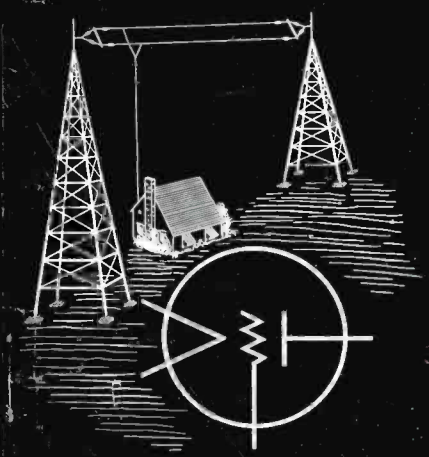
MAY, 1933

Radio Engineering



IN THIS ISSUE

THIRTEENTH YEAR OF SERVICE

The Journal of the Radio and Allied Industries

SVEA METAL

Facts for—
TUBE EXECUTIVES and ENGINEERS

THE most important change in basic raw material in the past ten years is now taking place in radio receiving tube manufacture.

We can save you at once one-half of the cost of metal material used in your tubes.

A finer quality tube is actually at hand—finer because of less gas, better electronic emission and longer life —with full tonal qualities.

The pioneer spirit back of all progress has caused able research engineers to overcome production difficulties, both real and imaginary—originally regarded as insurmountable and admit that SVEA METAL is superior to other metals being used today.

Twenty-one manufacturers are now making internal parts of Svea Metal, such as are used in these tubes on a production basis.

More than 2,000,000 tubes already sold attest to the above facts.

Svea Metal is being marketed in all popular forms—bright ribbon—carbonized strip—pertruded or woven mesh—tubing—fine wire—or finished parts ready for assembly.

Swedish Iron & Steel Corporation

17 Battery Place New York City

For more than a quarter of a century suppliers of high grade metals to the foremost electrical equipment manufacturers.

No. T20 Series, with switch.

No. 11 Switch, for panel mounting
No. T, for unit mounting.

No. T70 Series, with switch.

Why not discuss your Volume and Tone Control problems with us?

Lowest Operating Torque and Contact Resistance

A lot to claim — a lot to deliver — yet our No. 11 *does* have these outstanding features. Also has smallest knob movement, positive kickoff, double bearing "cold" cam, and a lot of other advantages —plus Underwriter's Laboratories' Approval for 3 A, 125 V., 1.5 A. 250 V, AC or DC. Write for samples. You'll find our No. 11 even better than we claim!

IT is quite possible that we can help you solve some of those Volume and Tone Control problems of yours . . . We've done it for a number of other set manufacturers . . . Some of them have been just a little surprised—perhaps *astonished* would be a better word—to learn just how thoroughgoing and painstaking we are . . . A number of our set manufacturer friends have told us we helped them greatly in this particular phase of their production. And we'd like to help you, too!

No small share of our success in the development and manufacture of superfine wire wound and carbon element type variable resistors is due to our having constantly maintained a 100% Engineering and Research Department. And when we say 100% we mean just that! It is on its toes every hour of the working day—and on numerous occasions far into the night—to help folks like you obtain properly designed volume and tone controls . . . incidentally, our Engineering Department is second to none in the entire industry.

We want to help. How can we do so? If you will write us fully, sending specifications or chassis, we'll submit samples . . . efficiently engineered . . . promptly . . . and with no obligation whatever! May we hope to serve you soon?

CHICAGO TELEPHONE SUPPLY CO.

HERBERT H. FROST, Inc.

SALES DIVISION

General Offices ELKHART, INDIANA *and Plant*

RADIO ENGINEERING

Reg. U. S. Patent Office

MEMBER AUDIT BUREAU OF CIRCULATIONS

Western Editor ULMER G. TURNER

Editor DONALD MCNICOL

Managing Editor F. WALEN

Vol. XIII MAY, 1933 Number 5

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Departments

RADIO'S ACCOMPLISHMENT

By DAVID SARNOFF
President, R.C.A.

NO other development threatens to supplant radio in our national life. No product of the laboratory bids to displace it, whether in communications, broadcasting entertainment or the new industrial applications to which it is being adapted. What is promised by intensive research is not a substitution for radio, but rather an extension and elaboration of radio services. We are engaged in an industry that is moving forward rapidly along many different lines.

Radio has been an exceedingly important factor in the nation's commercial and industrial growth, and no unimportant element in the maintenance of the volume of general business prevailing during the last three years. During the last decade it has supplied from its own work shops the incentives for much employment and the advancement of trade and industry.

BRYAN S. DAVIS *President*

JAS. A. WALKER *Secretary*

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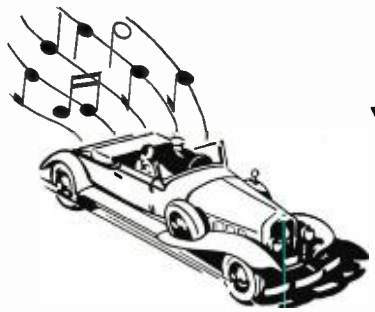


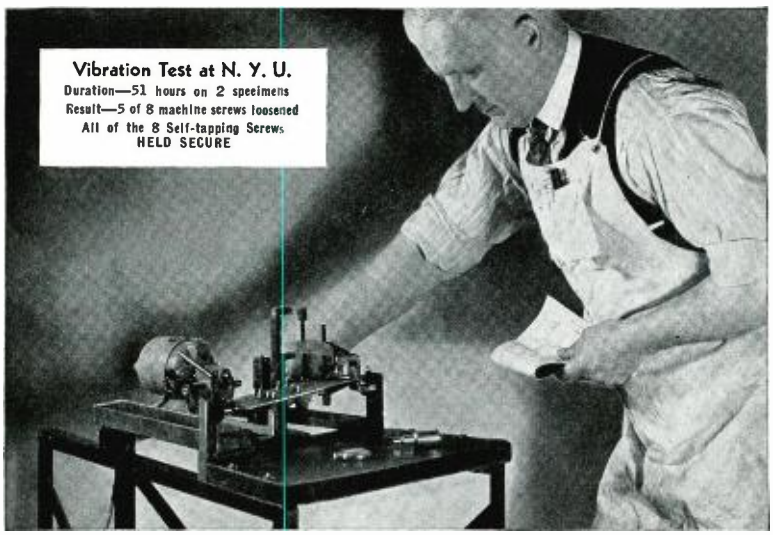
Vibration won't loosen auto radio assemblies

...made with money-saving Self-tapping Screws

IN ASSEMBLING auto radios, the leading manufacturers are using the same time- and money-saving fastening device that cuts cost on their models for home use... Parker-Kalon Hardened Self-tapping Screws. For there is no simpler, cheaper means of making the assemblies. And no other common device offers such great security against the severe vibration of auto service. In tests conducted by manufacturers and unbiased engineers, fastenings made with machine screws, bolts and nuts with lock washers, and even rivets, have failed under stresses of vibration, tension and shear that would not loosen sheet metal fastenings made with these Self-tapping Screws. Below is pictured one of the vibration tests made by authorities of the College of Engineering of New York University. Note that in this test the majority of the machine screw fastenings failed . . . yet not one Self-tapping Screw loosened. Here is evidence that by assembling auto radio parts with Self-tapping Screws you obtain STRONGER as well as cheaper fastenings.

These Auto Radios Built Stronger at Lower Cost

Philco, R.C.A.-Victor, Zenith, Atwater-Kent, U. S. Radio, Crosley, Stewart-Warner, American-Bosch, Sparton, Noblitt-Sparks — all save time, labor and money, and gain greater fastening security by using Parker-Kalon Self-tapping Screws to assemble their receivers.



Self-tapping Screws will help you

It will pay you to try these Screws, too. Use the coupon below to get FREE "Money-Saver Test Bag" of samples with unbiased recommendations of our Fastening Specialists.

Where and How to use them

Type "Z" Hardened Self-tapping Sheet Metal 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.

PARKER-KALON *Hardened* Self-tapping Screws

PAT. IN U. S. AND FOREIGN COUNTRIES

PARKER-KALON CORPORATION, DEPT. L, 190-198 VARICK STREET, NEW YORK, N. Y.

Tell me whether assemblies described on attached sheet can be made cheaper with Self-tapping Screws. I'll make a "Money-Saver Test" if you send samples and recommendations—Free.

Name and Title.....

Company .....

Address .....

Editorial

MAY, 1933

NEW RECEIVERS WITH NEW TUBES

IT is but a matter of two or three years since vacuum tubes were designed without adequate regard for radio receiver circuit requirements. A constructive advance that has taken place is that today tube design engineers and receiver design engineers are brothers out in the open, not only "under the skin."

A realization of this situation on the part of the tube manufacturers has resulted in commendable, efficient cooperation between tube factories and set factories. As manufactured receivers have become more complicated, they have demanded more from vacuum tubes in performance and uniformity of electrical characteristics.

These conditions hold the promise that the new tubes announced have been designed with a view to producing radio receivers having a decreasing number of the shortcomings evident in receivers heretofore in use, and an increasing number of new and pleasing features.

▲

RADIO INDUSTRY ALIVE

IN the boom days of 1922-1929 radio grew to industrial proportions equaling in gross income national industries which had a half century of background and momentum. During the seven years referred to, very few industries showed steep sales curves anywhere nearly approaching the overall totals for radio.

Executives in industries which sank to low levels of output since the collapse of 1929 are astonished to learn that with respect to radio receiver sales, the total number in the United States has increased during these years about four millions of sets.

Decreased purchasing power on the part of the populace at large naturally meant lower prices for radio receivers. Continuously lowering prices reflected aggressive competition for the business, and infinitesimal profits—if any.

Manufacturers of complete receivers and manufacturers of parts, still doing business, have survived somehow. A considerable number of these have continued without lapse to manufacture, to advertise and to sell.

The hope for improvement in the radio industry is in large part a hope for reasonable margins of profit.

The new National Administration at Washington has, within two months, been able to shuffle the deck and begin the new deal along several constructive lines. Moves so far made are in the nature of guaranties. Guaranties eradicate causes of fear. With fear relegated to the background, there is a greatly reduced hazard in responding to beckoning opportunity.

For many industries, radio included, this situation has certain of the earmarks of a new deal.

An examination of the radio pulse, as of May 1, 1933, discloses a strength and a quickening which reflects a desire on the part of the executives of the industry to play a constructive part in the upward swing of national prosperity, even though the gain be slowly gradual over a period of months or years.

▲

AS IT IS IN ENGLAND

A PROMINENT radio journal, published in London, recently carried a manufacturer's advertisement reading:

"The radio trade is face to face with the problem which confronts all industry. The solution to this problem lies in increasing the public capacity to buy. Neither list reductions nor high discounts will secure this end, but it will be reached by the accessibility to the public of a method by which radio receiving sets can be purchased on long credit terms, accompanied by small and frequent payments."

This is a sensible viewpoint, and one which will fit in with the slowly improving family income in the United States during the next year. Also it has the virtue of recognizing the fallacy of trying to increase sales through demoralizingly low prices.

Donald McNicol

Editor

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 XVII

1883 (*Continued*)

(636) Shephen D. Field exhibits (June) an electric locomotive, at the Exhibition of Railway Appliances, Chicago.

(637) An electric sign, reading "Edison" is installed at No. 65 Fifth Avenue, New York.

(638) Cromwell F. Varley dies. (Born in England 1828.)

(639) An Edison three-wire electric light station is opened at Sunbury, Penna., July 4. Two dynamos are installed. (These machines saw twenty-two years' service.)

(640) A nation-wide telegraphers' strike throughout the United States, inaugurated on July 19, terminates August 17.

(641) Leroy B. Firman is granted patent No. 283,334, August 14, covering the principle of leaving one of the subscribers' drops in circuit at the exchange switchboard to act as a clearing-out signal. (The application was filed March 26, 1881.)

(642) James Wimshurst makes improvements in frictional generators of electricity.

(643) The Telephone Exchange Company, of Baltimore, Maryland, and the National City Telephone Company, of Washington, D. C., combine under the name of the Chesapeake and Potomac Telephone Company, with a capital of $2,650,000.

(644) The celebration of the completion of the Northern Pacific Railroad is begun, at St. Paul, Minn., September 3.

(645) The first three-wire underground electric light service is installed, October 1, at Brockton, Mass. Three dynamos installed. The work in charge of H. Ward Leonard and Frank J. Sprague.

(646) An International Electrical Exhibition is planned to be held at Philadelphia, Penna. in 1884.

(647) For the year ending June 30, 1883, the Western Union Telegraph Company's revenue amounted to $19,454,902.98, and the expenses $11,794,553.40.

(648) The Manhattan District Telegraph Company, New York, is incorporated, to construct underground telegraph and telephone conduits, employing the system developed by D. N. Hurlbut, of Chicago.

(649) Dr. J. Hopkinson shows mathematically that it is practicable to operate alternating-current generators in parallel.

(650) Fitzgerald suggests a method of producing electromagnetic waves in space by the discharge from a conducting wire.

(651) Watson, in the United States, patents telephone receiver circuit-switching mechanism. (Patent No. 270,522.)

(652) The lines of the Mutual Union Telegraph Company are leased to the Western Union Telegraph Company for a term of ninety-nine years.

(653) The Wheatstone high-speed automatic telegraph system is placed in service on the lines of the Western Union Telegraph Company.

(654) P. B. Delany's synchronous multiplex telegraph system invented.

(655) A private electric light installation placed in service in the Mills Building, New York. Three 25 kw. Edison generators installed.

(656) The Standard Underground Cable Company lays an underground "Waring" cable in Washington, D. C., a total length of two and five-eighths miles. The cable contains six conductors, lead covered.

(657) From Maxwell's equations, Poynting concludes that in all cases where energy is transferred in an electric system it flows parallel to the surfaces of both electric and magnetic equipotentials.

(658) Edison's tube system of underground electric distribution is introduced.

(659) Stephen D. Field invents a two-wire stock ticker instrument.

(660) Sir William Siemens dies. (Born in Germany 1823.)

(661) A three-wire electric lighting system is installed at Louisville, Ky., with 5,000 lamps in service. H. M. Byllesby and Luther Stieringer of the Edison forces are identified with this work.

(662) The New Orleans and Northeastern Railway Company, employs the telephone for train dispatching purposes over a 100-mile circuit, consisting of a single iron wire.

(663) Leo Daft, at Greenville, N. J., develops improved electric railway motors.

(664) Electrolytic voltmeters are brought out in England by Varley.

(665) The Page Steel and Wire Company founded at Adrian, Mich.

1884 (666) A hydro-pneumatic railroad interlocking plant is installed at the railroad terminal, Bound Brook, N. J.

(667) The Viaduct Manufacturing Company organized at Baltimore, Md., A. G. Davis is president.

(668) The American Institute of Electrical Engineers organized, May 13, by a number of prominent telegraph officials and engineers. Norvin Green, elected president.

(669) At the annual meeting of the Central and South American Telegraph Company, held on June 3, the following were elected directors: E. D. Adams, M. P. Grace, W. G. Hamilton, Charles Lanier, J. P. Morgan, Alfred Pell, Theodore Disabla, J. A. Scrymser and R. W. Thompson. From January 1 to June 1, the company's earnings amounted to $149,556.

(670) Governor Cleveland, of New York state, signs a bill (June) requiring wires to be placed underground in cities having populations above 500,000.

(671) An Electrical Exhibition and National Conference of Electricians is held at Philadelphia, Penna., September 8-13.

(672) The Bankers and Merchants Telegraph Company declared bankrupt, September 23.

(673) David Homer Bates, assistant general manager, Western Union Telegraph Company, becomes president and general manager of the Baltimore and Ohio Telegraph Company.

(674) A 100-kw. Edison Jumbo dynamo is built.

(675) J. H. Bunnell and Company, New York, build for Mailloux and Rae, engineers, a ten kw. dynamo, compound wound, and an electric motor, which were installed in a coal mine at Saltzburg, Penna.

(676) The Sprague motor for Edison commercial power circuits is introduced commercially.

(677) A telegraphers' fast-sending tournament is held at 195 Broadway, New York.

(*To be continued*)

June Number
Radio Engineering
at the
I. R. E. Exposition

8th Annual Convention
and
Trade Exposition
of the
Institute of Radio Engineers
June 26, 27, 28—1933
at
Chicago

Extra Copies of the June Number of Radio Engineering will be available at the Radio Engineering Booth.

Attend the Exposition
Visit the Radio Engineering Booth

The paid circulation of Radio Engineering (see Audit Bureau of Circulations statement) is larger than that of any competing publication.

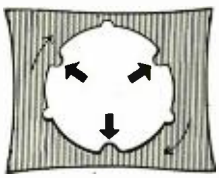
•

Advertising Rates for Radio Engineering are lower than those of competing publications.

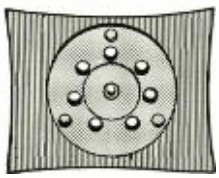
•

Advertising Forms for June close June fifth — mailing date June fifteenth.

NO RIVETS NO RIVETING — ONE COMPLETE PART NEW



Needs only a hole in chassis with three projections for gripping socket.



A short turn—snap—and it's locked in.

A complete radio socket in one part that does away with the handling of two extra rivets and the use of riveting machines. It is only necessary to punch a hole in chassis, as shown in the diagram at the left of this page. Insert socket and a short turn will lock it securely and rigidly in place. This new development will effect a substantial saving in assembling costs that you cannot afford to overlook. And it requires a smaller space.

This Cinch socket, to be known as model 44, is available for four, five, six and seven prong tubes. It is already in great demand, so prove to yourself the merits of this infinitely better radio socket; write for samples and prices today. Also ask for our latest booklet illustrating our complete line of Tube Sockets—Radio Plugs—Laminated Plugs—Binding Posts—Tip Jacks—Soldering Lugs—Mounting Strips—Metal Stampings.

CINCH MANUFACTURING CORPORATION

2335 W. VAN BUREN STREET, CHICAGO, ILL.

SUBSIDIARY

UNITED CARR FASTENER CORP. 31 Ames St., Cambridge, Mass.

RADIO ENGINEERING

FOR MAY, 1933

NEW RESPONSIBILITIES FOR THE R.M.A.

THE annual convention of the Radio Manufacturers' Association this year is being held at a time when trade associations appear to be slated to play an increasingly important part in our national economy. Two years ago Gerard Swope, president of the General Electric Company, issued a statement suggesting the control and regulation of production and prices through strong trade associations.

This procedure has been adopted in connection with the millers and the spinners as incorporated in the Farm Bill recently passed by Congress. It appears to us that a form of regulation, with Federal supervision and administered by the RMA, should be a decided forward looking move and a real benefit to the radio industry. Over the past two years we have had a price competition which has in most cases ground out the last vestige of profit for the manufacturer of receivers, tubes and components. Its effect upon the radio industry has been reflected in a continued increase in unemployment.

Manufacturers have been forced to continually cut their organizations in a constant effort to attain an approximately balanced budget, or have been forced to dip into reserves which in many cases have reached the vanishing point. In curtailing their organizations, engineers and executives thrown out of employment have set up competing organizations with further pressure brought to bear upon the price and production situation.

Now, it would seem to us that the RMA, functioning as a body which has the power to limit participation in the manufacture of radio receivers, tubes and components to its members—if such a thing can be legally obtainable, and we believe it can—and by the exercise of a flexible limitation of production, and by the exercise of control over prices, could effectively bring about a condition where we can again expect to see a reasonable element of profit, quality and service reinstated into our competitive picture. A profitable operation of the existing radio organizations means increased engineering and research undertakings, with a resultant reinstatement of engineering, executive and factory personnel. It means the availability of funds wherewith to develop commercially and to market the inventions and improvements developed through these research and engineering facilities.

FRED WILLIAMS, President, R. M. A.

We hope and predict that the June meeting of the Radio Manufacturers' Association this year will be one of the most important meetings which the organization has ever held, and that we can look back in years to come and regard it as marking the turning point in our own industry—the point from which we start upward in the restoration of a fair price level, a normal employment and an increased measure of progress.

Along these lines we would like to suggest that now is the time for those manufacturers who have over the past months and years developed new products and refinements to bring out these lines and incorporate new sales points into their product without further delay. Up to the present time there has been little encouragement to offer a new sales point to the public. We have been too busy leaning backward in an effort to continually lower prices. In the not too distant future, we believe it is going to be possible to again feature sales points, improvements and that much abused term "quality" and omit the 100 per cent emphasis upon price which has obtained in the past—and in doing this, to sell the public an improved standard of radio reception, at a reasonable and fair profit to the industry and with an adequate return for an adequate personnel.

Our best wishes to the Radio Manufacturers' Association, and our congratulations on this, their Ninth Annual Convention.

RADIO RECEIVER SITUATION for 1933

RADIO receiver design is a problem of producing saleable performance within limits of production cost, set dimensions, and of simplicity of operation. Lay aside these limitations and it is possible today to produce a receiver that would gladden the ears even of a radio engineer. Obviously, however, receivers which require expert handling would not be sufficiently commercial to be of interest to the public or to manufacturers.

So far as the public is concerned, from the beginning of broadcasting there has been but little disposition to do aught but marvel at the ability of a box of seemingly inert coils, condensers, tubes and accessories to "pick music from the air." Engineers, on the other hand were embarrassed by the squeals, station interference, inductive interference, distortion, inter-station noise, inadequate volume output, etc., which throughout the past years were sold with receivers. The vast improvement which has taken place in receiver performance in recent years is recognized in the fact that remedies for these various engineering defects have been applied without attaching to receivers additional manual controls; that is, by introducing remedies which function automatically.

The advent of the decibel as a measuring unit of use in laboratory and factory brought to the engineer a simplified formula of which he was quick to take advantage. The unit is of use as a measure of the sensitivity of receivers, or the gain of amplifier stages, and of the sensitivity of detectors. With the output of the generator and the scale of the v.t. voltmeter calibrated in decibels, the need for computation to learn the gain of a stage of amplification, or the sensitivity of a receiver is obviated. Thus radio receiver design and manufacture have been removed from the realm of guesswork, and from "try this" and "try that."

AVC

With automatic volume control applied to receivers costing about what a crystal set sold for ten years ago the public this year may be shown merchandise that has an appeal easy to recognize; an appeal that should speed up the replacement of the millions of obsolete receivers still in use. AVC as now applied holds the loudspeaker output constant over wide variations of signal input. The tendency in manufacture is to apply avc to the r-f. and i-f. stages, but in some instances it is applied in the a-f. section. In the latter method the first a-f. tube is of the variable mu type. With avc applied to it as well as to the other tubes of the set, the variation in input signal of 86 decibels causes a change in output of but 8 decibels.

As to circuit principle the superheterodyne is the favored hookup of the day. Intermediate frequencies of 175 and 450 kc. are common. The reincarnation of the superheterodyne three or four years ago brought this receiver system to the fore again in time for it to be given thorough study in advance of the arrival of the new multi-element tubes of 1932-33. The new tubes have made it possible to make progress in the direction of the selection of the desired signal with suppression of interference at the intermediate frequency, the image frequency and other spurious response frequencies.

"Midgets" and "Universals"

The possession of two automobiles per family may have been delayed for years due to the early custom of building one car garages. In the case of radio it was discovered last year that most residences are actually two or three radio homes. The advent of the "pee-wee" radio sets started all over again the exercise of verbal ingenuity contemporary with the nick-naming of the Austin car. The Iota sets brought grief to the designers, joy to the public, and gross receipts to the manufacturers who jumped at the call of opportunity. Then followed the logical step of making receivers universal—that is, operative by being connected directly to commercial 110 volt a-c. or d-c.

There is little doubt that the appearance and dimensions of the little receiver made up the main appeal. There was the additional feature that the purchaser if at present in an a-c. district might sometime be located in a d-c. district; thus his buy was independent of power system variations. It is stated that a million dollars worth of these tiny universal sets have been sold within the past six months. One manufacturer, previously not engaged in radio manufacture, is said to have marketed 100,000 sets.

A typical midget has four 6.3 volt tubes, the filaments operated in series, the first tube a '39, then a '36 detector of the screen grid type driving a pentode operating a magnetic loudspeaker, and a rectifier tube.

Actually, instead of adding to a multiplicity of types of receivers, it is being discovered that the advent and popularity of the small sets are clearing the atmosphere as to what should make up a logical, saleable "line" of receivers—as to the main details.

Refinements

Judging from the experience of other industries which have marketed home equipment, musical instruments, entertainment devices, etc., it appears certain that there will continue to be a substantial demand for the best, the most complete, the most satisfying, in the majority of homes, notwithstanding that attics, bedrooms and basements are to be served by midget radios. A new contribution in the way of refinement is a color control system recently introduced by one radio manufacturer, in which the relation between color and musical tone has been embodied.

The new "color radio" combines color visual indication with color control of noise, tone, and volume. A new type of double-action tone control is used making it possible to control the low and high notes independently of each other. There are two knobs with a rainbow-colored path of light between them. This rainbow arch, on the left, representing the bass register with a dark blue color, merges gradually through red to a golden yellow color on the right, signalizing the treble. As the left knob is turned and the bass notes diminish, the amount of blue light visible in the color path is proportionally reduced. Similarly, as the right knob is turned and the treble notes are affected, the amount of yellow light in the path is lessened.

Radio factory of United American Bosch Corporation, Springfield, Mass.

Aid to Tuning

In addition to the illuminated dial calibrated in kilocycles, there is another graduated dial against which the shadow of a meter needle is thrown. To tune a station into resonance, the dial is adjusted for maximum right-hand deflection of the shadow needle.

Color also enters into the noise silencer. As the knob is turned to the right, noise is decreased and a point of light moves around a circular path, indicating by its varying color and its position the exact degree of silencing effected. Volume control is also in the form of a visual indicator, a point of light moving across a color path.

New Sound System

The RCA Victor engineers have developed a new output arrangement which they call an organ-pipe sound system, of attractive appearance.

Instead of the conventional loudspeaker of the usual radio receiver, the new sound system has, in addition, a "sound projection" unit consisting of two dynamic loudspeakers hidden behind a grille of nineteen gold-bronze organ pipes and mounted on an attractive wooden frame. This grille may be attached to the wall in the music room to form a more harmonious and esthetic medium for the production of music. The operating mechanism is housed in an attractive cabinet which may be placed in the same room or at any distance from the sound projection unit. If desired, additional loudspeakers may be connected to the central system and ingeniously concealed behind pictures, in built-in wall grilles or elsewhere.

In addition to a twelve-tube superheterodyne radio receiver of advanced design, there is an automatic electric phonograph mechanism which plays ten selected records continuously and repeats them in sequence as long as desired. Then too, a special microphone connected to the instrument makes it possible to make one's own phonograph records, which are said to compare favorably in point of quality and permanence with the factory made product.

Instruments of this type will find application in restaurants, tea rooms, dance halls, school auditoriums, as well as in homes.

Typical Receivers

The new a-c.—d-c. midget receiver recently announced by the Crosley Radio Corporation is equipped with full floating moving coil dynamic speaker. The tube complement includes one '77, two '78, one '38 and one 12Z3 tubes. The Transformer Corporation of America announces a new five-tube superheterodyne receiver which includes the new Hazeltine avc circuit. The tube complement consists of one 6A7 seven-prong Hexode oscillator detector, one '75 duo diode triode second detector amplifier, one 25Z5 voltage doubler rectifier, one '78 i-f. and one '43 power output tube.

Philco is marketing an improved remote control receiver. The station and volume controls of this set are in a small portable cabinet which may be located anywhere in a room. The receiver proper is a cabinet type, inclined sounding board unit of modern design. Philco reports that their set sales for the first week of April, 1933, were larger than for the entire month of April, 1932.

The Fada Radio Company has designed a new modern line of receivers having new and attractive furniture housing. The United American Bosch Corporation likewise is actively engaged in producing receivers embodying all of the latest improvements.

Automobile Radio

Aggressively following up the substantial start made last year in furthering the use of radio receivers in automobiles RMA engineers are exchanging data with the automotive industry toward rapid improvement of automotive radio and wider sales of receiving sets for motor-cars. Under Chairman Wells of the RMA engineering committee and Virgil M. Graham, chairman of the association's special committee on automotive radio, improved installation and operation of automobile receivers is being developed. The special committee of the Society of Automotive Engineers has been given much data on operation of electrolytic capacitors in automobile radio equipment, and the RMA committee is developing additional data on trend of development regarding size of chassis and speakers. The problem of mounting automotive sets is left to each manufacturer but recommendations for standard mounting dimensions are being developed. Further work also is being done on mounting dimensions for chassis and loudspeakers, together with information for guidance of automotive body builders in arranging for antenna.

For some time factors in the industry have been working to build an automobile radio that would give radio reception in an automobile with the same pleasing tone quality and volume which is secured by a high grade home radio set.

Three phase transformer connections and their application to high voltage rectifying circuits

By J. B. EPPERSON*

AS it is generally known, three-phase voltages and currents consist of three separate sine-waveform voltages which are generated by three different sets of armature coils mounted in the alternator frame 120 electrical degrees apart, so that when a magnetic field is rotated within them, three separate e.m.f.s are produced which differ in phase by 120 electrical or time degrees.

To transform three-phase alternating currents, there are four different connections in general use viz.: the delta-delta, (Fig. 1), the delta-star, (Fig. 2), the star-star, (Fig. 5), and the star-delta, (Fig. 6). With separate single phase transformers used on each phase, these transformer connections are flexible, and furnish a simple and convenient means for obtaining different output voltages.

The output voltages from these four connections are found as follows:

Delta-star	Eo equals Pl $\times$ Tr $\times$ 1.73
Star-delta	Eo equals $\frac{\text{Pl} \times \text{Tr}}{1.73}$
Star-star	Eo equals Pl $\times$ Tr
Delta-delta	Eo equals Pl $\times$ Tr

Where Eo equals the output voltage between any two of the three-phase secondary leads, Pl the primary voltage across each transformer, and Tr the step up ratio of the transformer.

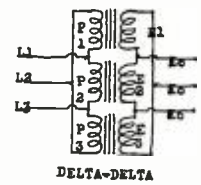
In the delta-delta connection, (Fig. 1), the voltage across each transformer primary will be the same as that of each primary phase, since each phase of the primary line connects directly across one of the transformer primaries. The voltage induced in each transformer secondary, E, will equal Pl $\times$ Tr. Since any two of the secondary output leads are connected directly across one of the tranformer secondaries, the output voltage Eo will be the same as that on each transformer secondary. Then, Eo equals Pl $\times$ Tr.

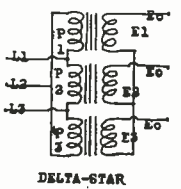
In the delta-star connection, (Fig. 2), the delta connection is again used on the primary side of the transformer, and Pl equals Ll, Ll being the voltage across one of the incoming lines. The voltage induced directly in each transformer secondary will be found to be the same as in the delta-delta connection, that is, Pl $\times$ Tr. The voltage between any two of the secondary output leads, Eo, however, will not be the same, but will be 1.73 $\times$ E due to the fact that any two of the output leads are not directly across one transformer secondary, but are across two secondaries in series, with their induced voltages differing in phase by 120 degrees.

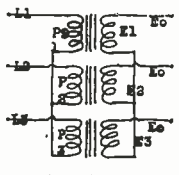
The reason for the secondary voltage across any two of the secondary output leads, in the star connected secondary being 1.73 times the voltage in one transformer secondary is explained as follows:

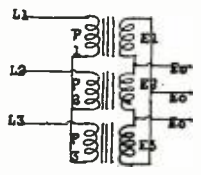
Refer to Fig. 3A. The two similar coils A and B each have equal voltages induced in them which differ in phase by 120 electrical degrees. In the vector, Fig. 3B, OA represents coil A, and OB coil B. The resultant vector OR is equal in intensity to OA or OB. This means that if two similar coils are connected in series and equal voltages induced in them differing in phase by 120 degrees, the resulting voltage across the two in series will be the same as that across each coil taken independently. This statement, when applied to the star connected secondary where the resulting voltage of two secondary windings in series is 1.73 times the voltage of each coil taken independently, appears to be in error. Such is not the case, however, for in the case of the star connected secondaries, a different condition exists. Each transformer secondary winding is in series with each of the other two, and the voltages induced in any two windings in series does differ in phase by 120 degrees, but, the windings are connected in series in opposite polarity. Refer to Fig. 4A. Coils A and B are again connected in series, but coil B is reversed with respect to coil A, which changes its relation to coil A by 180 degrees. Therefore the vector OB in Fig. 3B changes to OB' as shown in Fig. 4B. Thus, finding the voltage across two transformer secondaries connected as in Fig. 2, becomes a problem of vector subtraction. In Fig. 4B, OA represents the voltage in coil A, and OB' represents the voltage in coil B, which now has its voltage relation reversed from that of coil A by 60 degrees. By completing the parallelogram, the resultant voltage vector is represented by OR. Since angle AOB equals 120 degrees, angle AOB' must equal 60 degrees. Angle AOB' is bisected by OR, making angle AOL equal 30

Chief Engineer, WNOX, Inc.


DELTA-DELTA
FIG. 1


DELTA-STAR
FIG. 2


STAR-STAR
FIG. 5


STAR-DELTA
FIG. 6

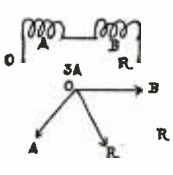


FIG. 3 B

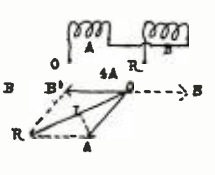
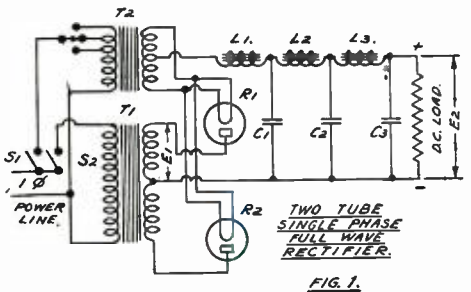
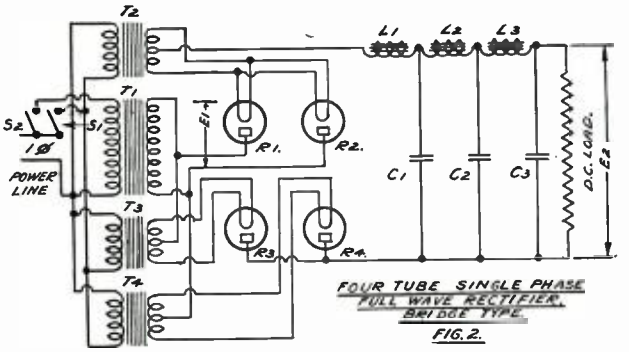


FIG. 4 B



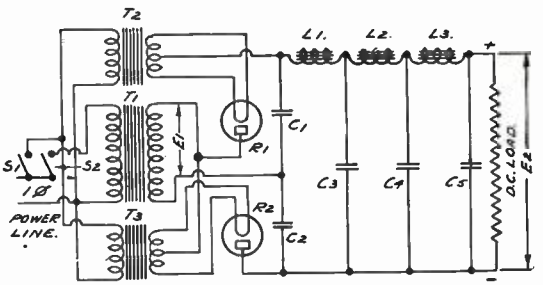
TWO TUBE SINGLE PHASE FULL WAVE RECTIFIER.

FIG. 1.



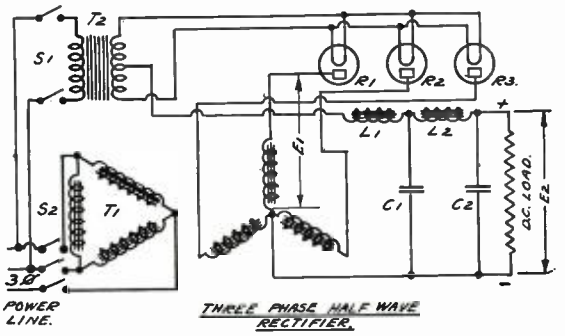
FOUR TUBE SINGLE PHASE FULL WAVE RECTIFIER. BRIDGE TYPE.

FIG. 2.



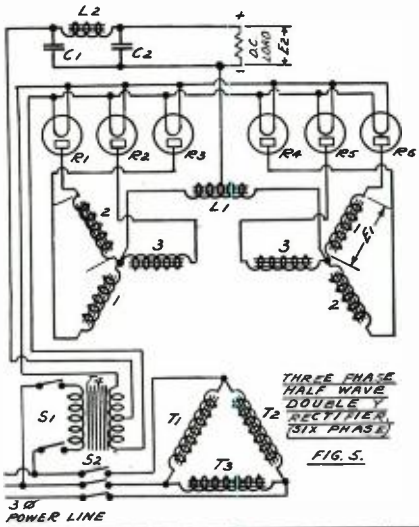
TWO TUBE HALF WAVE VOLTAGE DOUBLER RECTIFIER.

FIG. 3.



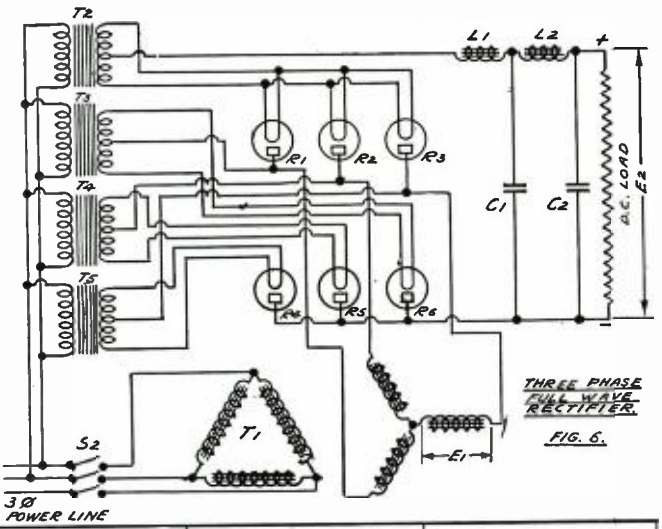
THREE PHASE HALF WAVE RECTIFIER.

FIG. 4.



THREE PHASE HALF WAVE DOUBLE Y RECTIFIER (SIX PHASE)

FIG. 5.



THREE PHASE FULL WAVE RECTIFIER.

FIG. 6.

CIRCUIT.	NO. TUBES.	MAX. INPUT VOLTS E1 R.M.S.	D.C. OUTPUT VOLTS E2 LESS DROP IN FILTER.	MAX. D.C. OUTPUT CURRENT.
FIG. 1	2	35.3 % M.P.I.V.	85% E1	66 % M.P.P.C
IF L1 IS OMITTED			113 % E1	27.5 % M.P.P.C. OF 1 TUBE.
FIG. 2.	4	70 % M.P.I.V.		66 % M.P.P.C.
IF L1 IS OMITTED			113 % E1	27.5 % M.P.P.C. OF 1 TUBE.
FIG. 3.	2	114 % M.P.I.V.	170 % E1 *	33 % M.P.P.C.
FIG. 4	3	41 % M.P.I.V.	117 % E1	84 % M.P.P.C.
FIG. 5.	6	41 % M.P.I.V.	117 % E1	200 % M.P.P.C.
FIG. 6.	6	41 % M.P.I.V.	234 % E1	100 % M.P.P.C.

* DEPENDS ALSO ON SIZE OF C1 & C2.

FOR 3-PHASE OPERATION ONLY

M.P.I.V. - IS MAXIMUM PEAK INVERSE VOLTAGE RATING OF RECTIFIER TUBE.
M.P.P.C. - IS MAXIMUM PEAK PLATE CURRENT RATING OF RECTIFIER TUBE.

MUST BE USED WITH T TYPE FILTERS WHOSE PARTS CAN HAVE SMALLER VALUES THAN THOSE OF FILTERS FOR 1 PHASE.
INTERPHASE REACTOR ACTS AS FIRST CHOKE.
TRANSFORMERS CAN BE EITHER THREE-PHASE WITH DELTA PRIMARY & STAR SECONDARY OR PREFERABLY THREE SINGLE PHASE TRANSFORMERS WITH DELTA PRIMARIES & STAR SECONDARIES.
SWITCH S1 SHOULD BE CLOSED FIRST, S2 CLOSED 40 SECONDS AFTER S1.

A. T. Co. Drawing C-12985

degrees. Also, AL bisects the resultant OR at right angles. By trigonometry, OL equals OA cos. 30 degrees, and OR equals OA $\times$ 2cos. 30 degrees. From a table, cos. 30 degrees equals .866 making OR equal 2 $\times$ .866 or 1.732 $\times$ OA. Since OA represents the voltage in one coil, (coil A), the voltage across the two coils in series is 1.732 times the voltage of one coil.

In the star-star connection, (Fig. 5), the primary input voltage L1 is not applied directly across each transformer primary Pl, but is across two primary windings in series. Therefore, for the same reasons as outlined above, the voltage across each transformer primary winding will be the line voltage Ll, divided by 1.73. The voltage induced in each secondary will then be $\frac{Ll}{1.73} \times Tr$. However, with the star connected secondary as has already been explained, the voltage of each secondary winding is increased by 1.73. The equation for determining the output voltage between the output leads

$$Eo \text{ becomes } Eo \text{ equals } \frac{Ll}{1.73} \times Tr \times 1.73 \text{ or simply } Eo$$

equals Pl $\times$ Tr. The input voltage is decreased by 1.73 while the output voltage is increased by 1.73 making the output voltage figure the same as with the delta-delta arrangement.

In the star-delta connection, (Fig. 6) the voltage on each transformer primary Pl, is reduced by 1.73 the same as with the star-star connections since the primary connections are the same in both cases. The voltage induced

$$\text{in each secondary is Pl} \times Tr \text{ or } \frac{Ll}{1.73} \times Tr.$$

With the delta connected secondary, as used with this connection, the output voltage Eo between any two of the secondary output leads will be the same as that on one transformer secondary E. The primary voltage is reduced by 1.73, but, in contrast to the star-star connection, the delta connected secondary does not increase the voltage by 1.73 making the equation for output

$$\text{voltage, Eo equals } \frac{Pl}{1.73} \times Tr.$$

Reviewing the output voltages obtained from these four connections, we find that the delta-delta, and the star-star, connections give a straight step-up ratio depending upon the turns ratio of the transformer. The delta-star increases the voltage output over the delta-delta or star-star by 1.73. The star-delta decreases the output voltage by 1.73 as compared to the star-star, or delta-delta.

Applying the Three-phase Connections to High Voltage Rectifying Circuits

On page 15 is reproduced a set of diagrams with separate numbers 1 to 6 showing the transformer connections and output voltages for the most commonly used mercury vapor rectifying circuits.

The three-phase rectifying circuits usually employed are: the three-phase half-wave, Fig. 4, the three-phase half-wave, double star, Fig. 5, and the three-phase full-wave, Fig. 6. With these three arrangements, it is essential that the star connections be used on the secondaries. For the three-phase half-wave, and half-wave double star connections, the center of the star connected windings must form the negative load terminal. With the three-phase full-wave circuit, the star connected secondary largely accounts for the voltage doubling action as will be explained shortly. As is the case with the diagrams the primary connections of these rectifying circuits are almost invariably shown as being delta connected, and the output voltages, likewise, are computed for a delta connected input. In either of the three circuits shown, however, the primaries may be star connected, and the voltage outputs reduced by 1.73. Then, with star connected primaries, the three-phase full-wave output would be 135% El instead of 234% El and the half-wave circuits output would become 67% El instead of 117% El.

There are two separate factors entering into the voltage doubling action of the three-phase full-wave rectifier as shown in Fig. 6. This rectifier, being of the bridge type, utilizes the full transformer output voltage, which, in this case, is 1.73 times the voltage in one transformer secondary (El). Due to the three-phase output waveform, .955 of the peak voltage is available. The total output voltage obtainable with this type rectifier, then, becomes .955 $\times$ 1.414 $\times$ 1.732 $\times$ El or 2.34 El.

With the three phase double star circuit as shown in Fig. 5, and the three-phase half-wave circuit as shown in Fig. 4, the same relations exist as with the three-phase full-wave circuit, but, due to the negative load terminal being taken from the center of the star connected windings, the output of the half-wave type is reduced to $\frac{2.34}{2}$ or 1.17 El.

▲ ▲ ▲

RMA CONVENTION AT CHICAGO, JUNE 6TH

INDUSTRY stabilization and promotion, with definite and constructive projects submitted, will be developed at the ninth annual RMA convention at the Stevens Hotel in Chicago on June 6, according to a program arranged by the RMA board of directors. The entire RMA membership is being invited and urged to send two or more representatives to the association's annual membership and business meetings, including group meetings of its four main divisions, of set manufacturers, tube makers, parts and accessory manufacturers and those of amplifier and sound equipment. On June 5 preceding the annual membership meeting there will be a final meeting of the present board of directors and new elections to the board will be made by the four divisions on June 6. President Fred D. Williams will preside at the annual convention and membership meeting. On the evening of June 6 there will be held an informal dinner for RMA members and guests. Paul B. Klugh has been appointed chairman of the committee on arrangements

The RMA convention falls during the opening week of the Century of Progress Exposition at Chicago and also coincident with Chicago conventions of the electrical and musical industries. The Edison Electric Institute, which succeeded the National Electric Light Association; the National Association of Music Merchants and the National Association of Sheet Music Dealers will hold their annual conventions while the RMA membership meeting is in progress.

With the annual RMA trade show omitted this year and with the RMA membership meeting and convention being confined strictly to business at a one-day session on June 6, merchandise exhibits for the one-day RMA meeting are not being encouraged.

•CONTROLS•
For 1933 Receivers

By NORMAN E. WUNDERLICH*

OF all component parts used in radio receivers, no other unit has the importance of the volume control, and yet there has been but negligible improvement in the mechanical and electrical characteristics of these in the past few years.

The volume control, in all but a very few radio receivers, has been in the nature of a variable resistance, varying either the signal input, the plate load and effective voltage applied to a r-f. tube; variation of the control grid bias or varying the signal voltage to an audio stage.

Because the volume control is manually rotated every time the radio receiver is put in operation, and because of its electrical position in the circuit, it is highly important that it be both mechanically and electrically smooth and quiet in operation, and remain that way over a period of years.

That many volume controls have not met this requirement in full is attested by the fact that hundreds of thousands of such controls are sold yearly as replacement units for those which have become defective in service.

Noteworthy improvement has been made in the development of molded carbon resistors having no "voltage coefficient," no "temperature cofficient," fixed carbon units which did not change their value under the most extreme humidity conditions and which did not introduce any circuit hiss or circuit noises due to electro-chemical action. In these important respects, molded carbon resistors have vastly improved in the past three years.

*Consultant, Stackpole Carbon Company.

A standard type of control unit made for radio set manufacturers as an improved volume control, tone control or audio gain control.

A new type of volume control employing a molded carbon resistor element.

Both the switch type and the non-switch types are made very small to fit in with the new small a-c.–d-c. chassis.

For over one year the writer has been in close touch with the engineers of a certain manufacturing company who have been striving to perfect a new type of resistor element which would meet all of the operating requirements of any radio receiver under all conditions of temperature, humidity, current carrying and hard usage.

Satisfactory experimental production was attained about six months ago and over 250,000 controls have already been placed in use on new receivers.

Fig. 1 shows the motor driven "cycling" device used to check the mechanical and electrical characteristics of these variable resistors under various usages.

The electric motor drive has a cam and a ratchet to which are attached the units under test.

The time of a complete cycle is adjustable and a large Veedor counter keeps track of the test period. Under some tests current is drawn through the rotating arms of the controls to simulate the conditions in a radio receiver where the controls are used in the cathode or plate circuits.

After each 1,000 cycles the bearing wear is checked, the resistance of the units measured, and the noise from the moving contact checked by amplification through an extremely high gain amplifier into a v. t. voltmeter. As part of this latter test, an unmodulated r-f. carrier is introduced into the test circuit making a very severe test condition.

Just behind the rotating test machine in Fig. 1 is seen a large electrically operated humidity machine. The controls are placed in this box to check the effect of humidity and temperature while they are periodically rotated from end to end and with current passing through the whole unit and through the moving arm portion. This is the test in which many controls fail miserably for the moisture absorbed results in

Replacement controls are manufactured for all sets.

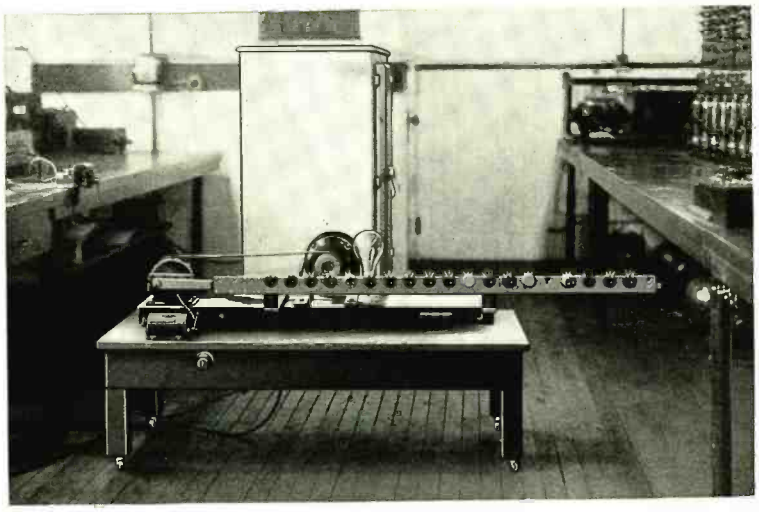


Fig. 1. In the foreground is the electrically driven "cycling" machine for making wear tests, both accelerated and extended. In the background is the huge humidity box wherein the volume controls are investigated in all conditions of humidity and temperature, while in operation and carrying current. The units on test are regularly checked for noise in special high-gain audio circuits with super-imposed r-f. currents.

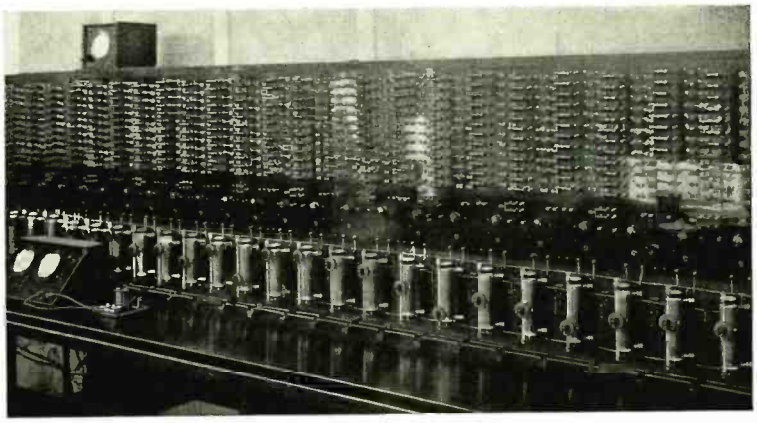


Fig. 2. Test board in the laboratory of the Stackpole Carbon Company, used to make life tests, wattage dissipation tests, voltage coefficient measurements and temperature coefficient checks on the experimental and production resistor elements.

changes of as much as 70 per cent. in their resistance value. The new molded carbon type of control, under a test condition of 95 per cent relative humidity and 115°F, shows a change of less than 5 per cent over a period of 100 hours.

The Resistor Element

The resistor element is in the form of a molded carbon ring about 3/16 inch thick and 1/4 inch wide.

After the manufacturing process, which makes possible any resistance taper and any desired "hop-off" resistance at both ends, the resistor element is fired in a continuous furnace at high temperatures which imparts a hard, glass-like surface to the resistance unit, impervious to temperature, moisture, voltage dissipation, or hard usage, and forming a perfect surface for the smooth, sliding, variable contact. There is no rough, granular structure to the surface to create noise or electro-chemical disintegration.

A small contact shoe of nickel-silver slides smoothly, firmly and quietly over the surface of the resistor element. This is held in place by the spring steel arm attached to the Bakelite rotating member. The shaft is molded into a Bakelite hub so that the shaft and mounting bushing are well insulated from the control element and the moving contact, as well as being insulated for well over 3000 volts. The capacity has been kept very low between the various parts.

On a "cycling" test of one second per phase, these units have been checked regularly on runs up to 100,000 cycles with a change in resistance value of less than 5 per cent.

The noise introduced, whether carrying current or merely signal voltage, is so low that it is not discernible in any type of radio receiver. This molded carbon type of control is particularly advantageous for use in cathode or plate circuits where current must be passed through the resistance element.

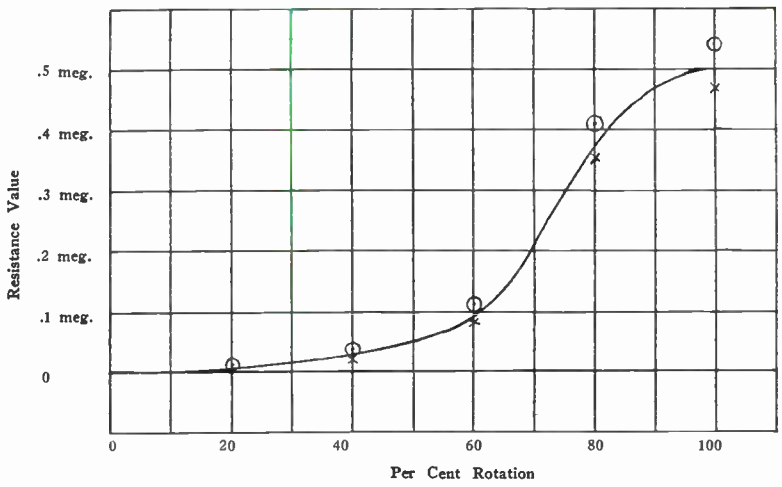
New Circuit Requirements

In the new, small chassis, a-c.—d-c. receivers, space is an important factor. This new control is only 1-1/2 inches in diameter and less than ½ inch thick. The a-c. switch type is but 7/8 inch from front to back.

In a special type of assembly provision is made to reduce the length of the mounting bushing. In this the mounting L-bracket is assembled directly to the control unit with practically no projecting bushing. This saves considerable space and the control is so designed that proper bearing surface still remains with this fore-shortened bushing.

Shielding Controls

Most receivers now use the control with a-c. switch attached. In the newer circuits employing such as the 55, 85 and 75 tubes, bad a-c. hum will be introduced unless the switch is well shielded from the control elements. This has been properly provided for in the controls where the shielding is not only complete, but the capacity between elements kept low to further reduce a-c. coupling. In the L-bracket assembly.



This curve is of a typical Stackpole molded carbon variable resistor, showing the changes due to (1) life test (×) and (2) humidity test (⊙).

the electrostatic shield is automatically grounded to the chassis through the bracket.

Automatic Tone Compensation

A control for obtaining automatic tone compensation is included in this line of controls. This functions with the volume control action so that as the receiver volume is reduced, the bass and high ends of the audio scale are brought up to compensate for the peculiarity of the human ear that demands more and more relative power at the two frequency-extremities as the volume is lowered. The compensation consists of a series-resonant circuit bridged across a portion of the volume control resistor.

The choke has a value of 160 mh., and placing the value of the series condenser from .025 to 0.1 mfd. will locate the resonating point at the frequency desired.

The two circuits shown are of the Clarion 14-tube receiver and the well-known Scott all-wave de luxe instrument, both of which use these tapped controls in this type of tone compensating circuit. The control used in both of these receivers has a total resistance of 500,000 ohms with the tap located at approximately 90,000 ohms. The best location for the tap will be determined by the gain of the receiver so that the effect of the tuned circuit becomes most prominent at about the accepted position for low room volume. The results are very pleasing to listen to under home operating conditions and this feature is recommended for all console models.

Resistance Taper

With this new processing of a molded carbon resistor unit, it is readily feasible to obtain an ideal type of "taper" or variation of resistance with mechanical rotation of the control. For audio controls it is usually desirable to have about 10 per cent of the total resistance at 50 per cent rotation. Thus a 500,000 audio control would have 50,000 ohms at the half way point.

It is also best to taper controls used in the i-f. cathode to control grid bias. In these units it is desirable to have about 20 per cent of the total resistance at the point of 50 per cent rotation. In cathode controls, whether they are used to simultaneously shunt the antenna primary or not, the resistance should increase counter-clockwise. Audio controls usually have their resistance increase clockwise.

In either type of radio or audio control, the "hop-off" resistance is of vital importance in order that the signal may be fully attenuated to a zero position. In switch type controls, the resistance should be less than 5 ohms at the position where the switch closes to turn on the set.

The controls herein described use a new silver spray process to secure definite, low resistance hop-off value.

In r-f. cathode circuits, where an initial bias is desired, these new controls are built with just the desired resistance always left in the circuit, about 250 ohms or whatever is desired, so that no separate external fixed resistor is required. This saves in material and labor cost.

It is gratifying to have a variable resistor which we can safely employ in any position of the radio receiver circuit without fear of noise or of the set becoming inoperative after a short period of service.

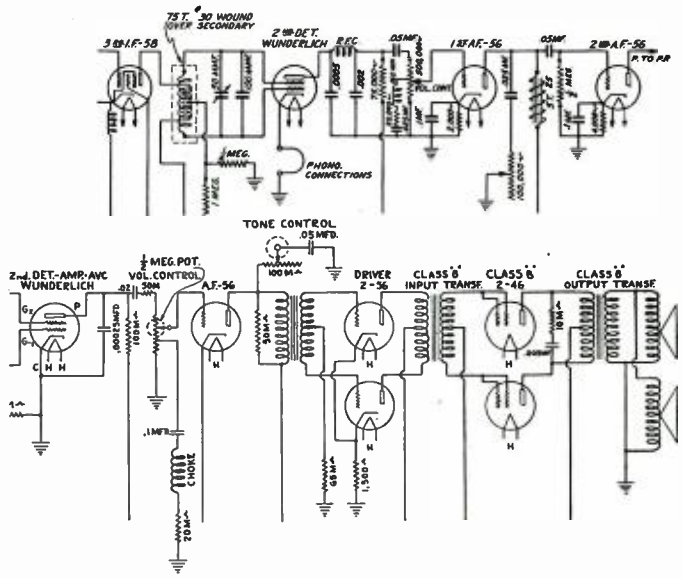


Fig. 4. These two circuits show the use of the "tapped" molded carbon volume control in the Clarion and Scott receivers to obtain automatic tone compensation. A tap on the regular audio volume control is connected with a series-resonant circuit to improve the low and high frequency response at low speaker levels to compensate for the response characteristic of the human ear. The circuits also show the application of these new control units for tone controls.

THE USE OF INSTRUMENTS in Radio Receiver Manufacturing

By J. H. MILLER*

THE departments of the radio receiver plant using instruments may be sub-divided into three general groups:

1. The design and experimental laboratory.
2. Inspection of component parts.
3. Inspection and adjustment of completed assemblies and receivers.

The requirements of the laboratory will be so very broad that they can hardly be mentioned in detail. All laboratories, however, should have available basic standards with which the shop instruments may be checked from time to time and which will serve as standards in case of disputes with suppliers of parts. Such instruments as the microfarad meter, capacity bridge, resistance bridges, precision ohmmeters, precision step-down transformers (for accurately checking filament voltage) as well as radio frequency equipment will all be required. Such basic standards will serve to give confidence in the plant tests and a single dispute settled on the basis of exact knowledge will pay for a large group of primary standards.

Under the methods of manufacture used today, the inspection of component parts is probably the most important use for instruments. Condensers of all kinds, fixed resistors and volume controls, transformers, chokes and inductances. loudspeakers and tubes; the radio set is simply an assembly of these and they must be correct if they are to function together.

Electrolytic condensers must be tested for capacity and leakage or capacity and power factor. The Model 372 capacity meter will serve as the basic standard and the Model 480 power factor meter is available as standard equipment for power factor tests. For rapid production testing instruments of the voltmeter type may be used. Although line voltage must be held constant. the instruments are so inexpensive and rugged that it will pay to install regulating equipment in order to use this sort of a measuring device. The Model 156 instrument is a good example of this with a nominal 7" diameter metal case and a standard iron vane movement. It is available with ranges from 0.6 up to 10 mfd. full scale for use on 110 volts 60 cycles and special ranges going somewhat lower and considerably higher in value can be had at a very small premium. A stock instrument with a range of 1.5 and 15 mfd. will serve to take care of a large number of such tests.

These instruments are valuable because a shorted condenser will not burn them out but will merely give a full scale indication; if a condenser charged to a high potential on d-c. is placed across their terminals. the discharge passes so rapidly that the impulse is not transmitted to the moving element to any great degree and the pointer merely moves up the scale a trifle. The control springs carry no current and hence there are no fine filaments to be burned out by such discharges and this type of instrument is, therefore, ideal for rapid use. Its accuracy is subject to waveform voltage and frequency errors and as a basic standard the dynamometer capacity meter must be used. This latter type is, however, more fragile and in general should be confined to the laboratory.

Condenser Measurements

Leakage measurements on electrolytic condensers may be taken on any voltage and using any standard type of milliammeter. Since a shorted condenser has practically no resistance it is necessary to protect the instrument in one way or another against such short-circuits. This may be done by means of ballast resistance or a fuse. Instrument fuses are available which will protect even a 1 ma. instrument. A somewhat simpler method, however, is to supply sufficient resistance to limit the current to perhaps four or five times the full scale range of the instrument. The instrument will stand this overload quite satisfactorily and this value of resistance will not materially reduce the voltage when the leakage is of normal, low values.

Fixed condensers of both mica and paper types. either moulded or wrapped, may be tested for capacity in the same manner as described for electrolytics. Leakage, however, is rarely a factor, but breakdown potential is important. This is usually checked on direct current and the energy can be supplied from a small power pack. A series resistance to limit the current in case of breakdown is usually arranged although the power pack itself may have a sufficient falling characteristic to protect itself. The instrument in this case being a voltmeter, placed across the capacity, cannot be damaged and does not need protection.

Variable condensers, particularly in gangs, may require checking for linearity or tracking between units. While this is a relatively slow check, it should be done on at least a portion of the units to insure that they are sufficiently close to require but little balancing when the final adjustments are made. The condenser is usually connected to a group of similar inductances just as in a receiver and these are excited from some fixed flexible source. Thermocouple galvanometers in each of the several circuits will indicate when they are tuned to resonance and the trimmers or other adjustments on the condenser may be manipulated to bring the groups into resonance at each of several points. As manufacturing methods improve and as better fixtures are used in assembly, the condensers will run more nearly alike but it is believed that a check of this sort is always worthwhile as a production control.

Resistance Units

The modern radio set uses a large number of resistance units, usually of the carbon variety. These must be checked for resistance as received and this check may be made through the use of a bridge or the series type ohmmeter. In the years past it has been necessary to check these units with normal current flowing through them or with normal voltage across them. This was because a so-called voltage error existed and unless

*Radio Engineering Department, Weston Electrical Inst. Corpn.

measurements were made at an established value agreed upon by manufacturer and user, arguments invariably came up due to a misunderstanding of the situation. Today resistors are being supplied which have a very small voltage error and it is doubtful if it is necessary to follow this exact procedure. The laboratory, of course, can determine the voltage error for the particular make or makes of resistors to be used by checking the resistance with various values of current; this should be done at the normal value of current which will flow through the resistor as well as the other values. If the difference between the several readings is only 1 per cent whereas a 10 per cent tolerance is allowed on the resistor. it is probably not worth while to set up special test equipment to maintain the voltage at the proper value. However, a clear understanding of resistance testing methods will usually allow of such tests at approximately the voltage being used with very little extra equipment and it is suggested that the normal operating conditions be approached even though not exactly met. This will allow for the elimination of even the slightest residual errors and give more confidence in the general test.

In resistance testing it should be remembered that a special bridge setup can be made for any condition of voltage, current and resistance. There is no law that says the arms must be any particular value or that any particular value of voltage can be used. Given the current through a resistor with a certain value of resistance, established voltage supply can usually be arranged to fit the needs of a particular test through the judicious use of a few decade boxes and a galvanometer.

Ohmmeters

Production run ohmmeters may be found more desirable where very high speed testing is required and again in this sort of a circuit the requirements as to current and resistance can always be met in one way or another.

Volume controls must be checked to resistance and position where each increment of resistance occurs. This usually means a special setup for the test, the details of which depend largely upon the requirements of the engineering division as to limits of resistance at the various positions. But having the various resistance measuring methods available, it is a rather straightforward mechanical job to make an inspection fixture to take care of any reasonable requirements.

The checking of inductance coils is nearly always a r-f. job. They are usually set up against condensers, excited with r-f. and checked for resonance by means of thermo-galvanometers in the individual circuits. The reading of the condenser will tell whether the inductance is high or low. Beat frequency methods may be used although in general such precision is not required. Routine checks on inductance coils and especially small honeycombs made with an ohmmeter will frequently provide a sufficient test since this will indicate that a circuit exists and that the resistance is close to the proper value which in turn indicates that the normal amount of wire has been used. While it does not directly indicate inductance it will throw out abnormal coils.

Choke Coils

The checking of choke coils is more or less of a laboratory job and will largely depend upon the requirements of the engineering division. Methods of measuring inductance are quite variable particularly with respect to the methods of segregating a-c. and d-c. components. Once the method has been decided upon, however, indicating instruments are available for the job.

The power transformer must be checked and this in turn requires a multiple range voltmeter or, where speed of testing is important, a group of instruments may be used connected individually to the several taps. One arrangement for high speed testing calls for each instrument to have a black line at its center and a red line on each side indicating the tolerance limits. Each instrument is calibrated by means of series resistance to indicate at the center position on the normal expected voltage of the tap to which it is connected. Connections may be made by a gang connector of special design and if all the instruments indicate within their red line limits, the transformer is normal. This arrangement simplifies enormously the job of voltage testing and eliminates the necessity of reading scales; checking within limits is very much easier and less fatiguing than attempting to read divisions. Such instruments are not particularly special and can be supplied very readily. As a matter of fact the scales can be transferred with very little trouble and in some cases clips are placed on the scale instead of lines which will allow them to be moved when the instrument is opened. Although more expensive, special indexes can be supplied on certain instruments which are adjustable from the front and which indicate by a pair of red pointers the upper and lower limits for the particular test involved.

The laboratory should have a set of basic instruments for voltage measurement such as Model 341 and one of the special low voltage potential transformers. These instruments will serve to check the shop equipment which latter may be of the 7-inch round type such as Model 156 or the smaller Model 476 where it is deemed of sufficient accuracy.

Speaker voice coils and other miscellaneous parts may be checked for resistance and except in certain special instances this will be the only testing required.

The New Tubes

The tubes themselves should be tested because after all they are responsible for the amplification in the set and it is quite necessary that normal units be used in making the plant measurement. Many plants turn in all tubes in the evening and they must be tested before being checked out in the morning. This applies only where sets are shipped stripped. Where they are shipped complete with tubes, the testing of the tubes is again of importance and the tube comes into its position as a component, hence the test must be rapid and straightforward. The Model 576 mutual conductance meter may be adapted for most of these requirements, although for simpler operation one of the ordinary dealer checkers may be used. The more complex tubes, however, must be checked very carefully as to method since the multiplicity of electrodes may give rise to results which only a series of tests will show.

The final assembly is usually tested by supplying a signal derived from a large laboratory oscillator and power amplifier. The level of the input signal may be determined at each test position by a thermo-galvanometer or one of the more sensitive thermal instruments using vacuum couples which are now available commercially in the small size such as the Model 301. down to 2 ma. full scale. This will allow for the individual adjustment of correction input signal at each position. The corresponding output can be indicated on a so-called output meter of the rectifier type and this instrument, when the input is turned off, will also indicate noise level or hum level. The rectifier type instrument with suitable blocking condensers where required will be found of great value in indicating audio frequency currents and voltage wherever they are to be measured. With a standard resistance of 1,000 ohms per volt, the energy taken by the voltmeters may in general be disregarded and measurements made with reasonable accuracy.

I. R. E. CONVENTION at Chicago

THE Eighth Annual Convention of the Institute of Radio Engineers will be held in Chicago, June 26-28, inclusive.

There will be interesting exhibits on display showing recent products of the parts and accessories manufacturers.

The convention will be held at a time when various other electrical meetings are to be held, thus it is expected that there will be a large attendance of radio engineers, executives and manufacturers.

The schedule of events is announced as follows:

Monday, June 26

9:00 a.m.—Registration.
9:00 a.m.-10:00 a.m.—Inspection of exhibits.
10:00 a.m.-12:30 p.m.—Official welcome and technical session.
12:30 p.m.-2:00 p.m.—Lunch and inspection of exhibits.
2:00 p.m.-4:00 p.m.—Technical session.
4:00 p.m.-6:00 p.m.—Inspection of exhibits.
7:00 p.m.—Banquet.

Tuesday, June 27

9:00 a.m.-10:00 a.m.—Inspection of exhibits.
10:00 a.m.-12:00 noon—Technical session.
12:00 noon-1:30 p.m.—Lunch and inspection of exhibits.

LEWIS M. HULL
President of the IRE.

1:30 p.m.-3:30 p.m.—Technical session.
4:00 p.m.—Trip to Fair.
4:00 p.m.—Sections committee meeting.

Wednesday, June 28

9:00 a.m.-9:30 a.m.—Inspection of exhibits.
9:30 a.m.-11:30 a.m.—Technical session.
12:00 noon—Trip to Fair.
12:30 p.m.-1:30 p.m.—Lunch at The Fair—Blue Ribbon Casino.
1:30 p.m.-6:30 p.m.—World's Fair.

The technical papers so far scheduled include the following:

"Vacuum Tube Characteristics in the Positive Grid Region by an Oscillographic Method," by H. N. Kozanowski and I. E. Mouromtseff, Westinghouse Electric and Manufacturing Company.

"Vacuum Tubes for Use at Extremely High Frequencies," by B. J. Thompson and G. M. Rose, Jr., RCA Radiotron Company, Inc.

"Application of Graphite as an Anode Material to High Vacuum Transmitting Tubes," by E. E. Spitzer, General Electric Company.

"A Life Test Power Supply Utilizing Thyratron Rectifiers," by H. W. Lord, General Electric Company.

"The Radio Patrol System of the City of New York," by F. W. Cunningham, Bell Telephone Laboratories, New York City, and T. W. Rochester, New York Police Department.

"Some Aspects of Radio Law," by J. Warren Wright, Navy Department.

"Studies of the Ionosphere and Their Application to Radio Transmission," by S. S. Kirby, L. V. Berkner and D. M. Stuart, Bureau of Standards.

EXECUTIVES OF THE NEW DIVISION OF THE HYGRADE SYLVANIA CORPORATION

WILLIAM J. BARKLEY, identified with radio engineering enterprises since 1907, and formerly executive vice-president of the DeForest Radio Company, has been appointed general manager of the new transmitting and industrial tube division of the Hygrade Sylvania Corporation.

D. F. REPLOGLE, ten years ago graduated from M.I.T., with a master's degree in electrical engineering. For several years past he has been chief engineer of the DeForest Radio Company, in charge of the design and manufacture of transmitting radio tubes. Mr. Replogle has recently been appointed chief engineer of the new transmitting and industrial tube division of the Hygrade Sylvania Corporation.

The Fabrication of Radio Receivers

AN excursion through the manufacturing plants where radio receivers are produced in quantities discloses that there is much involved other than electrical circuits and electrical devices. The matters of furniture, of cabinets and of methods of assembly of chassis and of completed receivers are clearly of great importance. As the radio engineers gradually improved the performance of receivers, whether of the five tube or eleven tube variety, appearance, dimension and novelty gained first importance as sales features.

In recent years much of the early difficulty experienced with radio receivers has been overcome. There was serious trouble due to loose and insecure assemblies, causing defective operation and frequent complaints from set owners that their receivers were out of commission.

Also, the advent of radio found the cabinet makers and furniture designers somewhat unprepared for calls soon to be made upon them for various forms and types of housings for receiver electrical equipment. Competition for business as time progressed called for mechanical designs and methods of chassis and cabinet assembly which would meet the exacting needs of musical instruments and at the same time permit of economies in manufacture.

At one time it was considered that metal parts not incorporated in the electrical circuits of radio receivers were detrimental to performance, but now it is rare indeed that any other material with the exception of insulating parts is used.

With this type of construction becoming general, there was at once opportunity for the development of new means of assembly which would insure alignment and placement of parts, which would make for mechanical permanence of completed units, and which would permit of economies of manufacture.

The radio manufacturers naturally turned to the self-tapping screw as these unique fastening devices had demonstrated their ability in reducing fastening costs in the automobile industry, yet improved the strength of the assemblies. These screws made possible the replacement of more costly fabricating operations using machine screws, bolts and nuts, etc., in difficult and inaccessible locations. It was discovered that costly metal flanges, welded on metal tap strips, and forming operations, could be eliminated by the simple procedure of fastening component parts with self-tapping screws.

The particular advantage of these screws is that they may be used in places that are hard to get at with rivets or bolts and nuts, and where it is not practicable to tap holes for machine screws because the metal is too thin to give satisfactory results by this method of assembly.

The adoption of this new means of receiver assembly by practically all of the important radio manufacturers is accounted for by the fact that there were clearly evident savings in time and assembly, compared with methods previously in use.

In the radio industry there are three types of these screws employed quite generally. These are: Type Z, hardened self-tapping sheet metal screws, hex head hardened self-tapping cap screws, and Type U, hardened metallic drive screws. The accompanying illustration, Fig. 1, shows various forms of Type Z screws. Fig. 2 (H. H. ST. cap screw.) Fig. 3 illustrates a form of Type U screw.

Applications

The Type Z screws are used for joining and making fastening to sheet metal from 28-gauge (.015 inch) up to 6 gauge (.203 inch). Also they are used for making fastenings to aluminum and die castings, Bakelite, Durez, ebony, asbestos and similar insulating materials.

The hex head self-tapping cap screws are used in sheet metal as light as 24 gauge (.025 inch) up to 10 gauge (.140 inch); in steel plates and structural shapes up to ½ inch thick; and in solid sections of many materials including brass, bronze, aluminum and die castings, slate, transite board, etc.

The unique structure of the threads of these screws and the hardening treatment to which they are subjected make them capable of forming a thread in the material as they are turned in with a screw driver. They may be removed when necessary and used over again in the same holes without impairing the security of the fastening.

Type U hardened metallic drive screws are for making permanent fastenings to iron, brass and aluminum castings, steel, Bakelite, Durez, etc., functioning somewhat differently from the Type Z and cap screws. They are driven in with a hammer. As the screw is hammered in its hardened spiral thread cuts into the material like a tap. The unthreaded portion, or pilot, at the tip holds the screw in place before it is driven in and also guides it so that it will go in straight. The diameter being somewhat larger than the root diameter of the screw and slightly smaller than the outside diameter, the material that is displaced when the screw is hammered in is forced between the threads and the pilot, thereby anchoring the fastening at the base.

The great increase in the use of these cost-cutting screws in the radio industry during the past two or three years in part accounts for the acknowledged improvement in radio receiver performance, and for the elimination of various annoying difficulties previously attributable to faulty assembly.

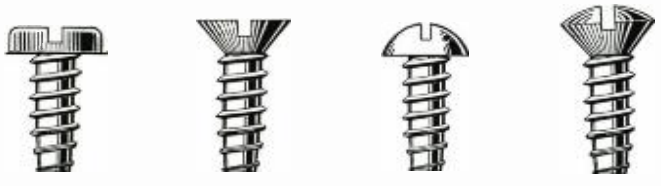


Fig. 1. Type Z screws.

Fig. 2. HH cap screw.

Fig. 3. Type U screw.

NEWS OF THE INDUSTRY

ARCTURUS ELECTS OFFICERS

The stockholders of the Arcturus Radio Tube Company, Newark, N. J., at their annual meeting elected the following directors: Chester H. Braselton, George Lewis, C. E. Stahl, Guernsey Curran and Emil Diebitsch.

After the stockholders' meeting, the directors elected the following officers: C. H. Braselton, president; C. E. Stahl, vice-president and general manager; George Lewis, vice-president; M. E. Dorn, secretary and treasurer; F. I. Sparrow, assistant secretary; E. A. Morse, assistant treasurer, and W. D. Anderson, assistant to the president.

At the stockholders' meeting a financial statement for the first quarter of 1933 was presented. This indicated a ratio of assets to liabilities of 6.98 to 1 as compared to 3 to 1 on December 31 last. The company also showed a net profit for the quarter.

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GENERAL CABLE EXPANDS FACILITIES IN CHICAGO DISTRICT

To insure a sufficient supply of magnet wire for servicing its middle western trade, General Cable, when temporarily suspending production of coils and magnet wire at its Fort Wayne plant, announced a program of expansion of its warehousing facilities at Chicago.

Over a period of years, General Cable has been producing magnet wire and coils at two of its plants—Fort Wayne, Ind. and Rome, N. Y. Production will be continued at Rome and the operating and department heads of the Fort Wayne organization are moving to that point for the duration of suspension of activities at Fort Wayne and will assume charge of all coil and magnet wire operations.

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CONSULTING RADIO SERVICE

The United Radio Laboratories, formerly of Arlington, Massachusetts, have been re-located at 30 East 20th St., New York City. Richard F. Shea, president and general manager, is well known in consulting engineering circles. Edgar Messing, formerly of Pilot, Pierce Airo, Gold Seal, and Emerson, has joined the company as treasurer, and brings a wide experience in radio engineering practice.

Mr. Shea states: "There is a very definite tendency on the part of the smaller manufacturers to avail themselves of high-grade engineering assistance. Many concerns have found in our consulting services a means whereby they can obtain up-to-the-minute assistance at times when it is most needed."

SYLVANIA'S NEW TUBE FACTORY

The accompanying picture is of the new tube plant at Clifton, N. J., of the Hygrade Sylvania Corporation. In this factory will be manufactured a modern line of transmitting radio tubes, photocells and tubes for industrial uses.

Such an undertaking at this time is convincing evidence of the optimism with which the management of the Hygrade Sylvania Corporation looks on future business conditions.

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RADIO EXPORTS TO SPAIN

In 1931 the number of American radio receivers exported to Spain totaled 24,365. In 1932 the number increased to 34,230. The number of radio tubes exported to Spain increased from 81,595 in 1931 to 103,466 in 1932. The number of loudspeakers exported for the two years were 5,510 and 10,144, respectively. In dollars the American radio shipment to Spain considerably exceeds one million dollars per year.

A reason for the growing exports to Spain is that Spanish radio interests have in the United States several export contacts well qualified to purchase dependable radio products. One of these is F. Del Carpio, Radio, 7th Floor, 19 East 47th St., New York. Mr. Del Carpio has had long experience in radio trading with Spain and with South American countries.

F. DEL CARPIO

KEN-RAD RADIO TUBES

As one means of placing definite information regarding new types of tubes before radio engineers and servicemen The Ken-Rad Corporation, Owensboro, Ky., is distributing from time to time copies of an engineering news bulletin.

This company will be glad to supply to any such interested person numbers 1, 2, and 3 of the current year's bulletins. Latest bulletin issued concerns the type 19 Ken-Rad tube, a complete Class B amplifier consisting of two sets of Class B elements enclosed in the same bulb. This tube has a six pin base and a common filament connection but separate external connections for each of the two grids and plates. Type 19 is a direct emitter type with a 2.0 volt filament intended for operation from a d-c. voltage source.

Other recent Ken-Rad tube types announced in this series of bulletins have been the 6Z3, the 12Z3, the 2A7, 6Z7, 2B7, 6B7, 6C6, and 2A3.

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SYNTHETIC MOULDED PRODUCTS, INC.

The opening of its new plant, at Stonington, Conn., is announced by Synthetic Moulded Products, Inc. through its president, O. W. Greene, Jr.

The machine equipment is new throughout and of the latest cost-reducing type. Eleven presses, varying in capacity from 50 to 320 tons, have been installed; and ten additional units are in order. The press equipment, when completed, will be adequate for the rapid and economical production of moulded parts in any size and in any quantity. The presses are supplemented by a battery of up-to-date pumps, accumulators and air compressors, all motor driven.

The products of the plant include:—moulded parts for aircraft, radio and telephone parts, textile specialties, parts for electrical apparatus, instruments, and utilities, moulded insulations, containers, caps, closures and display devices.

Production and management are under the personal direction of Mr. Greene, president, whose experience in plastic engineering includes six years in charge of the Department of Design and Development in the Pittsfield works of General Electric Co. Prior to that, he was associated with Western Electric Co. and Van Trump Testing Laboratories.

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FIVE YEARS' TUBE LIFE TEST

On April 21, 1928, the Arcturus Radio Tube Company, Newark, N. J., placed on life test the first twenty-five quick heater a-c. Type 127 tubes produced in the company's factory. The tubes have been burning continuously since that date, the test being terminated on April 21, 1933, establishing a record of 43,000 hours of constant life.

Western Electric 1 kilowatt equipment installed at Station WHAT, Philadelphia, Pa.

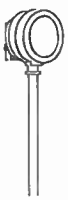
Low Power HIGH POWER or SUPER POWER

Western Electric 50 kilowatt equipment installed at Station WHAM, Rochester, N. Y.

. . . complete station equipment by Western Electric

Whatever your broadcasting needs, you can rely on Western Electric equipment to meet them fully.

Transmitters and amplifiers are available for the smallest station—or the largest. There are speech input equipments for station and studio. Tubes for every purpose, which maintain their characteristics throughout an unusually long life. Frequency Monitoring Units to keep your station on its assigned frequency. Pick-up apparatus, of which the Moving Coil and Lapel Microphones are outstanding examples. And Reproducer Sets for transcriptions.



High quality and operating dependability are built into all this apparatus—backed by more than 50 years of Bell Telephone making. Indicative of Western Electric leadership is the fact that more than 200 commercial broadcasting stations in the United States are now operating with this equipment. Many of these stations have replaced their initial installations with Western Electric equipment of higher power.

Western Electric

RADIO TELEPHONE BROADCASTING EQUIPMENT

Distributed by* GRAYBAR *Electric Company

GRAYBAR ELECTRIC CO. RE 5-33
Graybar Building, New York, N. Y.

Gentlemen: We are interested in Western Electric Radio Broadcasting Equipment, transmitter to have power rating of.....
Include information regarding:

☐ Moving Coil Microphone ☐ Frequency Monitoring Unit
☐ Speech Input Equipment ☐ Reproducer Set

NAME.....

ADDRESS.....

CITY.....STATE.....

NEW DEVELOPMENTS OF THE MONTH

NEW RADIO TEST OSCILLATOR

A test oscillator for the radio serviceman, having the frequency stability of a signal generator, has just been announced by the Clough-Brengle Company, Chicago, Ill.

The usual self-modulated oscillator circuit is not used. The Model OA employs three tubes, the r-f. oscillator stage, a separate modulator stage, and a rectifier tube, for this instrument operates from any light socket, a-c. or d-c., eliminating battery cost and weight.

The "electron-coupled" oscillator circuit gives freedom from frequency variation due

to voltage change or input circuit conditions. Complete coverage of all intermediate, broadcast and short wave bands is provided, including the new 456 and 477.5 kc. intermediate frequencies.

The whole unit is contained in a single steel housing, finished in black crackle. Sturdy construction assures protection against mechanical damage.

Output frequencies are adjusted to zero-beat against a crystal oscillator, and are sealed while the zero-beat is maintained.

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A NEW FLEXIBLE SHAFT FOR REMOTE CONTROL

A new flexible shaft specifically designed to meet the requirements of remote control of radio receivers has just been introduced by the S. S. White Dental Mfg. Co., 152 West 42d St., New York. The shaft is known as No. 150L53. The feature of this shaft which makes it particularly suitable for remote control is its reduced torsional deflection when the shaft is turned in either direction.

The ordinary type of flexible shaft designed for speedometer drives, has a torsional deflection when turned in the winding direction of from .88 to .118 degree per ounce inch per foot, and in the unwinding direction from 2.14 to 2.95 degrees per ounce inch per foot. The total deflection, in going from the winding to the unwinding direction would be 3.02 to 4.13 degrees per ounce inch per foot. Compared with these figures the new No. 150-L53 shaft has only .35 degree per ounce inch per foot in either direction of rotation, or a total of .70 degree per ounce inch per foot.

For use with this shaft a special small diameter metallic casing has also been developed with an I. D. of .170 inch and an O. D. of .255 inch. Standard finish is Parkerized. An advantage claimed for this casing over the ordinary metallic casing is that its ends can be enlarged for a distance of ½ inch to a diameter of .375 inch. This enables its use with large end fittings on the shaft, the casing being held in place with a .375 inch bushing with set screw.

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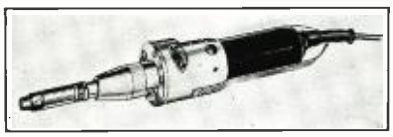
TOOLS FOR RADIO MANUFACTURING PLANTS

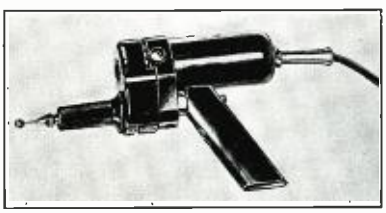
An automatic electric screw-driver and nut setter, and a compact high-speed electric die grinder, are two new electrical tools just announced by the United American Bosch Corporation, Springfield, Mass.

The announcement says these tools are forerunners of a full line of precision electrical tools, designed to reduce production operation costs by cutting down time, power consumption, and the elimination of spoilage.

The Bosch automatic electric screw-driver is a production economy factor wherever machine and wood screws, bolts or nuts, are used in quantities in produc-



Electric screw-driver.



High speed grinder.

tion or on the assembly lines. It has several unique features, including extremely compact size. The outside diameter is only 2 inches and its weight only 3 3/4 pounds. It has automatic pressure clutch, additionally adjusted through graduated scale, and a highly efficient low-current consuming fan-cooled universal motor. Weight is centered for speed and accuracy. The tool is Resistex insulated throughout. A special stationary centering sleeve with self-centering bit, provides an accurate and dependable adjustment for all types of screws and nuts, preventing damage to heads.

The Bosch high-speed electric die grinder is a compact precision tool, ideal for finishing patterns and dies, and has many unique features. Its exceptionally high spindle speed of 50,000 r.p.m. without vibration, enables it to do classes of work where no other grinder can be used, and also permits the use of extremely small wheels 5/64 inch to ⅝ inch diameter. It is possible to grind with great accuracy extremely small radii, and to reach heretofore inaccessible places.

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RESISTORS FOR ANALYZERS

The Precision Resistor Company which has recently moved its plant and offices to 334 Badger Avenue, Newark, N. J., announces types D and F resistor units ranging from .25 ohm to one megohm especial-

ly suitable for constructing set analyzers and in places where space for mounting is limited or tap nuts are required.

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NEW MICROVOLTER

The model 10B microvolter, manufactured by the Ferris Instrument Co., Boonton, N. J., has been designed to supply a convenient, portable unit for sensitivity measurements on radio receivers. It is intended for factory and field testing, and for much of the use in laboratory and development work where all the features of a more expensive signal generator are not needed.

It covers a frequency range of 150 to 20,000 kc. by means of six coils included in the instrument. This permits measurement not only at broadcast and intermediate frequencies, but at practically all frequencies covered by the vast majority of aircraft, police and other high frequency receivers.

The change from one coil to another is made by means of a knob on the front panel. This is handy when broadcast and intermediate frequencies are to be checked alternately, in factory testing, or where multi-range receivers are to be tested.

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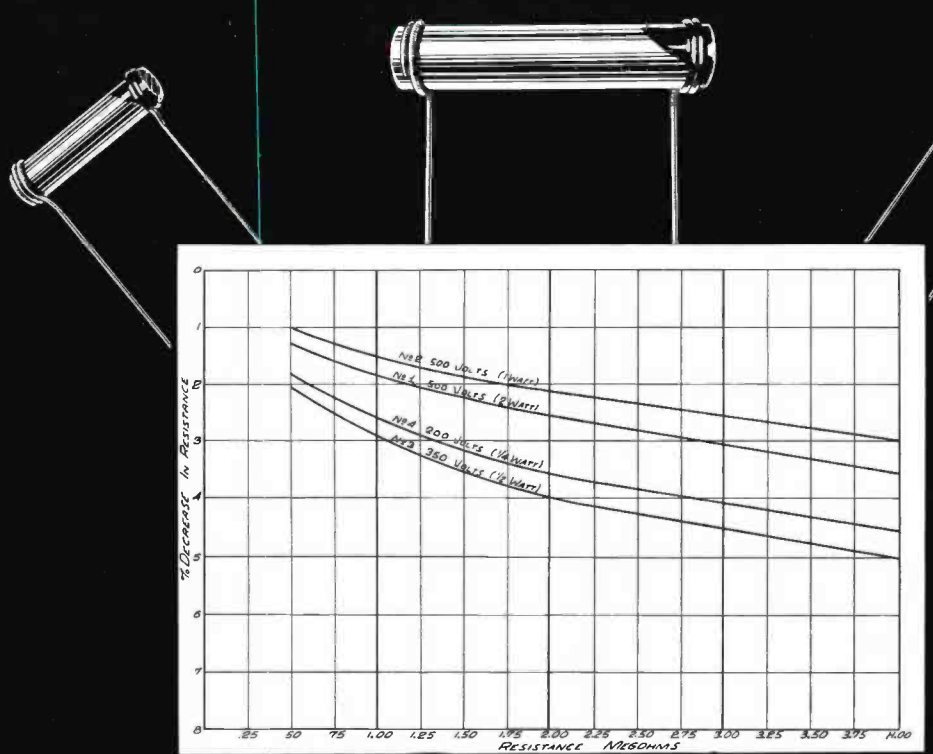
VOLUME AND TONE CONTROLS

The type 100 molded variable resistor, manufactured by The Stackpole Carbon Company, St. Marys, Penna., is a development which represents a major advance in the design of variable resistors for application as volume controls and tone controls in radio receivers and as a manual gain control in audio amplifiers.



IMPROVED VOLTAGE COEFFICIENT

Decided improvements in the voltage coefficient of ERIE RESISTORS have been made by our Engineering Department. On the higher resistance values the improvement reaches as high as 50% making those values far superior to any units previously offered.

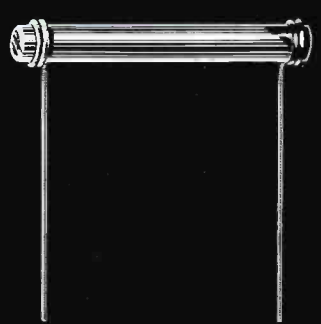
For example on a No. 4 Resistor of 1 megohm resistance the drop from 20 to 200 volts averaged 5¼% and on the improved units (as shown on chart) is now about 2½%.

Again ERIE RESISTORS lead with an improved product.

ERIE RESISTOR CORPORATION

Factories in

Erie, Pa. Toronto, Canada London, England



ERIE RESISTORS

TRANSFORMERS AND CHOKES

One of the indications of the optimism existing in the radio industries is the announcement of Central Radio Corporation, Beloit, Wisconsin, that they are adding a transformer and choke division to their present socket line. This division will specialize in small transformers, audio frequency and filter chokes, featuring a new conception of design in this field. Exhaustive field and laboratory tests over a period of two years have proved the soundness of the new design. Standard mounting centers have been adhered to.

Some of the features of the new device are greater inductance, smaller sizes and greater breakdown voltages, as well as a new and convenient lug terminal. J. C. Snell, who has been closely identified with transformer design and production in the radio field has become associated with Central Radio Corporation as head of this new division.

The Corporation has just been granted three patents in Great Britain, covering various sockets, the patent numbers being 385,362, 385,363 and 385,364.

▲

ERIE SUPPRESSOR RESISTORS

The Erie Resistor Company, Erie, Penna., is having success in the sale of its new line of auto radio suppressor resistors, types S-1, D-1 and S-2.

The standard resistance value of this type unit is 25,000 ohms but will be supplied in any resistance value desired upon application.

These units will change less than 10 per cent in resistance value in 50,000 miles use provided one suppressor is used in each high tension lead.

▲

WIRE WOUND RESISTORS

The Atlas Resistor Company, 423 Broome St., New York City, manufactures all types of wire-wound resistors for radio. These variable resistors have been designed to replace any variety of sizes for radio sets which have become obsolete. These pack wire-wound resistors both the variable and enamel coated are efficient.

▲

MIXER CONTROLS

The General Radio Company, Cambridge, A, Mass., announces a new volume control, No. 653.

This mixer control is of the step-by-step type, designed for operation at exceptionally low noise levels. It is equally suitable for use with all types of microphones, including ribbon and dynamic.

▲

SYRACUSE ORNAMENTAL CO.

The Syracuse Ornamental Company have moved their N. Y. City office from the Chrysler Bldg. to 358 Fifth Ave. P. R. Fortin is local sales manager. They manufacture Syroco wood carvings, knobs, grilles, cabinets, etc.

NEW CHIEF ENGINEER FOR ERIE

The Erie Resistor Corporation, Erie, Penn., announces that Byron Minnium, formerly chief engineer for the Stewart Warner Corporation, Chicago, has been appointed chief engineer of Erie.

▲

NEW LOW NOISE LEVEL MIXER PAD

Two new arrivals are announced in the family of Daven attenuators. These are the Type LT-202 modified T and the Type LA-220 ladder type networks. Both attenuators are designed for low noise level.

The Type LT-202 modified T is especially designed for portable mixers. It is only 2¼-inch diameter and 1¼-inch deep and suitable to replace old style mixers. This unit has 15 steps and will be furnished in any practical impedance and decibel range desired.

The ladder network, Type LA-220, is a 30 step unit having all the desirable characteristics of the Daven LA-160. It has constant impedance both ways and a low insertion loss. and may be used for a master control as well where otherwise expensive H or T pads would be required. Standard impedances are 50, 200, 250 and 500 ohms, but any other practical value can be furnished. The standard attenuation range is 30 steps at 1.5 db. or 45 db. total with infinite loss on the last point. The size is 2¾-inch diameter by 2 1/16-inch deep.

COURSE IN TELEVISION

A new course covering the study of scientific as well as practical problems in the transmission of images and television is offered by the Polytechnic Institute of Brooklyn.

The first series of lectures, to be given by Dr. A. Ray Olpin, a member of the technical staff of the Bell Telephone Laboratories, will analyze the problems of image transmission, emphasizing the fundamental physical principles of telephotography and television. Topics will cover the nature of light and color, light sources and illumination, geometric optics, photoelectric phenomena, glow discharge in gases, and visual perception.

The second part of the course, to be presented by Mr. Ivan Bloch, former chief engineer of the General Television Manufacturing Corporation, will be devoted to a detailed study of practical problems of television.

▲

I. R. C. SUPPRESSORS

Ignition noise suppressors suitable for all types of cars have been made available through the International Resistance Company, 2006 Chestnut St., Philadelphia, Pa. They are specially valuable in that they are able to withstand severe cold, intense heat, grease deposits, steam and severe vibration, without having their characteristics altered appreciably.

FEDERAL TYPE F-307-A VACUUM TUBE RATINGS AND DATA

Main use ..... Oscillator and Power Amplifier

Number of electrodes..... 3

Volament voltage ..... 22 v.
Current ..... 52 amp.
Type ..... Tungsten

Average characteristic values calculated at Eb = 7000. Ec = O, Ef = 22 volts.
Plate current ..... 1.9 amp.
Amplification factor 20
Plate resistance ..... 3500 ohms
Mutual conductance .... 5700 micromhos

Approximate direct inter-electrode capacities:
Plate to grid..... 27 mmf.
Grid to filament..... 18 mmf.
Plate to filament..... 2 mmf.

Overall dimensions:
Maximum length .....20¼ in.
Minimum radius ..... 5 1/16 in.

Type base ..... Standard

Mountings ..... Standard

Type of cooling..... Water

Operating limits:
Maximum plate voltage. 15,000 v.
Max. d-c. plate current... 2 amps.
Max. plate dissipation... 10,000 w.
Max. r-f. grid current.. 30 amp.
Max. d-c. grid current..200 amp.

Water jacket ..... Federal Type F-1000

The above information by no means represents exact conditions of operation to be imposed for any particular situation. Tubes are used under many widely different conditions and consequently the manufacturer should be consulted for information regarding characteristics for design purposes.

The unique grid support system insures perfect alignment of the elements and rapid conduction of heat directly to the outer envelope for radiation instead of to the filament stem.

Manufactured by the Federal Telegraph Company, 200 Mt. Pleasant Ave., Newark, N. J.

INDEX TO ADVERTISERS

THE Group Subscription Plan for RADIO ENGINEERING enables a group of engineers or department heads to subscribe at one-half the usual yearly rate.

The regular individual rate is $2.00 a year. In groups of 4 or more, the subscription rate is $1.00 a year. (In Canada and foreign countries $2.00.)

The engineering departments of hundreds of manufacturers in the radio and allied industries have used this Group Plan for years, in renewing their subscriptions to RADIO ENGINEERING.

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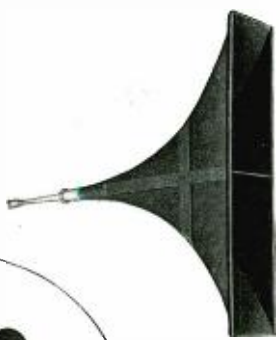
Remember this Group Plan when *Your* Subscription Expires

(Radio Engineering)

THE FINEST SOUND TRUCKS USE

RACON REPRODUCERS

In practically every state in the Union you will find efficient, high-quality sound trucks making money with their complement of Racon Reproducers. Discriminating public address specialists have learned that Racon quality and reliability means dependable performance "under fire", sure profits and increased rental contracts.



Racon manufactures the most complete line of horns on the market today. A few types are illustrated: The Triple-Connector assembly, ideal for small cars and all-around service. The Radial Horn, the most remarkable and economical projector ever made. The Six-Foot Flat Bell Trumpet, especially good for roof-top mounting and concealment.

To match these outstanding Racon Horns there is a complete line of type B units, heavy duty, high power drivers that will withstand the most severe service demands.

You will find it practical and profitable to incorporate Racon Stormproof Guaranteed Reproducers in your sound car set-up.

RACON Horns and Units are Covered by U. S. Patents Nos. 1,507,711; 1,501,032; 1,577,270; 73,217; 73,218; 1,722,448; 1,711,514; 1,781,489; 1,832,608; 1,834,327; 1,835,739; 1,845,210; 1,878,360; 1,888,442.

RACON ELECTRIC CO. INC.
52 East 19th Street, New York City
London, England Toronto, Canada

When radio goes joy riding

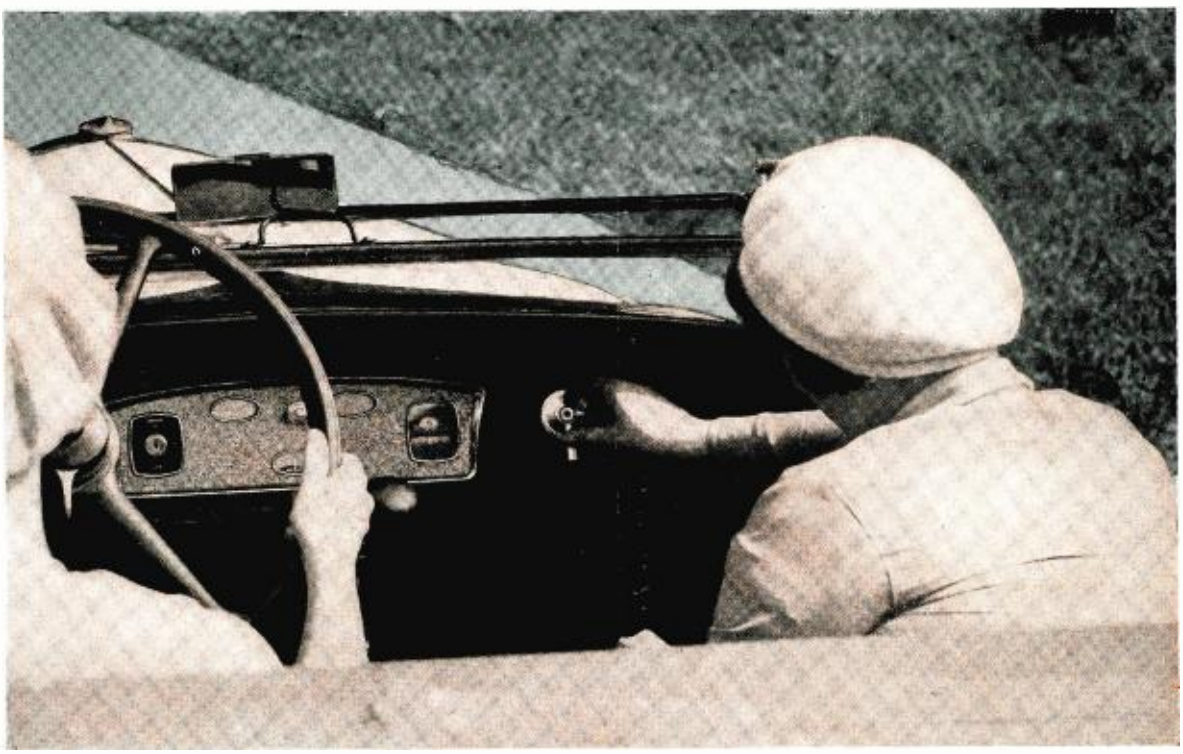
sturdy insulations are required

MANY 1933 AUTOMOBILES are wired and otherwise equipped for radio. The handicap of wiring having been eliminated, makers of small auto radios should receive a welcome increase in sales. Since these sets are subjected to unusual vibration, sudden shocks and wide variations of temperature and moisture conditions, insulating materials must be chosen with care.

Bakelite Materials, both Molded and Laminated are ideal for this service. They possess high insulating efficiency and mechanical strength and they are unaffected by temperature changes, oil, moisture or gasoline. Because of their high dielectric and mechanical strength they may be made into small yet efficient insulators, helping to make the set trim and compact.

Bakelite Materials have long been the choice of manufacturers of radio devices of all kinds. In addition to their excellent insulating properties, they have effected many real production savings. Bakelite Molded, through the use of multiple cavity molds, lends itself admirably to quantity production methods without sacrifice of accuracy or efficiency. Bakelite Laminated is readily sawed, punched, drilled or otherwise machined.

Write for our illustrated booklets 12M, "Bakelite Molded" and 12L, "Bakelite Laminated". These booklets contain valuable information concerning the properties and uses of Bakelite Materials. There are also many special materials developed to solve particular insulating problems. Call upon us for information about any of these materials.



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BAKELITE CORPORATION OF CANADA, LIMITED, 163 Dufferin Street, Toronto, Ontario, Canada

BAKELITE

REGISTERED U.S. PAT. OFF.

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THE MATERIAL OF A THOUSAND USES