. Each unit is in a sturdy, substantial steel container, hermetically sealed. Thoroughly insulated high-voltage terminals are mounted on top of the container, while lugs or feet at the bottom facilitate mounting. The standardized container sizes permit of ready multiple assemblies. The enormous reduction in volume and weight, together with a marked reduction in cost, is made possible by the high dielectric strength and the high dielectric constant of pyranol a newly patented impregnator used in these units. The reduced volume and weight make these condensers especially desirable for use in portable equipment.

◆

CATHODE RAY TUBES

The RCA Radiotron Company, Inc., Harrison, N. J., announces four new cathode ray tubes, the 906, 3 inch; 905, 5 inch; 904, 5 inch, and 903, 9 inch. These are of the hot cathode, high vacuum type. Complete information may be procured by writing to the company.

◆

ACKNOWLEDGMENT TO RCA-VICTOR

In the October issue of Radio Engineering, page 15, appeared an illustration of the velocity microphone, in a technical article on this subject written by A. Barbieri. The illustration should have carried a courtesy line to the RCA Victor Company, Camden, N. J. The velocity microphone is a product of that company.

◆

NEW TELEVISION SERVICE INAUGURATED

Television has taken a new and significant step forward, it is revealed in the announcement of a "full-length feature" broadcast of movie film by the Don Lee television transmitters W6XS and W6XAO, Los Angeles.

By virtue of the new schedule, full-length motion picture features, and preview trailers, now become part of the regular transmission schedules of the television stations, in addition to the newsreels and close-ups heretofore comprising the television fare of W6XS and W6XAO.

In the past year some interesting experimental demonstrations were made by this television service in carrying on transmission of pictures from the ground station to a moving airplane. In these tests considerable success was attained.

NEARLY A MILE LONG

ELMET MOLY GRID WIRE is available in Extra Long Lengths — (any length, up to 1600 meters) — in the exact diameter and other specifications you require. This ELMET feature eliminates the frequent changing of spools or bands, speeds up production and saves you time and money.

Besides these obvious production advantages Elmet Long Lengths are proof of the superior quality of our wire. To produce 1600 meter lengths requires a metal of exceptional purity.

Use ELMET. Write Today For Prices. Box R-11.

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LEWISTON MAINE

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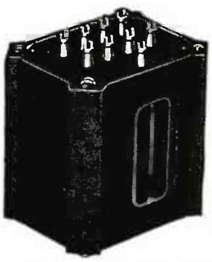
TRANSFORMER CORP.

The NEW UTC BULLETIN is ready.
Send for your free copy today!!

UTC engineers take pleasure in announcing a new Linear series of high power class B audio transformers for use with 46, 53, 59, 210, 211, 203A, 204A, and 849 tubes.



All UTC audio, filter and power units are housed in high permeability cast iron shields.

Standard designs are now available on these units having a frequency response of ∓ 2 DB from 30 to 15,000 cycles.

For recording and sound laboratories special coupling and interstage transformers have been developed covering a range of nine octaves (linear ∓ 2 DB, 20 to 20,000 cycles).

Broadcast engineers interested in circuit data requirements for Class A, 245, 59, 2A3, 250, 845, Class B 53, 59, 79, 210, 203A amplifying systems should write for Bulletin U1000-A, which contains schematic layouts of all these amplifiers in complete detail. Free for the asking.

UNITED TRANSFORMER CORP.
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America's Outstanding Microphone Values!

Model No. 77

THE LIFETIME CORPORATION introduces model No. 77 Condenser Microphone and Amplifier—a product of expert radio laboratory specialists giving the public, for the first time, a high quality instrument at a nominal price.

Lifetime Condenser Head is of special design using a special heat-treated duralumin diaphragm .001" thick, and is sealed after proper adjustment, thus assuring a long life and a dependable instrument.

The Head amplifier is housed in a black crystal cylinder and is especially designed for use with the Lifetime No. 77 Head. Each microphone head is perfectly adjusted and synchronized with the amplifier and tubes with which it is to be shipped so that it works perfectly as a unit.

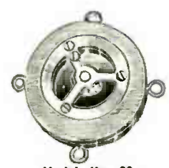
The frequency range is practically flat thruought entire audible spectrum useful to modern broadcast and sound equipment. Output either 200 ohm or 400 ohm—200 ohm output is standard.

Special introductory offer to the trade. Model No. 77 Condenser Mike and amplifier, complete with 2 No. 864 tubes and 10 feet of rayon covered cable only $37.50
List price, $95.00

Another outstanding value is the Lifetime Model No. 99, Double button Carbon Microphone listing at $50.00 and offered to the trade at only **$14.95**

Lifetime Model No. 99 is a custom built microphone at a production price. Each microphone performs with perfect fidelity thruought entire voice and music range. Each unit is individually adjusted to conform to the highest standards of performance.

Precision machined of solid brass model No. 99 is 3-1/16" in diameter—2" thick overall and weighs 1¼ lbs. It has a gold spotted duralumin diaphragm .001" thick—gold contact buttons 200 ohms each, and is sufficiently damped to give outstanding performance.



Model No. 99

A desk stand to match only $2.25,
and a matching transformer at . . . . 1.95.

Write for our descriptive literature of our complete line of microphones and Electro-Dynamic Sound Equipment.

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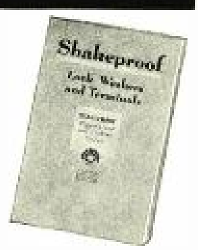

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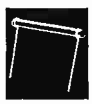

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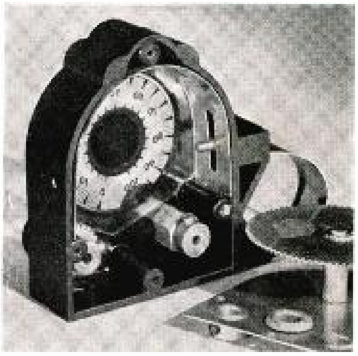
Simplified Assembly

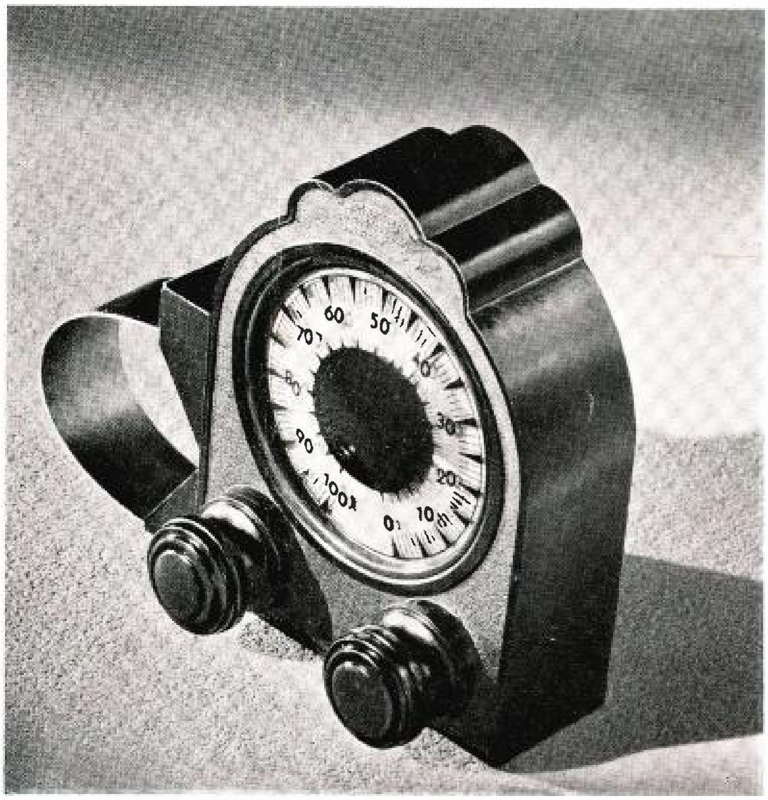
through using Bakelite Molded for this remote control housing

COMPLETELY FORMED to close dimensions in one press operation, so that each part slips into place with ease, this Bakelite Molded housing for the Falck Remote Control makes the assembly operation simple, quick, and inexpensive. In addition to these practical advantages the use of Bakelite Molded provides lasting beauty of color and finish, light weight combined with strength to resist the vibrations and shocks of automobile service.

This is but one of the manifold uses of Bakelite Molded for radio. Others include cases for midget receivers and various types of instruments, dialing knobs, terminals, tube bases, condensers, and dozens of other parts. Bakelite Molded possesses a combination of properties which make it especially valuable in the construction of radio receivers and parts. It has high insulation value, is unaffected by temperature and atmospheric variations, is resistant to most chemicals and to mild alkalies, and retains its molded form, dimensions, and finish indefinitely.

We invite radio engineers and manufacturers to enlist our cooperation in the economical solution of production problems involving the use of Bakelite Materials. We also would be glad to mail on request a copy of illustrated descriptive booklet 12M, "Bakelite Molded".





Photos show Falck Remote Control with Bakelite Molded housing and knobs. Product of Advance Electric Company, Inc., Los Angeles, Cal.

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