Radio Engineering

AUGUST, 1937

VOL. XVII NO. 8

DESIGN • PRODUCTION • ENGINEERING

- Broadcast Receivers
- Auto-Radio Receivers
- Electric Phonographs
- Sound Recorders
- Sound Projectors
- Audio Amplifiers
- P-A Equipment
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- Testing and Measuring Equipment
- Television Apparatus
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The Journal of the Radio and Allied Industries

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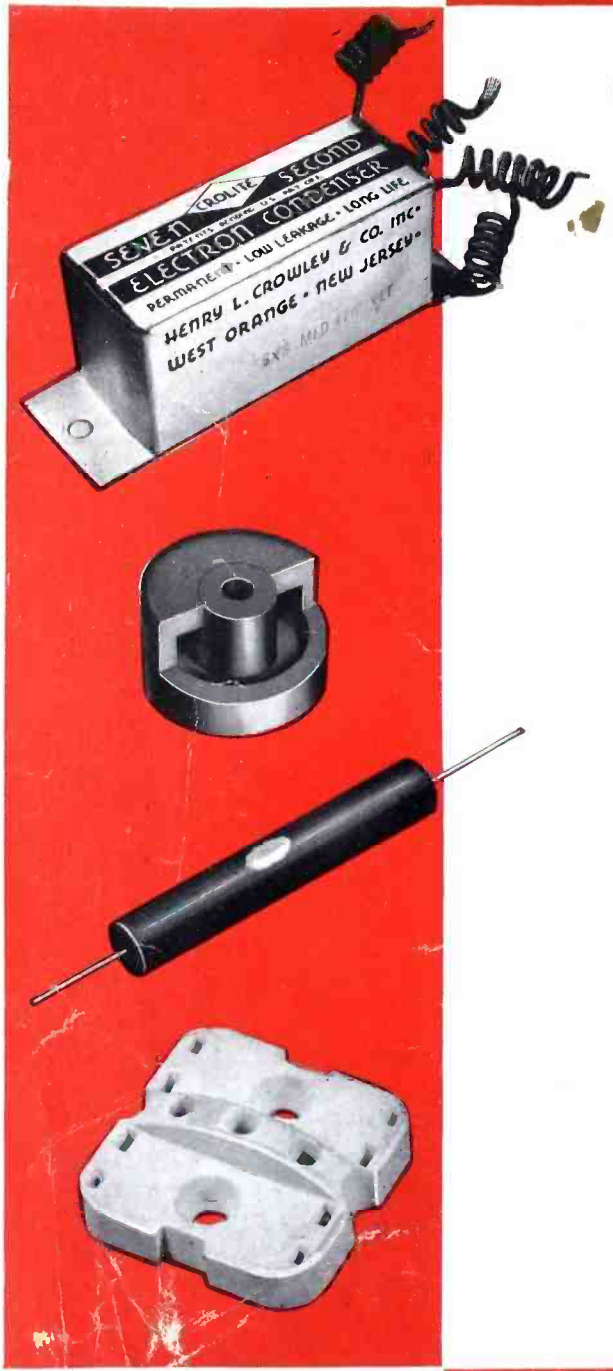

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RADIO ENGINEERING

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W. W. WALTZ • Editor

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FEATURES

DEPARTMENTS

VOL. XVII *Member Audit Bureau of Circulations* NO. 8

COVER ILLUSTRATION

GUGLIELMO MARCONI
1874-1937

(Photo courtesy of George Clark, RCA)

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Editorial

THIS MONTH

PRACTICALLY ALL OF the 1938 lines of receivers by the various manufacturers have been released and are on display. Our "Unofficial Observer," absent from these pages for some months, returns and looks them over. What he discovered forms the basis of our lead article.

It seems that the author of the series on Dynamic Symmetry takes exception to our observations regarding the difficulty, apparent or otherwise, of his pet subject. All we meant was that the subject was liable to be so new to engineers that it might *seem* difficult; we're glad to hear that it isn't, but we would like to have it explained to us in words of one syllable. We're one of these birds whose education in art appreciation never progressed much beyond the silk-stocking ads.

In our ramblings around the country we have discovered, much to our surprise, a strange lack of interest in what is being done abroad. It may be that foreign publications are not readily available to many engineers—and again, it may be a "don't-give-a-damn" attitude. But after all, foreign research and development groups are just as likely to fall into something good as are those on this side of the water. We aren't going to reprint or report on everything that comes to our attention—not by a long shot! However, once in a while we'll show a few items that may possibly be of interest; some will be found on our Notes and Comments pages this month.

And—the conclusion of the article on how to tune a circuit, whether by changing the inductance or capacity. You can predict the results and draw your own conclusions. Also, how to pack tubes—and why, even though it ought to be perfectly obvious.

MARCONI

WE CAN THINK of little to add to the tributes which have already been paid to the memory of Guglielmo Marconi. Certainly he needs no memorial other than the millions of antennas which, literally, sprout from every housetop. No corner of the globe is without its memento of the man whose genius made world-wide communication possible. Marconi was not a god, but he was the direct antithesis of the type of man of whom Kipling wrote:

Very rarely will he squarely push the logic of a fact,
To its ultimate conclusion in unmitigated act.

FOREIGN TRADE

LAST MONTH, under the same heading, we made a suggestion to the effect that someone ought to start shooting radio programs to foreign centers. Just too late to catch the issue, we had a long talk with a man whose knowledge of foreign trade is, to say the least, commanding. His suggestion differed from ours to this extent, that only certain programs should be sent to foreign countries. It is quite obvious that these programs made up of long-winded rehashes of old joke books, or (worse yet!) the adventures of the sweet little thing in the big, bad city, aren't of the slightest interest to people who can't even understand English—let alone what passes for English on the average radio program.

Musical programs are the answer. It's an old one, of course, about music being a universal language, but it seems to be true. However, one wonders if a symphony program would create as much interest among, say, prospective customers in a Mexican Indian village as it might in Mexico City—or any place where there is some slight chance of at least a portion of the population being educated to the level of Beethoven and Bach. Careful selection of program material would, evidently, be essential—here, we abruptly reverse our last month's comment!

We feel that one solution would be a group of stations, each directed to some particular spot on the map, and with *all* of the programs originating in the U. S. available for over-seas transmission. Selection of suitable material could then be made, announcements made in the appropriate language—in other words, the program, regardless of its origin, could be "keyed" to its prospective listeners abroad.

Such a set-up might involve some degree of co-operation between the broadcasters—and that in itself might be a good idea!

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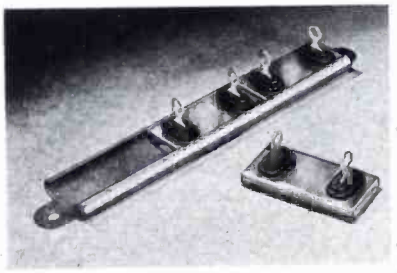

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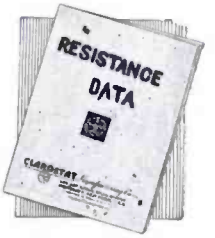

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This Mallory capacitor is not a stock item. It is, however, of standard construction and was designed by Mallory engineers based on circuit information supplied by the customer.

Let Mallory engineers work with you on such problems. Submit the needed circuit information or preferably the complete chassis for a Capacitor Analysis.

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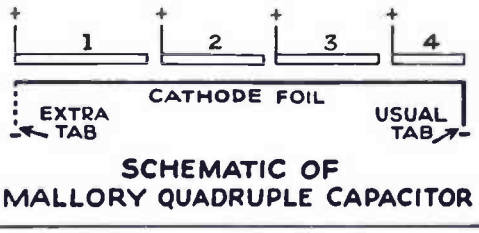
*Mallory Dry Electrolytic Capacitors are manufactured under U. S. patents 1,710,073; 1,714,191; 1,918,716, et al.



SCHEMATIC OF MALLORY QUADRUPLE CAPACITOR

Coupling effects noted in ordinary multiple section capacitors are caused by voltage drop in the cathode foil and an improper sequence of the anode plates. In fact, the entire matter is due mainly to mechanical rather than electrical design. The voltage drop in the cathode was corrected by the proper placing of the cathode tabs. Each tab was assured positive contact to the container by a special rivet (see arrow). The plate sequence was arranged after careful analysis of the circuit. The remarkable R.F. impedance characteristic was obtained through the proper relation between cathode and anode tabs.

RADIO ENGINEERING

FOR AUGUST, 1937

THE NEW RECEIVERS

Our Unofficial Observer "goes to town" and looks over the manufacturers' offerings for the 1938 *season. Many points of interest are described below—but notice how few radical changes there are.*

USER CONVENIENCE outranks improved performance as the most striking feature of 1938 receiver design.

The receiver is treated, in most models, as being merely one functional factor in the complex living organism of a home. It is no longer either an excrescence or a toy, but designed to fit in as a necessary and inconspicuous component in the dynamic flow of domestic activities. No longer something to fuss about, but merely a utility, of which we demand only a reasonably acceptable appearance, and that it do its work with a minimum of bother.

This unexciting view of the place of radio in the scheme of things is forced upon the mind by a survey of the new models of all leading manufacturers. The outstanding feature common to all is the ease with which they can be used. Chief emphasis is upon the reduction of tuning to a casual process that requires only a minimum of time and attention. So-called automatic tuning is offered by every manufacturer whose products were included in the survey.

Automatic tuning can be divided into two classes according to the method used, and again into two classes according to the function to be performed by the user. From the point of view of the purchaser of the set, the two kinds of automatic tuning involving either pushing a button, or twirling a dial similar to a telephone dial. From the point of view of the manufacturer, the two classes are mechanical and electrical. The latter, which makes use of a small electric motor, permits a further extension of convenience in the form of remote control.

The automatic dial or button positions are set up by the local distributor or dealer in accordance with the frequencies of favored local stations. Trimmer condensers are provided for these adjustments, and usually located where they will be easily accessible from outside the chassis. From four to twenty pre-set positions are available in different models. All other stations are tuned as usual.

Those smaller and less expensive models that do not include automatic tuning facilities offer the next best substitute in that station call letters are printed on the tuning dial. Short-wave call letters of the favored international stations appear on the dials of the larger sets which use automatic tuning for domestic reception. In some cases the call letters of foreign stations are illuminated and color-coded.

A-f-c is also included in some models, and naturally adds as much to the convenience of tuning as to the quality of performance.

Physical construction that also revolves around convenience is another outstanding feature of the current season's models. One prominent manufacturer bases his chief sales appeal upon a sloping tuning panel which can be operated equally well from a standing or a sitting position. But sloping panels are found in the product of several other makers. One tuning panel presents a quarter segment of a circle, curving backward from the front to the top of the set, and consisting of rows of figures designed to be read with the utmost convenience. Still another maker offers a conventional, vertical-face

tuning panel, in which the figures representing kilocycles are also arranged in horizontal rows, but each row is printed on a small louvre, and can be seen equally well from in front or from above.

The same trend toward convenient operation is further represented by the greatly increased prominence of chair-side models, with tuning controls on top. Some manufacturers offer as varied a choice in this construction as in the more usual console and mantel models.

One make features a combination chair-side and tea-table model. The combination kitchen radio and refrigerator is again represented. Other combinations tending to obscure the conspicuousness of the radio are desk and book-case models.

But while the radio itself tends to become less conspicuous the tuning dial grows more so in the interests of legibility. Dials are larger. The combination dial, somewhat similar in appearance to the combination indicators of a modern automobile dashboard, is increasing in popularity.

In the matter of cabinets, some makers stress neutral design, intended to harmonize with every style of living-room furnishings, while others, as heretofore, offer period cabinets to match specific decorative arrangements.

Improvements in performance center almost entirely on audio quality as distinct from sensitivity or selection. Minor improvements in reception include: spreading of short-wave entertainment bands, attained by eliminating amateur, police, ship and other bands of little public interest; an antenna-tuning feature found in one prominent make; small improvements in antenna kits, and the screen-shielding of the whole chassis offered by a few manufacturers.

The basic feature of those improvements that bear on audio quality is found in the acoustic treatment of the newer cabinets. Closed-back consoles are now common. Multiple-speaker arrangements, while still used, are less conspicuous than in the past. While the great majority of receivers do not offer audio response above 6,000 cps. flat response is given greater attention than ever before, accompanied by far greater realization that (a) a receiver functions in homes, not in laboratories, and (b) that its work is not finished at the loud speaker, but only at the ear of the listener.

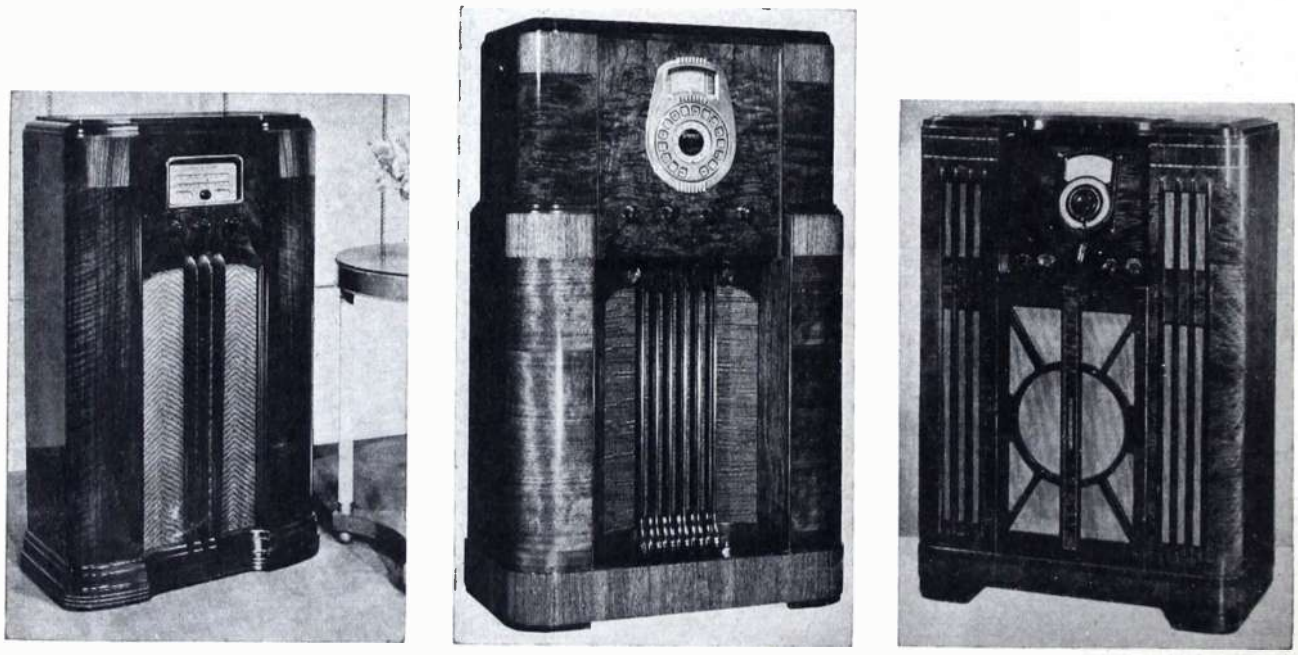
The acoustic changes that result from moving an old-type console a little closer to, or further from, the wall behind it, are eliminated by the closed-back design which leaves the acoustic performance of the set wholly under the control of the manufacturer. The weight of material formerly needed to prevent undesirable resonance of the back of the cabinet is reduced, in one brand of receiver, by imparting a curved shape to the enclosing partition; it is claimed that this method of construction permits the use of light ply-wood. The acoustic labyrinth and the inclined sounding board (concealed) remain substantially as in previous years.

A new speaker with a "floating" diaphragm is introduced, with the claim that its design enables it to deliver exceptional results while mounted in a conventional console.

The difference between loudspeaker output and ear input is further recognized in the wide-spread use of vanes for deflection of the higher audio frequencies. These vanes are found even in mantel and midget models, where they form part of the cabinet and take the place of the standard grille-cloth.

A-f-c as used in some receivers has been shown to require special precautions with reference to temperature and humidity. Three general types of drift control are found in current models. Impregnation against humidity has been improved, and is the only precaution incorporated in some receivers. Other makers use a special form of condenser impregnation, applied at such high temperatures that condenser leads must be welded instead of soldered. The nature of the material used is said to impart to the condenser a negative temperature coefficient that balances the positive temperature coefficient of the coils. A third method of compensation is the use of bi-metallic condensers designed to have

(*Continued on page* 14)



Some 1938 models. Left. General Electric. Center, Grunow. Right, Philco.

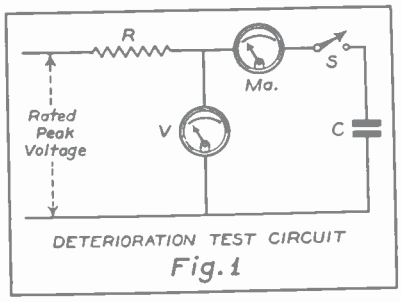
IDLING CHARACTERISTICS OF ELECTROLYTIC CONDENSERS

by L. W. Appleton
RESEARCH CHEMIST, SOLAR MANUFACTURING CORP.

ONE OF THE MOST important problems confronting the user of electrolytic condensers of the wet type is the so-called "shelf-life" of such units; that is, the extent of deterioration of the anode film from the time it is shipped by the manufacturer to the time it is first put into operation. This deterioration is measured by the amount of current drawn by the condenser upon initial application of the working voltage, and by the time required to reduce the leakage current to a normal operating value. The importance of these two factors is readily apparent to all radio engineers—a high intial current and slow reduction to normal value being likely to damage either the rectifier tube or transformer in the power pack, besides possible damage to the condenser itself.

Since all electrolytic condensers are subject to some deterioration, we may divide them into two classes: those showing a normal rate of deterioration, and those whose deterioration rate is abnormal.

The approximate shelf-life of a condenser can be ascertained by a test which is based upon the fact that during idling, the rate of deterioration increases with an increase in temperature. Hence, an accelerated test for idling characteristics is readily obtained by subjecting the condenser to some temperature below the boiling-point of the electrolyte for a specified number of hours, a definite length of time at the chosen temperature corresponding to an idling period of so many weeks or months at room temperature. From the many tests carried out in order to correlate the deterioration at an elevated temperature with that at normal temperature, it has been found that an idling period of one hour at 85°C is equivalent to an idling period of approximately one month at room temperature.



DETERIORATION TEST CIRCUIT
Fig. 1

This principle is utilized in effecting control of the finished product. Condensers representing each production batch are placed in an oven for four hours at a temperature of 85°C, after which time they are removed, cooled to room temperature and then tested as follows: The condenser, C, is placed in the circuit shown in Fig. 1. With the switch S open, the d-c voltage is adjusted to the rated peak voltage of the unit. Then S is closed and the initial reading of the milliammeter is noted; readings on the milliammeter are taken after 15, 30 and 60 seconds. The value of R is chosen to keep the maximum current drawn within the range of the milliammeter. By plotting the current as a function of time, curves are obtained which indicate the relative rates of deterioration for the various production batches. Fig. 2 shows curves obtained with anodes having normal and abnormal deterioration rates. Precautions are taken during the actual formation of the anode film to prevent the production of condensers which have abnormal rates of deterioration. These precautions include satisfactory control of the temperature, concentration and purity of the electrolyte, and the proper choice of current density.

Prior to this investigation, it was extremely difficult to control the idling characteristics of wet electrolytics, and naturally the question arose as to what could cause such a wide divergence in their shelf-life. Analysis of the manufacturing process made it necessary to consider the following factors:

(1) Procedure used in forming the dielectric film.

(2) The effect of impurities in the raw materials.

(3) The concentration of the electrolytes used.

(4) The solvent used in the final electrolyte.

The dielectric film is formed on aluminum by immersing the cleaned electrodes in an electrolyte, which usually consists of an aqueous solution of boric acid and ammonium borate, and passing a current through the solution. Electrolysis results in the building up of a non-conducting film on the aluminum, the thickness of the film depending upon the voltage which is maintained while the current is allowed to drop to a negligible value. It has been found that the electrical characteristics of this dielectric film can be satisfactorily controlled during the formation process so that the completed anode will have a very low deterioration rate. Strict control is therefore exercised over such formation factors as concentration and temperature of the electrolyte, current density, formation time and final leakage current.

With regard to the effect of impuri-

(*Continued on page 24*)

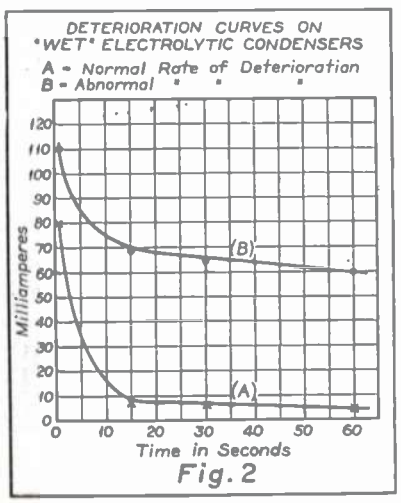


Fig. 2

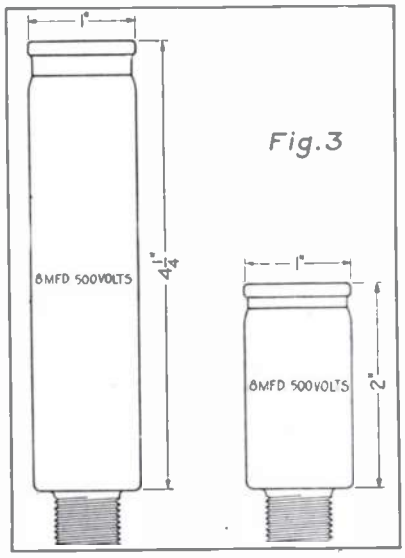
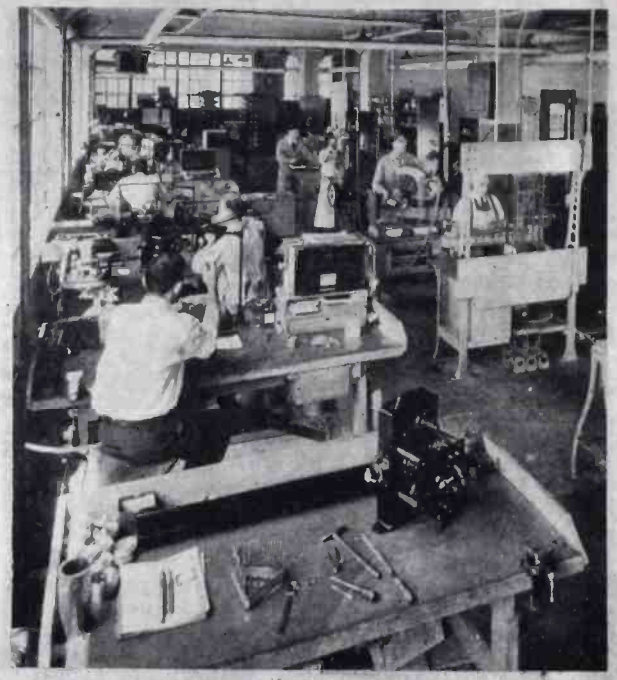


Fig. 3

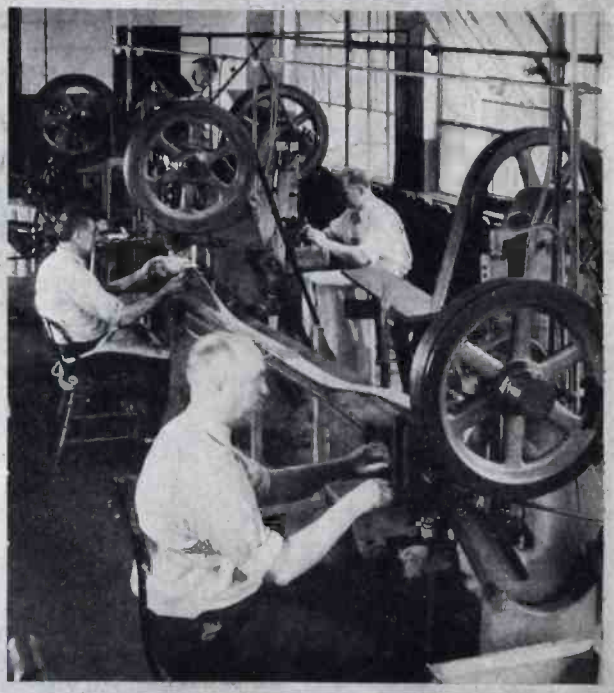
LABORATORY

•ONE OF THE TWELVE INDIVIDUAL ENGINEERING LABORATORIES•



•EXPERIMENTAL ENGINEERING SHOP•

•TOOL AND DIE MAKERS•



•PUNCH PRESSES•

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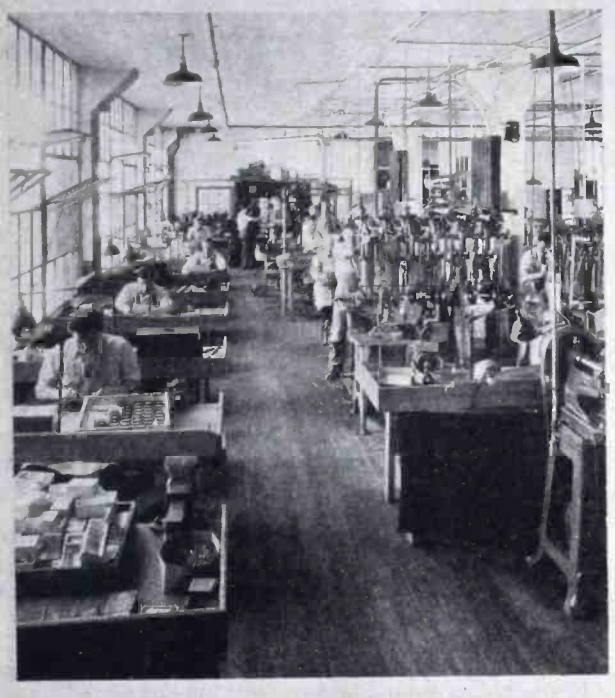
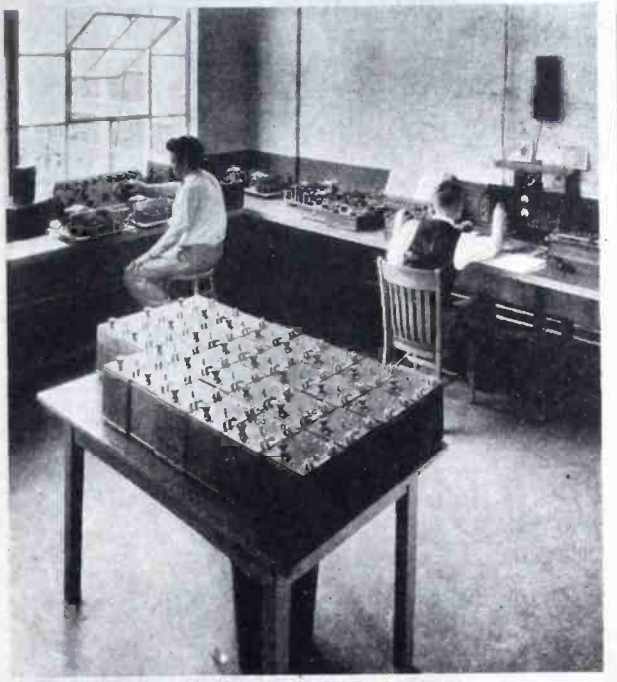
EQUIPMENT



• MACHINE SHOP •



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TUBES IN

by Stanley W. Todd

Broadcast tubes in fransit by express.

THERE WAS A TIME, not many years back, when it seemed well nigh impossible to ship radio tubes without a substantial amount of damage. Packing along scientific lines was unknown; cartons were made for appearance rather than for protection and the tubes themselves had basic weaknesses, which made them delicate to handle, even in and out of a radio set. The receiver itself was a "weak sister," when it came to being moved about or shipped any great distance.

How many thousands of dollars the former highly fragile character of radio and accessories cost the transportation companies in the early days will probably never be known. It became necessary in their own defense to study the underlying causes of damage and to establish tube-testing laboratories, to determine whether breakage was not more frequently due to structural weakness and inefficient packing, than to any rough handling in transit.

Since a large portion of the radio business moved by express, the problem became a serious item in the loss and damage account of the Railway Express Agency and its predecessors. They found that both receiving and transmitting tubes often had brittle filaments, poorly welded points, loose bases and the most mysterious and annoying of all—the "sagging filament."

That was encountered chiefly in receiving tubes, then packed separately from the sets. Even joint inspections of manufacturers and express representatives did not always bring out this characteristic. Yet, unless a tube was held in a vertical position, there was always the possibility that, laid on its side, the filament would touch the grid and cause the tube to "burn out" in the operation of the set. But tests would not tell of this condition and many a tube marked O.K. would not "work," while presumably bad tubes often functioned properly.

But to-day all such troubles are gone forever. The ability of the modern radio tube to withstand even rough handling is an indication of the marked advance in sturdiness achieved in designing and manufacture. Once it was thought merely inviting damage to ship receiving sets with the tubes in the sockets; to-day that is common practice. Even more significant is the fact that in the handling of thousands of receiving tubes as individual carton shipments and in their proper position in radio receivers, claims for breakage in transit have dropped almost to zero. Needless to say, the express people are happy over this triumph of modern manufacture and packing science.

Yet proper "positioning" for shipping purposes is still of vital importance in the safe transportation of the larger and more expensive transmitting tubes. Here the manufacturers and the express company have co-operated constantly to remove any practices, either in the construction of crates and containers or in handling methods that have been found to be the cause of damage in specific instances. It has not been a simple matter to work out the proper principles of suspension of such tubes inside the shipping crate, but the manufacturers have spared no time or expense in making such shipments damage-proof, with ordinary handling.

Owing to the high value of the larger broadcasting tubes and the fact that filament or glass breakage virtually destroys them, since they cannot be repaired, the express company is equally concerned in the use of the most advanced positioning and single-point suspension ideas in the shipping department. For the same purpose, the outside of such shipments has also received much attention. Crates used for these tubes are either pyramid in shape or equipped with extension poles at the bottom so that they must be handled upright; handles of metal are placed on top to facilitate movement in that position. The same principles are employed in fibreboard cartons used in packing the smaller types of transmitting tubes.

The largest tube shipped is the water-cooled 100 kilo-

Railway Express Agency

watt introduced some ten years ago and progressively improved in design since. It is a slender 60 inches in length. of which 19 inches are of glass and the remainder metal. It must be kept upright constantly and the shipping crate built especially for it is 7 feet high, with a broad pyramid base, and is almost as impressive as the tube itself.

As it is now valued at $1500 and even slight tilting may invite damage, the necessity for extreme care in shipping is obvious. Because of its height, the chief problem is to get such shipments in and out of express cars; delivery is always made in open trucks. Many of these giants move from the factory to broadcasting stations and on arrival are promptly inspected and tested. Sometimes, when such stations are some distance from the express office from which the delivery is to be made, engineers test the vacuum and filament circuit right on the premises.

As one can readily imagine, the Express Agency provides these shipments with every safeguard at every stage of their movement. That is to say, men of intelligence and experience are on hand to see that employes do nothing that would in any way result in the carrier being held responsible for damage, because it would be penalized by a heavy claim payment. Considering the fact that handling of these tubes increases the carrier's hazards, due to heavier elements inside, it is impressive to note that little difficulty is experienced in getting these huge but delicate tubes through safely. even though they move on long hauls as a rule. Usually, "there's not a claim in a carload."

But as they are jointly involved in the problem of safe transportation of this commodity, the manufacturers and express people have come to an understanding in the matter. All tubes subject to complaint of possible transportation damage reach the Express Agency's tube inspection laboratory in New York for examination. There, with representatives of the patrons interested, the cause of the damage is determined; only in rare instances is a joint factory test necessary.

There is also a considerable movement by express of smaller-powered transmitting tubes used by the wireless amateurs. In many cases, these are second-hand tubes, in the transportation of which the damage hazard is greater for that reason. In a used tube, the filament is liable to be far more brittle and if breakage occurs, that may be the main contributing factor.

There is much to be said on this subject, but without going into technical details, it should be pointed out to

100-kw tube compared with small receiving type.

those who ship such tubes that they can profit by following the practices of the manufacturers. Realizing that proper containers are seldom available, the express company recommends that wooden boxes, with extension strips at the bottom be used and handles at the top be provided. Tubes should be placed in an upright position either by cloth slings or amid ample cushioning material.

Complete marking with correct addressing is also an important step in preparation of such tubes for shipment. "This End Up," "Handle with Care," "Transmitting Tube," "Glass," and other such admonitions will be readily acted upon by expressmen through whose hands they pass. Such marks in red gain attention more readily. When express employes are thus made aware of fragile nature of the shipment they are handling, they are immediately put on guard and act accordingly.

In a highly specialized and fast transportation system, as the Railway Express essentially is. it is called upon to handle innumerable fragile articles, which probably could not be safely moved by any other service. Under present day conditions, the bulk of the traffic in radio tubes of almost all types finds its way into the express channels of distribution. Usually there is always need for expedited movement of radio sets and accessories between manufacturers and jobbers and retailers and customers.

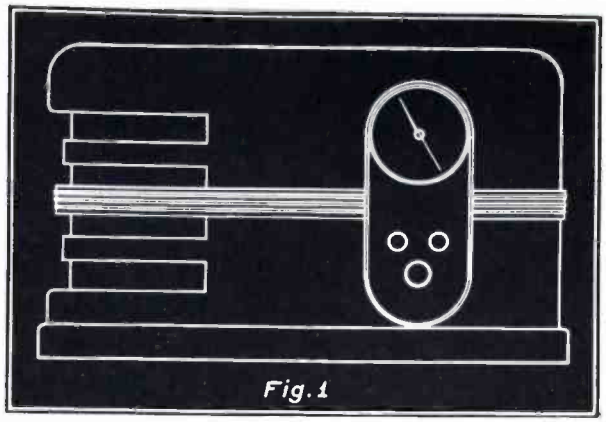

Fig. 1

DYNAMIC IN RADIO

by W. C. Eddy

PART III

NOTWITHSTANDING THE RATHER pointed remarks of the editor in the last issue relative to the increasing complexity of these articles on Dynamic Symmetry, this installment will take up the applications of design formula to actual commercial problems. If this had been written five years ago, it would have been a simple matter to illustrate the art by reference to the many examples of non-dynamic designs that were then on the market. The scarcity of such products of poor composition today can be taken as an indication of the importance that the radio industry places on the dynamic theories in formulating its cabinet work. Some of the best examples of commercial applications can be found in the numerous plastic cabinets that now dominate the low price field. Analysis of these products will indicate to the student the strict adherence to the general principles of Dynamic Symmetry now practiced by the majority of radio designers and in addition will illustrate the wealth of original thought that stems from the same theme. It will be impossible in one short article to break down more than a few of these examples, but for the sake of illustration let us consider the design data of one of these midget sets and resolve its dimensions into its design fundamentals. Fig. 1 represents the cabinet in question, a plastic case with brushed chromium escutcheons. We must first determine the theme or root figure used in the design and so, by methods similar to those explained in Part II, we arrive at Fig. 2, indicating that the boundaries of the cabinet itself have been created about the Whirling Square formula. Our next step, then, is to determine the method of subdivision used in developing this theme; i. e., whether to carry out the reciprocal method or resort to the addition and subtraction of parent shapes. Fig. 2 indicates that many of the component parts of the set lie at intersections of diagonals or diagonals of the reciprocals and therefore it is reasonable to believe that the reciprocal method of subdivision was used. Now that we know the root figure employed and the method of subdivision used, it is an easy matter to carry Fig. 2 into a more complex arrangement and produce the necessary intersections and parallels to satisfy the requirements of the design. Fig. 3 represents such a development of the fundamental area and delineates the position of the minor parts by means of successive intersections. Looking at the design from a coldly critical standpoint, we must admit that it is interesting and yet not ornate. The center of the dial (A), the dominant feature has been placed at the intersection of the diagonal of the whole and the diagonal of the reciprocal which we know to be the major emphatic point. The tuning knob (B) occupies the secondary point of interest and is therefore placed at the point of secondary intersection. The weight of the control group is evenly balanced by the speaker grille work and the cabinet itself gives the impression of a clean, economical and interesting piece of cabinet engineering.

Having succeeded in taking apart such a standard design to find out what makes it tick, let us attempt to

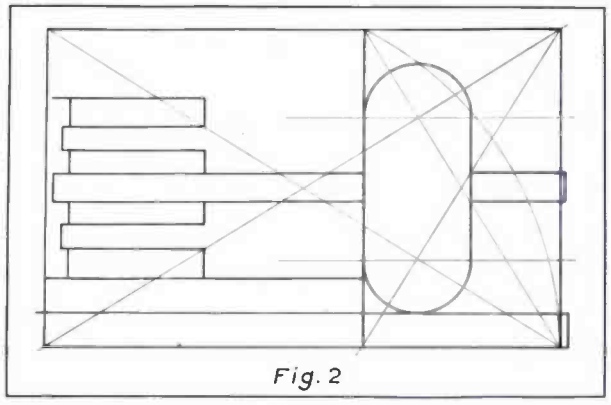

Fig. 2

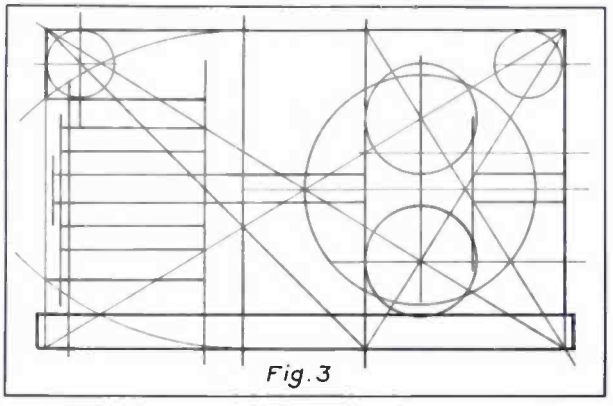

Fig. 3

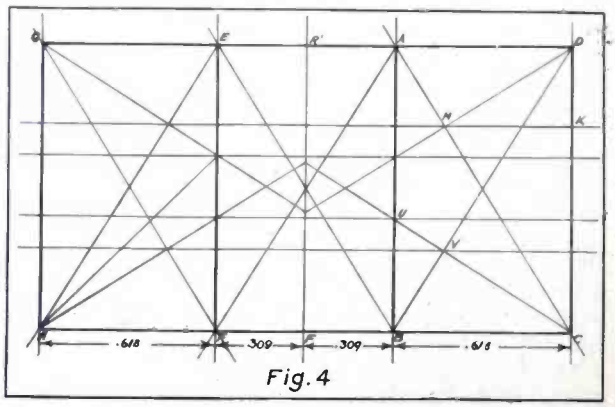

Fig. 4

SYMMETRY DESIGN

Lieut. U. S. N. (retired)

build up a cabinet based on this same procedure. Assume that we have been given a chassis whose front projection, including the eight-inch speaker, measures in the neighborhood of twelve inches high and twenty-three inches long. The problem: to design a modernistic cabinet that will not only enclose these working parts, but will appeal to the buying public's eye. Assuming that we will wish to keep the cabinet as small as possible, let us first determine the height to width ratio of the chassis in order that we may arrive at some indication of the design themes that are open to us. As explained before, we derive this ratio by dividing the length by the height. In this case 23 divided by 12 gives a quotient of 1.833. Reference to Table 4 of Part II indicates that this ratio in itself does not fall directly into any dynamic root figure. A Root 3 rectangle would have a length to height ratio of 1.732 while the single Flying Square will of course be represented by the familiar ratio of 1.618. If our cabinet is to be within reason as to size we must resort to some more complicated theme or better still a combination of shapes that will closely approximate the required 1.833 relation. As we have repeatedly pointed out in the previous articles the Whirling Square and the Root 5 rectangle represent our strongest design factors and therefore these shapes should be investigated first. Taking the reciprocal of the Whirling Square, 0.618, and using it as a multiplier of the length (23 inches) we find that the resultant height of a cabinet if this theme were employed would be 14.214 inches. This necessarily is wasting both space and material and we therefore must search further for a combination of roots that will more closely approximate the area defined by the chassis.

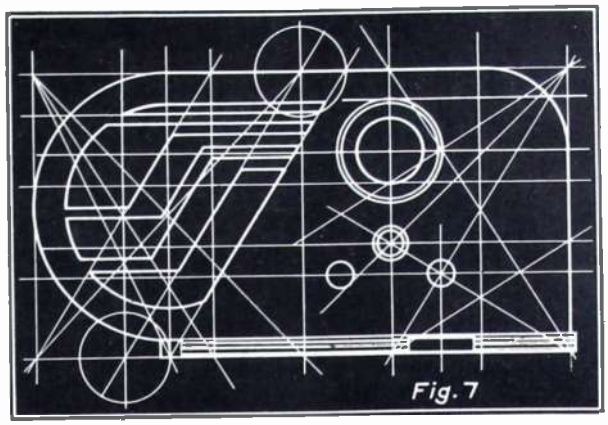
Fig. 7

Five Root 5 figures on end represent 0.4472 x 5 or 2.236 or further resolved into inches, a cabinet 26.8 inches long by 12 inches high. Here again we have waste space even though the multiplicity of Root 5 figures would furnish an unlimited field of design possibilities. If we discard the Root 5 theme and turn to the reciprocal of the Whirling Square (0.618) we find by division, that three of these shapes will satisfy the required conditions with very little wasted space. Let us therefore assume that this combination of three Whirling Squares on end represents the most satisfactory solution to our problem and proceed with the creation of a composition in this arrangement. Fig. 4 represents the areas in which we must work with the main intersections about which we will build. The chassis has three main divisions that must necessarily be considered in our layout, namely, the controls, the speaker and a certain amount of space demanded by the engineering arrangement. Let us therefore take these three divisions and assign each section one of the Whirling Squares. The controls will normally be on the right hand side which demands that the speaker occupy the extreme left hand section to create good balance. The next step in creating the cabinet is to subdivide the right hand section into its reciprocal functions so that the parts required can be allocated emphatic points and such details as fillets and horizontal lines of design can be estab-

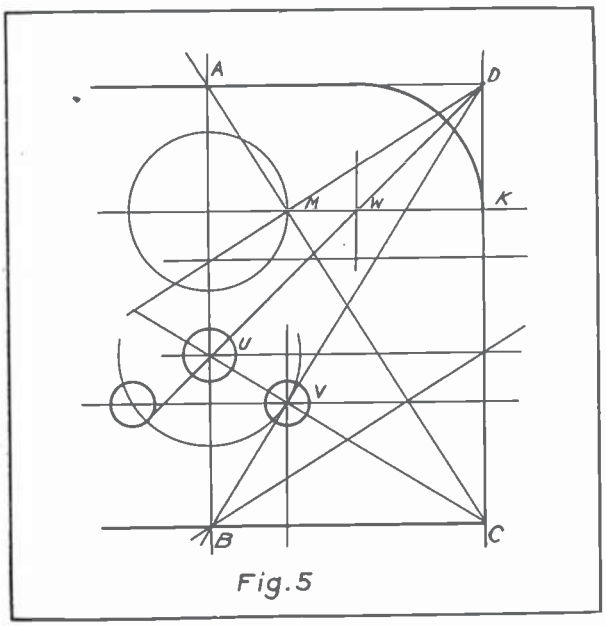

Fig. 5

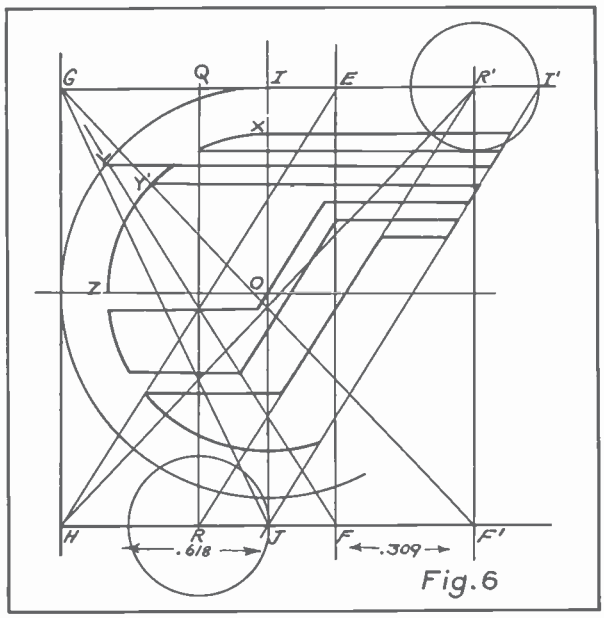

Fig. 6

lished. Fig. 5 demonstrates such a subdivision of the right hand section. AC and DB, the diagonals of the whole are intersected at M and V by perpendiculars MD and VB. These intersections establish two horizontals that are carried into the adjoining rectangle while the continuation of these diagonals completes the reciprocal subdivision of the area. The center of the dial is located on the projection of the focal point MWK while the tuning knob takes the secondary position of the intersection U. The volume control is placed at the lower focal point V and with UV as a radius the position of the tone control is fixed. Constructing the diagonal of the square DU establishes the radius WK with which we can describe the fillet in the upper right corner.

Fig. 6 represents a similar arrangement of the left hand area with a portion of the center rectangle added to complete the design. GEHF represents the left hand Whirling Square with EF' as the added half section. These two areas added (0.618 plus 0.309) give us the diameter of the limiting arc for the left hand dimension. This diameter is applied from the top at point I, the line of centers of this combined area. The length RJ between the center line of the original Whirling Square and the center line of the combined shape is now added to the right of R' as R'J and the main diagonal of this new figure established as J'J. This by reason of its construction is parallel to the original diagonal EH. The point X and the subsequent diameter of the inner circle are found by continuation of the horizontal from the first area considered. Point Y is the intersection of the original diagonal with the outer arc, while Y' is the intersection of the second diagonal with the second arc. This spacing establishes the thickness or width of the webs and is carried on through the design. Reference to Fig. 6 will indicate the geometrical constructions that underlie the remainder of the design in this panel.

Having completed the layout of the two major panels it now remains to combine them with the third or empty section and clean up the layout. Fig. 7 illustrates such a combination with the construction lines retained for ease in analyzing the procedure. The base area represents the difference existing between the diameter of the end arc and the actual height of the original section. It is started at the intersection of the diagonal J'J with the outer or limiting arc. A modernistic touch is added to the composition by the inclusion of the three chrome bands on the pedestal so formed. The name plate, in Root 5, is centered under the volume control (V) to get away from strict adherence to balanced construction.

We will not take up the matter of color or finish to be applied to the design, this falling more in the premise of the cabinet engineering section than the student designers' desk. However this phase should be considered from the standpoint of practicability in formulating the general theme. The use of plastic materials in cabinet work has opened new fields to the artist for original work in both shape and color, but here too he must consider the limitations of his medium so that on completion of the layout, the product can be sent to the moulds without a major re-design of ideas. Such a cabinet as is illustrated in Fig. 7 will lend itself to production in either wood or plastics. A very similar design created by Philco last year, became one of their most popular models from the standpoint of sales appeal. This job was marketed in wood with a contrasting inlay and its acceptance by the public was an indication of the value of good design in radio cabinet engineering. This year, a good many of the smaller models have gone to plastics for new design possibilities and the products seen to date indicate an extremely high percentage of excellent composition.

It is our firm belief that simplicity in design is the keynote of good composition today. It is a simple expedient for the artist to add a multitude of non-essentials designed to give the buyer the impression that he is buying a lot of radio for a small price. The average man today however is cognizant of the general simplicity of the standard unit and this inclusion of gingerbread does nothing more than discourage his urge to buy the product. One has only to look at the better examples of modern art in the home and in architecture to see that the trend in commercialized design is toward simplicity rather than complexity. It is in this vein that these designs are submitted. They necessarily are not complete nor will they satisfy every person's taste. They represent only two examples of the application of the principles of Dynamic Symmetry to cabinet design, variations of which are as numerous as the infinite subdivisions of the parent themes.

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THE NEW RECEIVERS

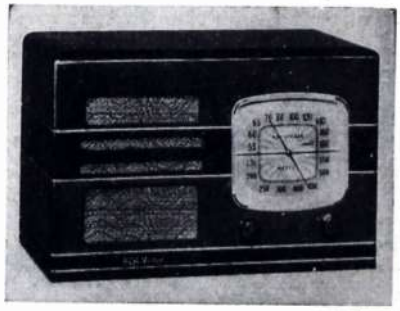
(*Continued from page* 6)

either a zero or a negative temperature coefficient. The efficacy of these new precautions under practical operating conditions in many climates remains, of course, to be tested by time.

Volume expansion has appeared in some of the larger models, and a-v-c has been extended to some of the least expensive midgets.

Among the new accessories is one, designed for use by dealers, that has been made more or less advantageous by the advent of automatic tuning. This is a calibrated oscillator for setting up local station trimmer adjustments. Time clocks for pre-setting a day's radio entertainment in advance are featured, but none of them as yet include provisions for switching stations; they control the power line only. With universal acceptance of automatic tuning there might seem to be logical place for a time clock, perhaps built into the receiver, that will serve as a station selector as well as an off-on switch.

Among allied products, automobile radios offer little conspicuously new except an enhanced insistence on car-top antennas as opposed to the running-board type. The vertical rod-type car antenna has been improved either by increased bracing or by use of a tapered rod—both changes being intended to reduce variations resulting from wind pressure. The trailer, has come into its own with wind-chargers designed to mount on the trailer roof, and with communications systems for use between trailer and car. Automobile and trailer radios that combine (in a service where space is so limited) the functions of reception and communication, have not yet made their appearance.



An RCA table model receiver

INDUCTANCE OR CAPACITY TUNING

PART II

by W. E. Bonham

Laboratory Instructor

Signal Corps School, Fort Monmouth, N. J.

FOR ALL PRACTICAL selective circuit tuning, the resistance of the capacitive branch may be considered negligible. In Fig. 5 the currents in both the branches fall within the trace of the circle whose center is 0′ since the figure is drawn on the basis that the voltage drop across each branch is the same. If, however, the current vectors in each branch are drawn proportionally to the value which would flow in each branch when the reactance of the two branches becomes zero, then the branch having the least amount of resistance would trace the larger semi-circle. In Fig. 6 the lower semi-circle represents the trace of the current in the inductive branch, the maximum value being the diameter of the lower semi-circle which is proportional to E/R_L. Curve 'a' shows a portion of the semi-circle representing the trace of the current in the capacitive branch when the resistance of this branch is small compared to that of the inductive branch. The diameter of this incomplete semi-circle is proportional to E/Rc. If, however, the resistance of the capacitive branch is considered negligible, the capacitive current extends upward at 90 degrees. This figure enables an interesting set of conditions to be disclosed which cannot be readily shown with the previous figure. In Fig. 6 let the current through the capacitive branch be i_c (E/X_c); then varying the inductance causes the resulting external current to follow the trace of the projected semi-circle whose center is P, giving the unity power factor resonance condition at I, and minimum current resonance at I_{min}. If now the current through the capacitive branch were i_c', varying the inductance causes the external current to trace the semi-circle whose center is P′, so that there is no condition of unity power factor resonance, but only the minimum current resonance condition at I_{min}'.

Thus when the resistance of the capacitive branch is small compared to that of the inductive branch and if the C/L ratio exceeds a certain value, varying the inductance cannot bring about the unity power factor resonance condition. This odd circumstance has caused many low L/C ratio tank circuits with inductance tuning, to pass without ever being tuned to any but the minimum current resonance condition.

The condition which determines whether there is a unity power factor resonance setting when the inductance is the variable can be shown with the aid of Fig. 7. Since the inductance is the variable the diameter of the semi-circle

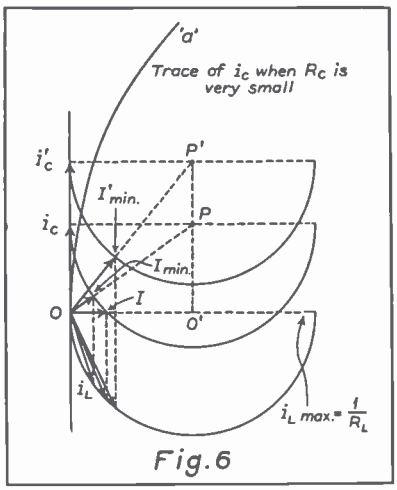


Fig. 6

whose center is 0′ is proportional to the reciprocal of the resistance of the inductive branch or $1/R_L$. The current vector i_c is inversely proportional to the capacitive reactance and it is evident that if $0—i_c$ is greater than $0—0'$ the projected semi-circle is lifted so that it no longer touches the in-phase axis $0—0'$. In this figure, i_c equals $0—0'$ and $0—0'$ equals $1/2R_L$, and i_c equals ωC, thus,

$$C = 1/2\omega R_L \quad \ldots\ldots\ldots\ldots\ldots\ldots (12)$$

which is the condition which just does permit the unity power factor resonance condition to be obtained when the inductance is the variable. Thus it follows that if $C < 1/2\omega R_L$ varying the inductance enables unity power factor resonance to be obtained, but when $C > 1/2\omega R_L$ the resonance condition cannot be obtained by varying the inductance.

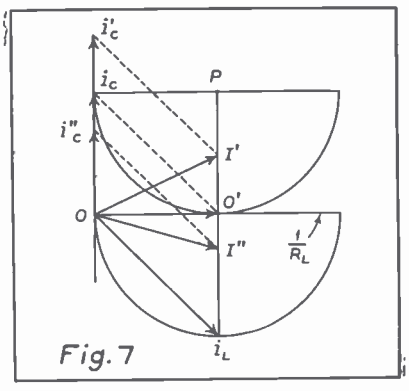


Fig. 7

From Fig. 7,

$$i_c = \omega C = i_L \sin \phi_L,$$

so that,

$$\omega C = \frac{\omega L}{(R^2 + \omega^2 L^2)} \quad \ldots\ldots\ldots\ldots (13)$$

and,

$$\omega = \sqrt{\frac{1}{LC} - \frac{R_L^2}{L^2}} \ldots\ldots\ldots\ldots (14)$$

If the quantity R_c in equation (7) is considered negligible it reduces to equation (14) showing the check of the two equations for the resonance frequency.

With the resistance of the capacitive branch negligible, the only in-phase component of current is that of the inductive branch, so that at unity power factor resonance the external current is just the active component of the inductive branch. In Fig. 7 the active component of the current in the inductive branch is equal to, $i_L \cos \phi_L$ or $1/Z_L \times R_L/Z_L = R_L/Z_L^2$. Thus the impedance of the combination becomes Z_L^2/R_L. From equation (13) the quantity

$$Z_L^2 = \frac{\omega L}{\omega C} = L/C\ ;$$

thus the impedance of the parallel combination at resonance becomes the very simple expression,

$$Z_r = \frac{L}{R_L C} \quad \ldots\ldots\ldots\ldots\ldots\ldots (15)$$

An equation which indicates the frequency at which the minimum current resonance condition occurs is not of practical value unless it also indicates the value of the impedance obtained at this frequency. Basically all wave trap circuits require that certain high values of impedance be obtained at certain frequencies. The complexity of the parallel circuit when variables are involved requires ordinarily that the solutions be obtained by carefully designed nomograms or cut and try experimentation. The following gives a simple approach to the solution for minimum current resonance when a certain impedance is required at a given frequency. Although it applies to the case where inductance is the variable, the same reasoning can be applied to the case where the capacity or the frequency is the variable.

In Fig. 6, P O is the long side of the right triangle $P—0'—0$. Side $P\ 0' = i_c = \omega C$. Side $0—0'$ equals $1/2R_L$; thus,

$$PO = \sqrt{\omega^2 C^2 + \left(\frac{1}{2R_L}\right)^2}.$$

P O equals $I_{min} + 1/2R_L$,

$$I_{min} = \sqrt{\omega^2 C^2 + \frac{1}{4R_L^2}} - \frac{1}{2R_L} \quad ..(16)$$

so that the impedance when inductance is the variable becomes,

$$Z_{max} = \frac{1}{\sqrt{\omega^2 C^2 + \frac{1}{4R_L^2}} - \frac{1}{2R_L}} \quad ...(17)$$

An inspection of equation (11) shows that when R_c is considered negligible it reduces to the same form as equation (17). The external current leads the voltage by the phase angle whose tangent is equal to side PO′ divided by side OO′ which is equal to $2\omega CR_L$.

From equation (17), ω becomes the exact value of

$$\sqrt{\frac{1 + \frac{Z}{R_L}}{Z^2 C^2}}$$

but since the Z/R_L is ordinarily much greater than unity, for all practical purposes we may say that,

$$\omega = \sqrt{\frac{1}{R_L C^2 Z}} \quad .....(18)$$

which is the frequency at which minimum current resonance is obtained when inductance is the variable and when the desired impedance is Z. This equation does not indicate the value of the inductance which obtains resonance but gives the existing relations of the circuit constants, the frequency and the impedance when the minimum current resonance condition is obtained.

Varying the capacity in the parallel circuit causes the resulting external current also to trace a semi-circle, but inverted from that obtained when the inductance is the variable. In Fig. 8 let the current through the inductive branch be i_L. As the capacity is varied, the current through the capacitive branch follows the trace of the upper part of the circle whose center is O′, so that the resulting external current follows the trace of the inverted and projected semi-circle whose center is P.

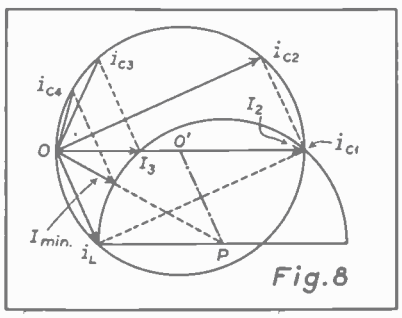


Fig. 8

The unity power factor condition at I_2 follows the same set of conditions as when the inductance is the variable. It also becomes the very peculiar case of unity power factor for all frequencies when the resistance of the two branches is adjusted equal and in turn equal to the square root of the L/C ratio.

The unity power factor resonance condition at I_3 is that for which the maximum of power exists in the parallel circuit. It is evident that the frequency and the impedance at this unity power factor condition are the same as though the condition were brought about by the varying of the inductance.

The graphs of Figs. 5 and 8 show an interesting comparison in the physical action of varying the inductance and the capacity. The unity power factor resonance condition is obtained for the same frequency, and the impedance is the same as though inductance or frequency were the variable. Equations 7, 9, 14 and 15 hold then for the unity power factor resonance condition regardless of the manner in which the resonance condition is obtained. The minimum current resonance condition I_{min}, however, is much different than when the inductance is the variable.

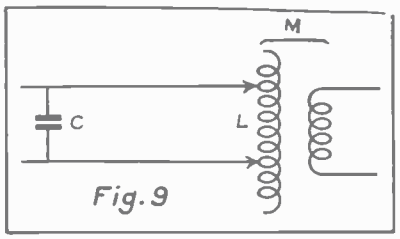


Fig. 9

The impedance for minimum current resonance is solved from the parallelogram O — O′ — P — i_L of Fig. 8 in the same manner as when the inductance was the variable. Thus when the capacity is the variable the impedance for the parallel combination at minimum current resonance is,

$$Z_{max} = \frac{1}{1/\left(\frac{1}{R_L^2 + \omega^2 L^2} + \frac{1}{4R_c^2} + \frac{R_L}{R_c(R_L^2 + \omega^2 L^2)} - \frac{1}{2R_c}\right)^{1/2}} \quad .....(19)$$

In Fig. 7 if the current through the inductive branch is set at i_L and the capacity is adjusted so that the capacitive current is i_c then the external current is in phase with the voltage as indicated by O — O′. If the capacity is decreased so that the current is i_c'', the resulting current is I″, which is greater than at the unity power factor resonance condition. If the capacitive current becomes i_c', the resulting external current is I′ which again is greater than the value at unity power factor resonance. From this it is evident that when the capacity is the variable and the resistance of the capacitive branch is negligible, the conditions of minimum current and unity power factor resonance are both satisfied by the same setting of the condenser. Thus equations 14 and 15 apply to both the resonance conditions when the capacity is the variable and R_c negligible.

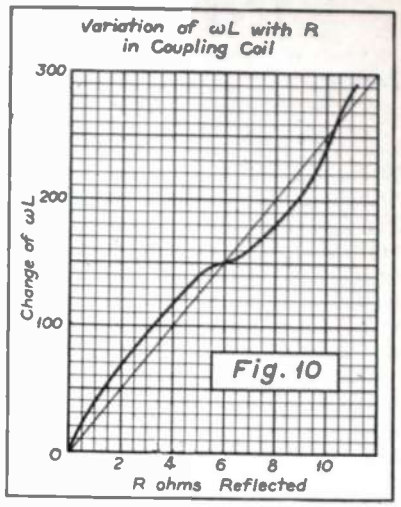


Fig. 10

The widespread use of the type of circuit shown in Fig. 9 makes it worth some consideration. The inductance L is in parallel with the capacitor C and is made variable by adding or removing turns. As the inductance changes so does the effective resistance of the coil. Before an analysis of the effects of varying the inductance in this manner can begin, it is essential to determine the rate at which the effective resistance changes with the inductance under ordinary circumstances. Let us assume that the working conditions are such that the circuit LC tunes always to a given frequency and different degrees of coupling are required to the circuit coupled to L. Measurements of the effective resistance of the coil as turns are added to L, keeping the frequency in LC the same and maintaining optimum coupling between the two circuits it is found that the effective resistance for practical purposes varies almost in line with the inductive reactance of LC. The curve of Fig. 10 shows that within certain portions and within small limits the ratio of the inductive reactance to the resistance of the inductive branch remains nearly constant. With the

(*Continued on page 24*)

POWER GUIDE CHART

(See page 19)

WATTS	DB	TUBE	Ep
.08	10		
.05			
	9		
		6R7G	135
		1H4G	135
		6C5G	135
.04			
	8		
.03			
	6		
.02			
	5		
		01A	90
	4		
.015			
	3		
.01		1H4G	90
	2		
.009			
.008			
	1		
.007		99	90
.006	0		

WATTS	DB	TUBE	Ep
.8	20		
		38	135
.5			
	19		
.4		71A	135
	18		
		31	180
		1F5G	135
		6J5G	250
	17		
.3		{1G5G	90
		{T89	180
		12A	180
		38	100
	16		
		6R7G	250
.2			
	15		
		6C5G	250
		31	135
	14		
.15			
		20	135
	13		
.10			
	12		
.09		1H4G	180
.08			
	11	6J5G	135
.07			
.06	10		

WATTS	DB	TUBE	Ep
6	30		
		6Y7G	180
5		6F8G	315
	29		
		50	450
		6V6G	250
4		6N8G	300
	28		
		PP49	180
		{59	250
		{6A6G	250
		{6P6G	250
		6B4G	250
	27		
3		PP48	125
		25A6G	180
		47	250
		38	250
	26		
		25L6G	110
		1J6G	135
2		48	95
	25		
		25B6G	95
		{45	250
		{1J6G	135
	24		
1.5		{6K6G	180
		{6A4	180
		33	180
		{6K6G	1875
	23	{46	250
		6A4	165
		PP6J5G	250
1.0		38	180
	22		
		PP6C5G	250
.9		25A8G	95
		T6F8G	250
		45	180
.8		71A	180
	21		
.7		{6A4	135
		{33	135
		{6K8G	125
		{1E7G	135
.6	20		

WATTS	DB	TUBE	Ep
60	40	PP6L6G	400
50			
	39		
40		PP6L6G	400
	38		
		PP6L6G	400
	37		
30			
	36		
20		{PP59	400
		{PP48	400
	35	PP6F6G	375
		PPT6F8G	350
		PP48	300
	34		
15		{PP6B4G	325
		{PP6L6G	250
		PPT6F8G	350
		PP8V6G	300
	33		
		PP8N8G	300
10		{PP8B4G	325
		{6N7G	300
	32		
9			
		PP8V6G	250
8		{6N7G	250
		{6Y7G	250
	31		
7			
		8L8G	250
6	30		

(Courtesy Hygrade Sylvania Corp.)

Design . . NOTES AND

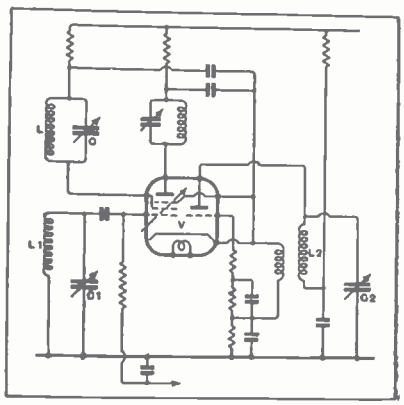


Fig. 1.

OF INTEREST TO DESIGNERS

DURING THE PAST few months several items which should be of interest to circuit designers and manufacturers have appeared in *The Wireless World*; a few of these are abstracted below.

Suppressing Image Frequencies. In the circuit of Fig. 1, the image rejector, LC, is connected to one grid of the mixer, V. The signal input circuit, L_1C_1, and the oscillator, L_2C_2, are connected to the other grids so that they are electronically coupled. The three circuits are ganged together; thus the rejector circuit is made effective at all settings of the tuning control. (British Patent No. 463070)

Feedback Amplifier. The output from amplifier, V, is fed back through a condenser, C, and a coil, L, connected as shown in Fig. 2 to a band-pass input circuit. A resistance, R, in the input circuit introduces a 90-degree phase shift which produces regeneration in both circuits and so increases both the gain and selectivity. When the resistance is absent both band-pass circuits are in phase and no feedback occurs.

The output of the amplifier may be rectified to provide the voltage for an a-v-c circuit; and automatic selectivity control can be obtained by varying the voltage on the grid of the tube, and hence the regeneration. (British Patent No. 463233)

I-F Transformers. Illustrated in Fig. 3 is a variable-coupling i-f transformer using the third coil of the conventional triple-tuned arrangement to vary the coupling between the primary and the secondary. The results claimed for this invention are shown in the curves of Fig. 4.

In Fig. 3, A and C are the primary and secondary, each tuned by condensers, K and K_2, respectively. The coils are of the so-called "dust-core" variety. Coil B is mounted in a movable yoke which, by means of a control not shown in the drawing, can be rotated about the pivot, P. The coils A and C are set at right angles to each other and a predetermined distance apart. The coupling between A and C then is adjusted at will by rotating coil B. (British Patent No. 463202)

A-V-C. In an all-wave receiver it may be found that the a-v-c is not equally effective on all bands. This invention provides for the ganging together of the sensitivity control, the tone or fidelity control, and the wave-changing switch in such a way that the signal strength supplied to the a-v-c rectifier is automatically controlled; in other words, the voltage input to the a-v-c rectifier is maintained substantially the same over the operating range of the receiver. (British Patent No. 462323)

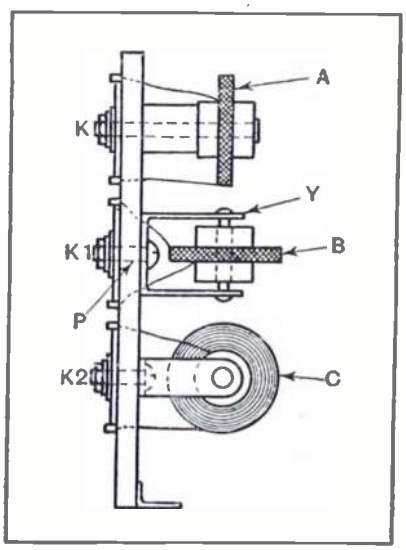


Fig. 3.

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POWER TUBES FOR SMALL RECEIVERS

THE USUAL a-c radio receiver operates with fairly high plate voltages; ac-dc receivers operate at considerably lower voltages. The recent introduction of

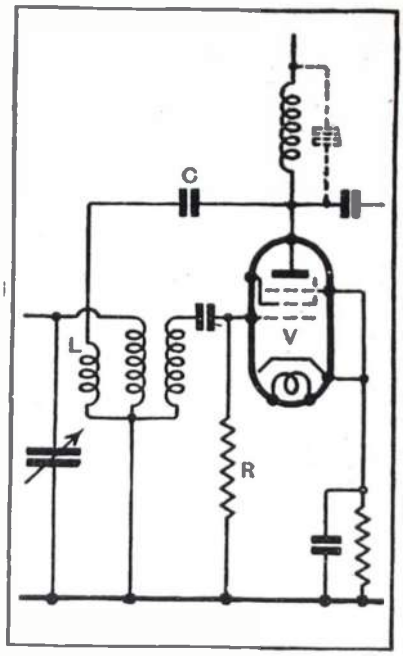

Fig. 2.

two tubes, the 25B6G and 25L6, for ac-dc receivers has made possible receivers giving approximately 2.0 watts output at about the same cost as the previous ac-dc receivers which gave about 0.9 watt output.

The 2.0 watt ac-dc receivers are thus giving about the same performance as the small a-c receivers using a 42 type output tube with about 220 volts availa-

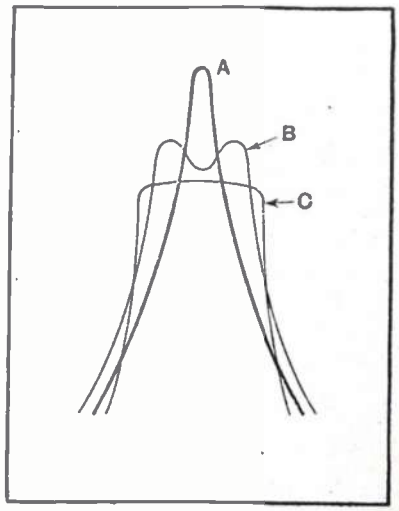

Fig. 4.

COMMENT . . *Production*

ble for plate and bias voltages. It would be necessary, using conventional tubes, to increase the cost of the small a-c receivers considerably to make them give appreciably better performance than the 2.0 watt output ac-dc receivers.

The performance of the small a-c receivers may be improved considerably with regard to power output by using an output tube similar to the 25B6G or 25L6 at lower voltages and larger currents than would be the case with the 42 type output tube. Some saving in the power transformer and condensers may be made at the same time. The saving in the power transformer comes from larger wire on the secondary, which reduces the material cost, and less turns on the secondary which reduces the labor cost; the condenser saving comes from lower voltage ratings.

The 6Y6G tube is being introduced to fill the need for an output tube which will give even more output at 135 volts on the plate and screen than the type 42 with 250 volts on plate and screen. The mutual conductance is designed to be as high as is practical for a good commercial tube. The high mutual conductance results in a fairly low input voltage requirement for full power output, and permits some degeneration to be used where desired.

RAYTHEON ENGINEERING SERVICE

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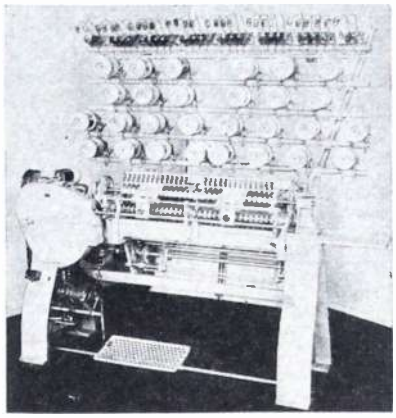
28 COILS AT ONCE

A LARGE CONSUMER of coils for Neon transformers recently had an analysis made of his coils for production on the "Duo-Matic," a new multiple-coil winding machine.

The coil, containing 19,000 turns of No. 37 wire, required that the wire turns be spaced apart on the first two and last two layers. The coil is wound on a rectangular tube 1¼" long, having a hole 1⅞" by 1 5/16". The outside dimension is 3 13/16" x 3¼". A special requirement is that four layers of paper must be put in between each of the first three and last three wire layers.

Operating from two separate rolls of insulating paper, which is automatically cut to length and automatically inserted between wire layers, this machine assures a marked increase in capacity, producing up to 28 electrical windings simultaneously.

On the No. 104 Winder of the same



The Duo-Matic Winder.

company, using a 12" width of paper, an ignition coil 2¾" long could be produced at a rate of only 4 coils at once, 120 coils in a day. On the "Duo Matic," with two 16" sticks, 10 coils can be wound at once (allowing a total of 1½" trim), resulting in a production increase of at least 250 percent.

But increased output is not solely due to the larger number of coils wound at once. Greater efficiency in handling completed coil sticks and the group transfer of wire terminals to a new arbor are said to contribute to the step-up in production. Handling of arbors has been simplified by means of a two-piece construction with individual supports and center rests, a pawl arrangement on the supports facilitating the rotation of arbors during transfer operations.

Change-over operations have been greatly simplified, so that set-up time for coil changes is reduced. This reduction is due principally to calibration of tensions and the opportunity to record definite settings for the different wire sizes. Various other machine adjustments are also accurately graduated so that they can be recorded for ready reference. Cutting and trial are now no longer necessary.

A radio power-amplifying transformer coil section contains 1,850 turns of No. 34 enameled wire, with a tap at 925 turns. Despite the handicaps of a small number of turns and the necessity of stopping the winding for application of the center tap, productiion is said to be at the rate of 950-1000 sections per eight-hour day at 85 percent operative efficiency.

One of the largest manufacturers of electric controllers is using this winder to turn out small coils containing 1050 turns of No. 31 enameled wire. Winding 30 coils at a time, a stick is completed in five or six minutes, giving an hourly rate of from 250 to 300 coils.

Another feature is that the individual paper rolls insure smoother paper inserts, eliminating the crinkling that often occurs with mechanical insertion of longer paper widths in a single roll. There are no extra paper attachments, the entire paper supply being self-contained.

Floor space requirements have been minimized wherever possible, the complete 28-coil machine occupying only 76" by 36", with a height not exceeding 60". A variable speed motor is provided with foot pedal control.

UNIVERSAL WINDING CO.

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POWER GUIDE CHART

THE POWER GUIDE, shown on page 17, is intended to serve as an index of power output tubes, so tabulated that the tube types which will supply a certain power output are apparent at a glance.

The guide is divided into four major columns, each column covering a power ratio of 10 db. The zero power level has been set at 6 milliwatts so that the total range of the guide is from 6 milliwatts to 60 watts, or 40 db. Four quantities are tabulated in each column: power output, db above 6 milliwatts, tube type and plate voltage.

In selecting tubes for driver stages in which it is desirable to introduce negligible distortion, the maximum power output to be utilized should be limited to about one-half that listed in the table, since the values shown are those obtained with maximum signal-voltage swing and therefore contain more harmonics than could generally be tolerated for driver stages. Many of the push-pull ratings are for Class AB operating conditions and require some driving power.

A few obsolete types are also listed in the guide to provide an historical background and also indicate the demand in the past few years for tubes capable of delivering increased power output.

The chart is reproduced from Engineering News Letter Number 40 of the Hygrade Sylvania Corp.

RMA NEWS

MAY EXCISE TAXES INCREASE 49 PER CENT

Internal Revenue Bureau collections of the federal 5 percent excise tax on radio and phonograph apparatus in May 1937 were $329,074.51, an increase of 49 percent over the collections of $220,740.43 in May 1936. The figures do not include excise tax collections on automobile radio which are not segregated in the tax reports of automobile accessories.

May excise taxes on mechanical refrigerators were $2,219,202.24, compared with $846,609.45 in May 1936.

APRIL EXPORTS BREAK RECORDS

Exports of American radio products in April 1937 increased 47 percent over April 1936, according to the current report of the U. S. Bureau of Foreign and Domestic Commerce, and were the second largest in any one month on record. The April radio exports totaled $3,097,706, compared with $2,104,065 in April, 1936, and for one month all American radio shipments were exceeded only in October 1936.

Receiving set exports last April numbered 60,393 valued at $1,532,255, compared with 46,046 valued at $1,221,688 in April 1936.

Tube exports last April numbered 1,056,446 valued at $442,847, compared with 648,955 tubes valued at $277,425 exported in April 1936.

Exports of parts and components last April broke all records for a month's shipment with a value of $792,732, compared with $439,177 in April 1936.

Loud speaker exports last April numbered 41,871 valued at $84,780, compared with 20,907 speakers valued at $45,127 in April 1936.

Transmitting apparatus exported last April totaled $245,092, compared with $120,648 in April 1936.

RMA SEEKS REDUCTION IN FREIGHT RATES ON TUBES

Substantial reduction in freight rates on tubes is being sought by the RMA Traffic Committee. Vice Chairman Davies held a meeting at New York on June 23 in preparation of procedure with the Railroad Classification Committee. In 1934 the RMA secured a special reduction in freight rates, but since that time there has been reduction in the value per pound of glass tube shipments, while the value per pound of metal tubes has also gradually reduced since their introduction a few years ago. Changes in rate classifications and also new minimum carload weights are now being proposed, and tube companies have submitted traffic data to support the RMA application for rate reductions.

ADDITIONAL EMPLOYMENT DATA FOR RMA MEMBERSHIP

The recent employment survey of the RMA was so valuable and its data of such benefit to contributing members of the Association that the RMA Board of Directors has authorized further development of industry employment information. The Board of Directors has authorized another mutual exchange by Association members of employment and labor data, files of which for the convenience and information of members will be maintained, both at Washington headquarters of RMA and in Chicago, the latter under President Muter.

Details of the new employment survey soon will be sent to RMA members. It is entirely voluntary and will consist of employment statistics and other information which may be contributed by Association members. The Board of Directors believe that such files of employment data will be helpful in present and future employment problems.

EXCISE TAXES EXTENDED

All excise taxes, including the 5 percent tax on radio and phonograph apparatus, have been extended by Congress, unchanged, for two more years, until June 30, 1939. No opportunity was given either in the Senate or House for hearings on the joint resolution of continuance, which was rushed through Congress on June 25 just before expiration of the excise taxes on June 30. However, a new tax program is planned by the administration in the next session of Congress, next winter, when proposals for repeal or reduction of existing excise and other taxes may be heard.

During congressional debate, it was admitted by administration leaders that there existed "reasonable arguments" for reduction of many of the excise taxes, which were criticized in the debate as widespread nuisance or sales taxes paid largely by those least able to bear them. Senate Republicans made a vigorous but futile effort to have the excise taxes continued only one year, but the demands of President Roosevelt for the revenue declared necessary to the government resulted in final action continuing the excise taxes without change until June 30, 1939.

RMA COMMITTEE CHAIRMEN NAMED BY PRESIDENT MUTER

The active working staff of the RMA to carry on regular services for the Association membership and develop new services during the ensuing year is now complete. All activities of the RMA are now in progress with the appointment, following the thirteenth annual convention of the Association at Chicago, by President Muter of all committee chairmen. At the next meeting of the RMA Board of Directors, scheduled during the summer and not later than September, several new promotion projects will be considered.

The RMA Credit Committee has a new chairman in Philip C. Lenz of Chicago, recently reelected to the RMA Board of Directors and former vice chairman of the Association's credit information work in the West. Mr. Lenz succeeds Arthur Moss of New York City as general chairman of the Credit Committee, which will continue to hold monthly meetings in New York and Chicago in cooperation with the National Credit Office, the credit information agency of the Association.

Dr. W. R. G. Baker of Bridgeport, Conn., has been reappointed by President Muter as chairman of the RMA Engineering Committee, heading up all Association engineering work. Virgil M. Graham of Emporium, Pa., as continued as chairman of the Standards Section, and the entire engineering personnel of the Association, through various groups, is engaged upon many technical services for the industry.

The many important legislative interests of the industry will continue under the direction of A. H. Gardner of Buffalo, reappointed chairman of the RMA Legislative Committee.

Foreign trade affairs and all export interests will continue under the chairmanship of S. T. Thompson of Long Island City, New York. Mr. Thompson also is a newly elected director of RMA.

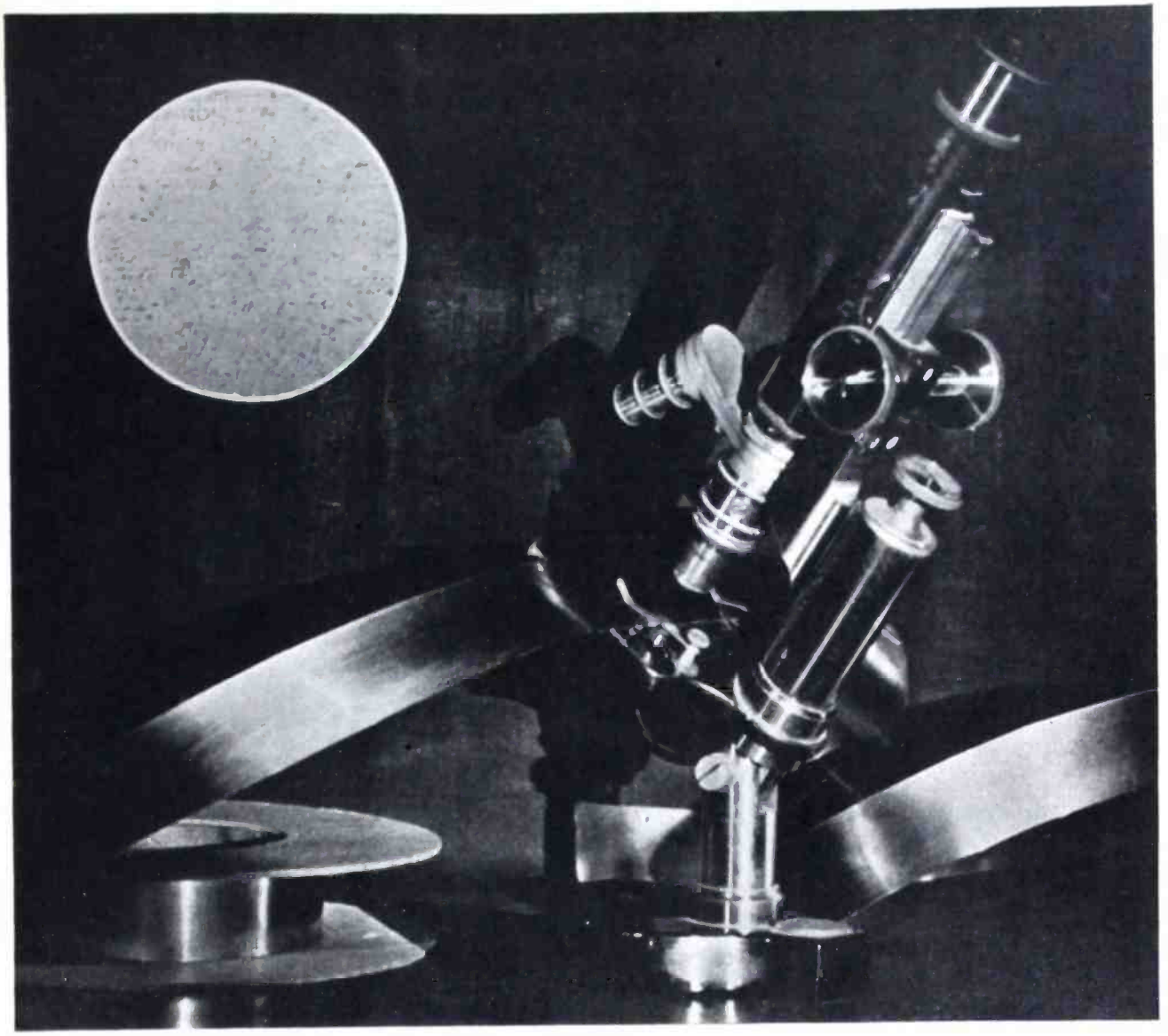
George A. Scoville of Rochester, New York, has been reappointed general chairman of the Traffic Committee, and O. J. Davies of Camden, New Jersey, will continue in his post as vice chairman and in active charge of all traffic affairs of the Association.

James M. Skinner of Philadelphia will continue as chairman of the special RMA committee in charge of pending fair trade practice rules before the Federal Trade Commission and also as chairman of the special committee on future commercial development of television and location matters before the Federal Communications Commission. A technical engineering committee on the latter problems also is headed by Dr. Baker, general engineering chairman.

Merchandising matters will continue under the chairmanship of E. F. McDonald, Jr., of Chicago of the special committee on fair trade practices.

The RMA membership committee has been reorganized and enlarged. Paul V. Galvin of Chicago has been reappointed general chairman of the committee, which will consist of Set and Parts Divisions. E. Alschuler of Chicago will be vice chairman for the western, and Ben Abrams vice chairman for the eastern committees for set manufacturers. For membership work among parts manufacturers, Jerry Kahn of Chicago is appointed vice chairman for the western territory, Sam Cole of New York for the eastern territory, and Ray F. Sparrow of Indianapolis for the central territory.

Committees of the Parts Division also



Unretouched photograph—inset a photomicrograph

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17 BATTERY PLACE NEW YORK CITY

have been appointed by Arthur Moss of New York, general chairman, with considerable activity and several meetings already planned. Parts standardization work which is in progress and several important items will be continued under the active direction of L. C. F. Horle of New York.

U. S. ATTACHES AID RMA PROTESTS IN FRENCH QUOTA

The State Department and also the Department of Commerce have advised the RMA that they are supporting the RMA protests to the French Government against proposed reduction in the French import quota of small radio parts, principally resistors and condensers. It is known that representatives of the U. S. Embassy in Paris have been active in the matter as well as commercial attaches in France of the Department of Commerce. The proposed quota reduction was held in abeyance during the quarter ending June 30 and further representations have been made by the RMA to the "Comite Interprofessionnel" at Paris, in charge of administering French import quotas.

Chairman Moss of the RMA Parts and Accessory Division, Chairman Thompson and members of the Association's Export Committee, and Association officials also have been active in the matter. It has been found impossible to reconcile or secure adequate export statistics on French imports of certain small parts involved, and the French authorities have been asked to further delay the proposed quota reductions and to continue unchanged the present quotas, at least during the current quarter ending Septemper 30 next.

RMA MEMBERS VOTED JULY 31 ON INCREASE IN DIRECTORS

Proposed increase of the RMA Board of Directors from eighteen to twenty-five members, to provide for more adequate representation on the Association's governing Board from the Set and Parts and Accessory Divisions, was voted upon by the Association membership July 31. The proposed increase in the RMA Board was approved at recent meetings of all RMA divisions during the recent convention at Chicago, but a formal "meeting" of the membership is required under the Constitution and By-Laws for formal action.

Three additional directors from the Set Division, Messrs. Ernest Alschuler and P. S. Billings of Chicago, and S. T. Thompson of Long Island City, New York; and four additional directors from the Parts and Accessory Division, Messrs. S. I. Cole of Brooklyn, New York, J. J. Kahn of Chicago, H. E. Osmun of Milwaukee, and Ray F. Sparrow of Indianapolis, were chosen last month at Chicago in the proposed enlargement of the Board.

CANADIAN SALES

May 1937 sales of Canadian set manufacturers, according to statistics of the Canadian RMA, total 12,973 sets with a list value of $868,338, compared with May 1936 sales of 10,925 sets worth $834,481. Of the Canadian sales last May, there were 8,289 A.C. sets valued at $581,167; 1,423 battery sets worth $99,614, and 3,261 automobile sets valued at $187,557.

NEW PHILIPS PUBLICATIONS

The Philips Company of Holland has issued a monthly publication containing technical information on radio, television, sound, telephony, X-rays, lighting, and other developments. The annual subscription price is 3 guilders (approximately $1.65), and a sample copy for loan to interested manufacturers is available upon application to the Electrical Division, U. S. Bureau of Foreign and Domestic Commerce at Washington. Also available on loan is the twenty-fourth annual report, 1935-1936 of the Philips organization.

NATIONAL PARTS TRADE SHOW IN NEW YORK, OCTOBER 1-3

Plans for the New York radio parts trade show, operated by the Radio Parts Manufacturers National Trade Show, to be held at Commerce Hall in New York City, October 1 to 3, have been announced. The exhibit hall with 150,000 square feet of space, is the largest exhibition hall in the world. Show headquarters will be at the Victoria Hotel.

AUSTRALIA CHANGES TUBE IMPORT RULES

The Australian government has changed its regulations regarding tube imports, according to the latest report to the U. S. Bureau of Foreign and Domestic Commerce from Assistant Trade Commissioner Wilson C. Flake of Sydney. Permits for importation of transmitting tubes and cathode ray tuning indicators for receiving sets will be granted free upon application to the Australian government, but there are additional rules regarding imports of receiving set tubes, as detailed in the following official report:

"The Government of Australia has announced that importers may bring in from the United States during the last 6 months of 1937 a quantity of radio receiving tubes equal to 25 percent of the quantity imported during the 'base period.' (The 'base period' is the 12 months ended April 30, 1936.) Therefore the 25 percent import quota for the last half of 1937 is at the rate of 50 percent of importations during the 'base period,' as the 'base period' covers a full year while the quota is for a period of 6 months only. At the same time the quota restrictions have been removed on transmitting tubes, permits being freely available or the importation of any quantity of *transmitting* tubes from the United States.

"Since May 22, 1936, when the importation of radio tubes from the United States became subject to import restrictions, many Australian manufacturers of radio receiving sets have complained that they are being handicapped by their inability to secure as many radio tubes as they wish from the United States. Nevertheless, the import restrictions on receiving tubes have remained, the renewal of the quota for the last 6 months of 1937, just made, maintaining the situation as it has existed since the import restrictions first became effective. In the meantime, extensions have been made to the radio tube factory operated in Australia by Amalgamated Wireless (Asia) Ltd., while a new radio tube factory is being erected in Sydney by the Philips organization of the Netherlands. This Philips factory, machinery for which is already in Sydney, is expected to commence production in the very near future.

"The present quota for the importation of radio tubes from the United States covers a period to the end of 1937. There is considerable speculation in the trade as to what will happen after that time; that is, whether the present quota will be renewed or whether the quota for American tubes will be reduced or allowed to expire altogether, thus reducing still further or stopping altogether the importation of radio tubes from the United States."

RMA PROTESTS REDUCTION IN FRENCH QUOTAS ON SMALL PARTS

Reductions ordered in the French import quota of small radio parts (weighing less than two ounces) have been followed by vigorous protests by the RMA to the State and Commerce Departments and also organizations in France in an effort by RMA to have the small parts quotas increased. A number of RMA manufacturers of small parts having substantial exports in France are affected and have requested all possible assistance by RMA. Condenser and resistor manufacturers are the principal interests injured by the French quota cut and with the promised assistance of U. S. Government officials, there is hope that the RMA action will result in restoration of small parts quotas.

The French quota reduction, applied in the current quarter ending June 30, was a general decrease to 4 percent of total radio import quotas. It is applicable to parts weighing less than 50 grams (about two ounces). The 4 percent quota restriction was general, applicable to imports into France from all countries, and, therefore, there was no special discrimination against American parts which could be the basis for action by the U. S. State and Commerce Departments. It is understood that the small parts quota reduction was prompted especially because of a flood of cheaper grades from Germany and Holland, regarded as injurious to local French manufacturers as well as the trade, because of flooding the French market with low-grade small parts.

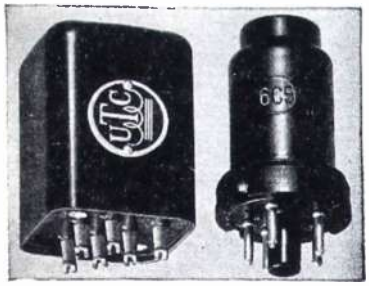
In enlisting the action of the State and Commerce Departments, however, the RMA alleged that the quota limitation against American small parts manufacturers is a violation of the new reciprocal trade agreement negotiated recently between the State Department and the French Government. In its request to the State and Commerce Departments urging protests and action to the French Government, the RMA pointed out that the actual effect of the small parts quota, although applicable to all countries, is in effect and actually a discrimination against American manufacturers of small radio parts whose business in France is thus reduced.

For the current quarter ending June 30, the immediate effects of the French official order reducing small parts quotas has been relieved. Import quotas of about 80 quintals were secured for the current quarter, about double the normal allocation permissible under the 4 percent quota decree.

In addition to enlisting the support of the State and Commerce Departments in the matter, the RMA has urged action through the Comite Interprofessionel, the French official import control agency, and also the American Chamber of Commerce in Paris, and the American Radio Importers Syndicate of France. It is hoped that the RMA action will result in reconsideration of the 4 percent quota order in time for possible increase of the American small parts quotas during the quarter beginning July 1.

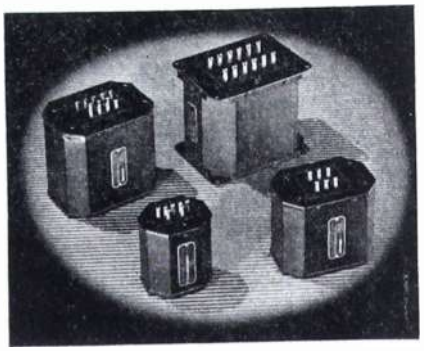
Detailed data from RMA member manufacturers of small parts is to be sought through the RMA Parts Division, of which Arthur Moss of New York is chairman, and the RMA Export Committee, headed by S. T. Thompson, chairman. Total exports of American parts and accessories to France during the first three months of 1937, the lastest figures available, were $77,235, and the RMA is endeavoring to secure statistics on the detailed exports of American small parts.

Choice of the Discriminating User*



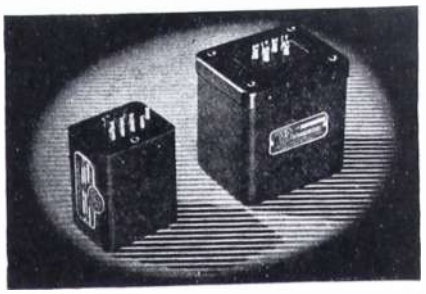
ULTRA COMPACT HIGH FIDELITY AUDIO UNITS

The UTC ultra compact audio units are extremely small and weigh only 5½ ounces. The fidelity, however, is excellent, the frequency response being uniform ±2 DB from 30 to 20,000 cycles. These units are ideal for remote pickup equipment and similar applications where both weight and size are paramount factors.



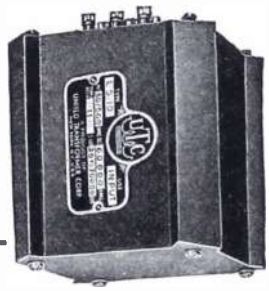
PUBLIC ADDRESS UNITS

The Public Address series of units is a popular priced line having medium fidelity. A complete line of input, output and power components is provided, suitable for every public address and amateur transmitting function. Units of this class are used extensively by commercial communications companies for service where broadcast fidelity is not essential.



UTC HIPERM ALLOY COMPONENTS

UTC Hiperm Alloy Components are similar to the Linear Standard units but of a more compact design and employ a light-weight high conductivity case so that these units can be employed for portable and compact service. They are used extensively in recording and remote pickup equipment.



UTC LINEAR STANDARD COMPONENTS

UTC Linear Standard components are ideal high fidelity units for broadcast and recording service. The frequency response is guaranteed uniform from 30 to 20,000 cycles, and the shielding and insertion loss is maintained at extremely low values. These units are unequalled for studio and speech input equipment.

* UTC transformers are used by RCA, G.E., Western Electric, Westinghouse, Bendix, C.B.S., N.B.C., M.B.S., U. S. Army, Navy, Signal Corps, Coast Guard, Dept. of Commerce, Bureau of Standards, etc.

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BOOK REVIEWS

THE GRAMOPHONE RECORD, by H. Courtney Bryson. Published by Ernest Benn, Ltd., London. 286 pages, price (about) $3.50.

While this book probably is not to be considered as an exhaustive treatise on the subject of phonograph records, it does happen to be the first (so far as we can learn) on the subject. For this reason alone it can be commended to the attention of all engineers and technicians who are interested or concerned with recording practice or record manufacture.

In general, it may be said that the book is one of manufacturing practice, although there are several chapters in which recording technique, the nature of sound, etc., are covered.

It is difficult to say just how much of the material contained in the book is applicable to present-day American practice; references to American sources are given, but the impression remains that it is British practices which are discussed in detail. However, because of the fact that these cannot be too radically different from those of domestic manufacturers, this reviewer feels that the ideas expressed will be of interest here as well as in Great Britain.

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BLUEBOOK OF PROJECTION, by F. H. Richardson. Published by Quigley Publishing Co., New York. 708 pages, price $6.00.

This is the sixth edition of a book which, for some unknown reason, has become more or less of a Bible to the motion picture projection craft. It may be that the author speaks the language of the man in the booth—but whatever it is, it can't be classed as anything but a mistake.

The book is so full of errors—both of theory and actual practice—that one is inclined to wonder how anyone can intelligently follow it. However, many men apparently "cram" for the license examination with this book; and since a good number of them pass the exam, it either speaks well for something which this reviewer missed in the book, or the laxity of examinations.

The sections devoted to sound equipment are not quite so incomprehensible as some of the others. However, there are several analogies—so-called—which won't hold water in the wildest sense; things such as these can tend only to confuse the projectionist and might better have been left unsaid. After all, it just isn't to be expected that the "movie" operator will understand the theory of amplifiers—and as far as teaching him about volume expanders, matching transmission line impedances, and a few others of the high-sounding points which are carefully reduced to A-B-C, are concerned, we can think of nothing more appropriate to say than, "Nerts."

Obviously, such a book as this would only be a painful experience to an engineer—so our recommendation is, No!

IDLING CHARACTERISTICS OF ELECTROLYTIC CONDENSERS

(Continued from page 7)

ties in the raw materials, it has been found that after the film has been formed, impurities in the electrolyte and in other parts of the assembled condenser have very little effect upon the rate of deterioration of the anode. However, these impurities, especially chlorides and sulphates, are to be avoided because of their detrimental effect upon the normal leakage current of the condenser as a result of the discharge of ions at the anode, with subsequent attack upon the dielectric film.

With respect to the concentration of the final filling solution, experiments showed that for a specific film-forming electrolyte such as boric acid and ammonium borate, the rate of deterioration increases with an increase in the concentration of ammonium borate. However, over the rather wide range of pH4 to pH7, the effect is negligible, and this covers practically the entire working range of electrolytic condensers as used at present.

The effect of the solvent used in the final electrolyte proved to be very interesting. The experimenal results showed more or less conclusively that the deterioration of the anodic film is practically independent of the electrolyte ions themselves, provided they are film-forming ions, but is dependent to a large extent upon the solvent used. Anodic films deteriorate much more rapidly in aqueous solutions than in solutions which are almost entirely non-aqueous, due possibly to a difference in the mobility of the ions in the two types of solutions and hence in their reactivity; it is obvious that in the case of aqueous electrolytes, the real factors which control the rates of deterioration of electrolytic condensers are to be found in the actual formation of the film itself.

Although several theories have been advanced to account for the electrical characteristics of anodic film, no one theory is able to explain all the known experimental facts. With regard to deterioration, it is possible that the dielectric film is composed of not only the non-conducting Al_2O_3 molecules, but also the conducting $Al(OH)_3$ molecules, and that the extent of deterioration depends upon the ratio of the former type of molecules to the latter. On this basis, the manufacturing process should be one which will produce anodic films containing the smallest number of $Al(OH)_3$ molecules. Further work along this line is being carried out, and it is hoped that the results may be available soon.

•

INDUCTANCE OR CAPACITY TUNING

(Continued from page 16)

$\omega L/R$ ratio remaining constant, as the inductance L is changed, the phase angle ϕ_L, Fig. 11, remains constant and the current through the inductive branch merely changes in magnitude, so that the resulting external current follows along the trace of the line $I - i_c$. It is evident that the minimum current resonance condition, I_{min}, occurs at a point along the line $I - i_c$ where a perpendicular from it passes through O. In this figure angle ϕ_L equals the angle 1; thus, $I_{min} = i_c \cos \phi_L$, and also $i_L' = i_c \sin \phi_L$; at the minimum current resonance condition the capacitive reactance is equal to the inductive reactance and the impedance becomes,

$$Z_{max} = \frac{\omega L}{R} \sqrt{R^2 + \omega^2 L^2} \quad \ldots\ldots (20)$$

It is interesting to note the manner in which this minimum current resonance condition differs from that obtained by varying the capacity or the inductance alone. The frequency at which resonance occurs is the same as that for which the unity power factor resonance condition occurs for the series circuit, since both the reactances are equal.

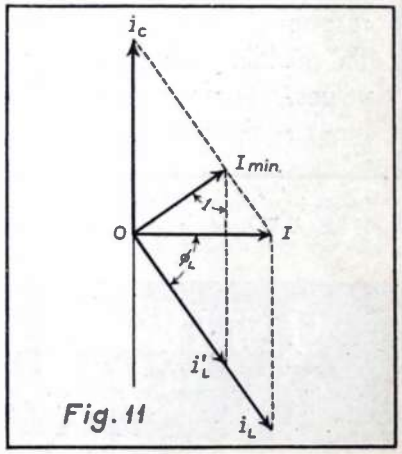

Fig. 11

New manganese-free silicon-nickel alloy.

●

Minimizes chipping and flaking of oxide coating.

●

Popular for oxide-coated tubes — particularly -80 type.

●

Permits operation at lower temperature.

●

Increases tube life.

●

SYLVALOY

Another of the radio filament materials produced by alloy specialists to meet the critical requirements of tube manufacturers. ● Write for data. Submit your problems and requirements.

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CREI offers you a thorough, modern course in Practical Radio Engineering, written for the man who is serious about getting ahead in Radio. It helps you to progress from the "mechanic" stage into the ranks of the expert specialist. It gives up-to-the-minute instruction in what goes into modern Radio apparatus, so that you can look at it with the eyes of the engineers who designed it and appreciate the results they are trying to obtain. If you realize the importance of technical training, send for the CREI booklet that describes our courses and your future in detail.

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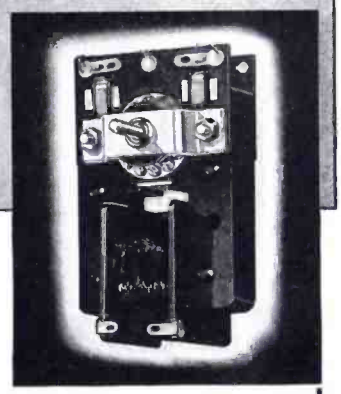


POWERFUL ECONOMICAL NOISELESS

● Built in accordance with Underwriters Laboratories requirements, this compact and efficient motor has been designed specifically for radio tuning.

● Highest quality materials machined to very close tolerances combined with the best electrical design practice make this the outstanding motor for long and trouble-free performance.

● Volume production and consequent cost reduction makes it possible to offer you this motor at a surprisingly low unit cost.

Your inquiry and correspondence is invited by

THE ALLIANCE MFG. COMPANY
ALLIANCE, OHIO

News Of The Industry

TRANSDUCER REPRESENTATIVES

Appointment of sales representatives in eleven different trade centers in the country was announced last week by J. T. Kane, Sales Manager of the Transducer Corporation, microphone and inter-office communication manufacturing concern located in Rockefeller Plaza, R. C. A. Building, New York. The news sales representatives who will handle the company's line in "Bullet" Dynamic Microphones are as follows: J. A. McCaffry, Michigan; W. B. Weyrick, Ohio and Indiana; Morris F. Taylor, South Atlantic Seaboard; George W. Sipe, Kentucky, Mississippi, Louisiana, Western Tennessee; Lee Maynard, Middle West with headquarters in St. Louis; J. R. McCarty, metropolitan Chicago; Hal F. Corry, Texas, New Mexico, Oklahoma; Sam Egert, metropolitan New York; C. B. Van Loan, Minnesota, Wyoming, Montana, the Dakotas, Wisconsin; Dave Ormont, New England; Nathan Lazarus, New Jersey, Pennsylvania, New York.

— RE —

W-E BULLETINS

Three new bulletins have just been issued by the Western Electric Company describing and illustrating the latest additions to its line of equipment for broadcast stations. In the first of these bulletins the new 104A, 105A and 106A amplifiers are set forth. Compactness and operation economy are featured.

In the second bulletin, the new 110A program amplifier is described. Being new in principle, this unit will be a welcome addition to any station where the management desires to increase the transmitter's coverage without the necessity of raising the output power rating. The increased efficiency is made possible by virtue of the fact that the device introduces automatic volume limitation, permitting a higher average percentage of modulation to be maintained without danger of over-modulation.

The third bulletin describes the new 23B speech input equipment which is designed for use by stations when the operators ride channel gain by means of the main gain control.

— RE —

SHARP JOINS CONSOLIDATED

Sam Sharp, who is well known to the radio industry of the middle-west for his activities in radio capacitor sales, is now connected with the Consolidated Wire & Associated Corporations, where he will handle manufacturers' sales for their well-known Red Head Brand of Condensers.

— RE —

TUBE VOLUME SHOWS INCREASE

A report issued today by the Arcturus Radio Tube Company, Newark, New Jersey, discloses that the company's tube volume for the first half of 1937 shows a marked increase over the corresponding period last year and marks a new high since 1929.

"Every division of our business, comprising manufacturers, jobbers and export sales are running ahead. Additional help has been hired to keep pace with this increasing demand and prospects indicate a record year for 1937," states C. E. Stahl, Vice President and General Manager.

CORRECTION

Because of an error on the part of our printer, the credit line for the illustrations, on pages 10 and 11 of our July issue, was omitted.

The photographs were furnished by P. R. Mallory & Co., Inc., Indianapolis, Ind.

— RE —

PROPERTY TABLE ON CERAMICS

A Property Table has just been published by The American Lava Corporation containing most recent and complete information of the physical properties of the most important ceramic materials manufactured by this company.

Listed are the properties of vitrified steatite bodies used for electrical and especially high-frequency applications, of refractory materials of low coefficient of expansion mainly used in electrical heating appliances and of materials with high dielectric constant used in radio condenser work.

This table gives complete information on ceramic materials and is, therefore, of special value to the designer of electrical apparatus or to any user of technical ceramic products.

This table is sent out on request, free of charge; address American Lava Corporation, Chattanooga, Tennessee.

— RE —

AIR EXPRESS UP 24.2% FOR JUNE

An increase of 24.2 percent in the number of air express shipments for June as compared with the corresponding month of last year was reported today by the Air Express Division of the Railway Express Agency. The total for last month was 51,837 shipments.

— RE —

AEROVOX FIFTEENTH ANNIVERSARY CATALOG

The Fifteenth Anniversary Edition of the Acrovox catalog is now ready for distribution. This 32-page book lists a large and diversified line of condensers together with resistors. A new and handy method of listing permits of finding any required condenser in minimum time. Condensers are grouped first under their general type classification, and then under working voltage, and finally by capacity. Concise, brief but adequate description text is included where necessary. Eight pages of exact duplicate replacement condensers are included, covering practically all standard set requirements. A copy of the catalog may be had by addressing Aerovox Corporation, 70 Washington St., Brooklyn, N. Y.

— RE —

G-E BULLETIN

A bulletin describing small Pyranol capacitors for power factor correction of small motors, luminous tube transformers, etc., has been made available by the General Electric Company, Schenectady, N. Y.

— RE —

EASTERN ELECTRIC REPRESENTATIVE NOW IN U. S.

G. C. Motwane, representing the Eastern Electric & Engineering Company of Bombay, India, is in the U. S. for a stay of several months. Mr. Motwane, who may be reached at the Hotel Irving, New York City, is interested in radio parts, public address equipment, etc.

SOLAR REPRESENTATIVE

The Solar Manufacturing Corporation announces the appointment of Leo C. McCarthy as representative in the Chicago metropolitan area, for jobbing accounts. Leroy Eschner will continue as senior representative for Northern Illinois manufacturing accounts, while Irvin Aaron, of Milwaukee, will visit Northern Illinois jobbers, outside of Metropolitan Chicago.

The Bayonne, New Jersey, plant of Solar is now in active production of wet and dry electrolytic condensers. The additional production facilities thus made available will almost double the Solar Electrolytic capacity.

— RE —

MERCOID OPENS BALTIMORE OFFICE

J. W. Owens, Vice-President, The Mercoid Corporation, 4201 Belmont Avenue, Chicago, Illinois, announces the opening of a new office at 1035 Cathedral Street, Baltimore, Maryland.

"We will carry a complete stock of Mercoid automatic controls in Baltimore," said Mr. Owens. "Mr. John Jex. Jr. will manage this office, cooperating with our distributors in that area."

— RE —

BOONTON LITERATURE AVAILABLE

To engineers and manufacturers interested in measuring coils, condensers, dielectrics and insulators at radio frequencies, the Boonton Radio Corporation of Boonton, N. J., offers an interesting collection of bulletins. The literature covers the Q-Meter, QX-Checker, the new Dielectric Unit, the Converter Test Oscillator, Hi-Q Parts, and Inductors. The bulletins in an attractive cover jacket, are available to engineers and manufacturers writing on their business letterhead.

— RE —

PEMCO STEPS UP PRODUCTION

The demand resulting from the decisive swing to continuously smelted porcelain enamel frits throughout the range, refrigerator, washing machine and other industries has made it necessary for The Porcelain Enamel and Manufacturing Company of Baltimore, Md., to build a new continuous smelter, the fourth in the world.

The new smelter, with three others built by PEMCO in the last three years, will step up the company's continuously smelted frit production by one third, it was announced by Richard H. Turk, executive vice-president.

— RE —

GODLEY & BROWN

It has recently been announced that Dr. George H. Brown, formerly, Research Division, RCA Manufacturing Co., Inc., has joined Paul F. Godley to form the firm of Godley & Brown, consulting radio engineers. This new organization is located in Upper Montclair, N. J.

— RE —

RICHLAND VISITING ENGLAND

Philip Richland, Vice-President and General Sales Manager of the Gemloid Corporation, New York, sailed for England on July 28th.

ALLIED RADIO

Allied Radio Corporation of Chicago announces the expansion of its facilities immediately to include an additional 10,000 square feet of space in its building at 833 West Jackson Boulevard. This marks the second space increase in the last two years and gives Allied more than 50,000 square feet to house its complete organization.

Allied also announces the release of a new 1938 Catalog. It contains 164 pages and includes more than 12,000 exact duplicate and replacement parts; 61 new Knight radios; amateur receivers, transmitters and transceivers; build-your-own-kits; public address systems; test instruments; books, tools, etc. Unique features of this book are its convenient arrangements of the parts portions and the separate amateurs, public address, test equipment and radio set sections. A free copy may be obtained by writing to Allied Radio Corporation, 833 West Jackson Boulevard, Chicago, Illinois.

— RE —

PRESTO CATALOG

A 15-page catalog giving specifications and performance data on the Presto line of instantaneous sound recording equipment has been made available. It may be secured by writing to the Presto Recording Corporation, 139 West 19th St., New York City, N. Y.

— RE —

MUTER BALLAST TUBE CATALOG

The Muter Company has just issued a very complete replacement catalog for radio parts jobbers and servicemen. This catalog is uniquely arranged in two sections; the first according to names of sets, showing the Muter stock number tube required, the second section or cross-reference giving the different sets and models each Muter stock number tube will replace. This catalog should be most helpful as there has been so much confusion resulting from the various systems followed in marking ballast tubes. A copy can be secured by writing The Muter Company, 1255 South Michigan Avenue, Chicago.

— RE —

GOAT ENLARGES FACTORY

Goat Radio Tube Parts, Inc., has provided additional space to manufacturing tube parts which they supply to the independent tube manufacturers, and their form-fitting tube shields used by set manufacturers.

Goat has taken additional space in an adjacent building to take care of the increasing demand on their facilities. This increased capacity will enable the organization to render better service to their customers.

— RE —

WOODALL COMPANY APPOINTS NICKEL

Edwin A. Nickel, formerly Sales Promotion Manager of Hygrade Sylvania Corporation, makers of Sylvania radio tubes, has been named as Sales Manager of the W. P. Woodall Company, mail selling and advertising firm of New York. Mr. Nickel's 18 years experience in direct advertising and selling with such firms as Dictograph Products Company, Fada Radio Corporation, Chas. W. Hoyt Company, Lennen & Mitchell and others, will be available to those accounts served by the Woodall organization, which numbers among its customers many of the country's leading radio firms.

MARCONI MEMORIAL

It has been announced in the press and over the radio that the Veteran Wireless Operators Association has launched a Marconi Memorial Fund, the purpose being to erect a monument commemorative of the ideals and achievements of the inventor of wireless telegraphy, Guglielmo Marconi, number one veteran of their association.

The Fund was started by the contribution of $100.00 by VWOA's President, William J. McGonigle, for the association. Mr. David Sarnoff, President of the Radio Corporation of America, was the second subscriber with a contribution of $1000.00. Mr. Alfred J. McCosker, President of Radio Station WOR and Chairman of the Board of the Mutual Broadcasting System, was the third contributor.

In general the Fund will be solicited from organizations engaged in the radio field: communications, manufacturing, amateurs, etc., and their employees—the people most likely to know of his outstanding achievements and desirous of participating, by contribution, in the erection of a "living tribute" to this truly great man.

A committee composed of outstanding men in the radio field will be appointed to pass upon a suitable design and site for the monument. Designs will be solicited from prominent American sculptors. Mr. Sarnoff has expressed his willingness to head this committee.

Contributions and communications should be mailed to the Marconi Memorial Fund, Veteran Wireless Operators Association, RCA Building, 30 Rockefeller Plaza, New York City.

NEW PRODUCTS

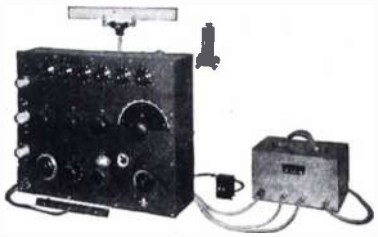
THE RESONOSCOPE

The resonoscope is new electronic instrument developed by the Allen B. DuMont Laboratories of Upper Montclair, N. J., and distributed by Epiphone, Inc., 142 W. 14th St., New York City. It comprises a special cathode-ray oscillograph used in conjunction with a standard set of musical frequencies representing the twelve notes of the chromatic musical scale. These standard frequencies, produced by twelve electrically-driven tuning forks, are utilized to synchronize an oscillator in step with them. The oscillator is employed to provide a horizontal sweep circuit for the cathode-ray tube.

Meanwhile, a voltage amplifier is employed to pick up the music of any single musical tone by means of a sensitive microphone. The amplifier output is placed on the vertical plates of the cathode-ray tube. This provides a visual image of the waveform of the musical note under observation. If that musical note is of the same pitch or frequency as the standard being used, or any harmonic of same, the waveform will appear to stand still on the screen. If the note is flat or lower in pitch than the horizontal sweep standard, the waveform will appear to be moving to the left. If higher in pitch or sharp, it will move to the right. The speed with which the waveform moves across the screen is a direct indication of the extent to which the instrument or voice is off pitch.

Any of the twelve standard frequencies in the resonoscope may be selected one at a time by the turn of a control knob on the front panel. The positions are marked C, C♯, D, D♯ and so on. These twelve frequencies represent the twelve notes of the chromatic scale.

The resonoscope permits tuning to within a small part of a cycle. Its tuning forks are tuned to an accuracy of 0.002%. It facilitates the tuning of such musical instruments as pianos, accordion reeds, harmonic reeds, organs and so on, not only for fundamental notes but for all octaves.



MODIFIED SCHERING BRIDGE

For the purpose of determining the characteristics of samples of both liquid and solid dielectrics, the Leeds & Northrup Company has developed a modified form of Schering bridge in which convenience, safety and accuracy are considerably enhanced. High voltage is applied only to the test sample and to the standard air capacitor. All adjustable elements being confined within a grounded shield, the operator is fully protected and accuracy is assured. The guard rings of the standard capacitor and of the sample are brought to the proper potential by merely connecting them to the grounded shield.

A method of compensation for residual capacitance is used which enables results to be calculated from simple equations. In the case of low power factors, the result is read directly. Capacitances ranging from 40 mmf to 0.020 mf and power factors from 0.0001 to 0.70 can be accurately determined.

The bridge is intended for use on 60 cycle circuits and the standard air capacitor and sample holders listed are rated at 10 K. V. Apparatus for other voltages and frequencies can be supplied.

For further details, ask for Catalog E-54 (2) from Leeds & Northrup Company, 4934 Stenton Avenue, Philadelphia, Pennsylvania.

— RE —

ARCTURUS 5W4G TUBE

Arcturus Radio Tube Company, Newark, New Jersey, announces a new 5W4G rectifier for use in a-c receivers. The electrical characteristics of this new Arcturus 5W4G remain unchanged, but the mechanical construction has been altered after considerable investigation and collaboration with several leading set manufacturers.

This change enables a set manufacturer to utilize any chassis arrangement with respect to the rectifier tube and r-f coils. Exhaustive tests in the laboratories of set manufacturers disclosed a general tendency of 5W4G's, when placed next to an r-f coil, to cause noise in the receiver when the tube was vibrated ever so slightly. The new Arcturus construction is said to eliminate this noise regardless of vibration or the positiion of the r-f coil and results in quiet set operation.

IRC POWER CONTROL

An IRC Metallized Type Power Control, capable of carrying 2 watts, for plate circuit tone control and other similar applications, is a new development being featured by the International Resistance Company, 401 North Broad Street, Philadelphia, Penna.

This is known as the IRC Type C P Control. It incorporates all of the features and characteristics of the Type C Control, including the Metallized type resistance element permanently bonded to a moisture-proof bakelite base, 5-finger contact, etc. Rapid heat conduction from element to cover and shaft assembly is said to be obtained. This makes possible the conservative 2 watt rating as compared to the ½-watt rating of standard IRC Type C Controls. The size is the same as that of the latter, being unusually small for a power control of this rating.

Complete specifications will be sent upon request.

— RE —

CONVERTER TEST OSCILLATOR

In view of the need for some criterion of the performance of the oscillator sections of converter tubes of the A7 type, the Converter Test Oscillator has been developed and made available by Boonton Radio Corporation, Boonton, N. J. This instrument, proposed by the RMA Committee on Vacuum Tubes as the standard for testing such tubes, is primarily intended to be used in conjunction with the typical tube bridge normally a part of the modern radio laboratory equipment. It may, however, be operated as an independent setup when connected to the essential batteries and meters. A radio receiver supplying the necessary voltages may also be used as a power supply. Three tube sockets are available, allowing measurements of six, seven and eight-prong tubes. It is also possible with appropriate adaptors to make oscillation checks of triodes, tetrodes or pentodes on this instrument.

— RE —

MICAMOLD POWER RESISTORS

Micamold has recently announced a complete line of Cement Coated Resistors in ratings from 10 watts to 100 watts. The standard line is of conventional construction and dimensions. They are listed in both the fixed and variable types with sliders and brackets. Special types can be supplied to manufacturers' specifications. The cement coating is processed in live steam so that the resistor is proofed against humidity. The resistance wire used has a low temperature coefficient and it is hard soldered to the lugs so that no open or noisy connection can develop at this point.

Complete specifications may be obtained from Micamold Radio Corp., 1087 Flushing Ave., Brooklyn, N. Y.

NEW RADIO CABINET MATERIAL ANNOUNCED

General Plastics, Inc., North Tonawanda, N. Y., announce a new Durez molding material especially developed for radio cabinets and other large housings where appearance is important. It is called Durez 113 Black and is being used on several of the latest plastic cabinets now in production. Feature of the new material is said to be the deep rich black color obtained, the long draws possible and the smooth lustre. It is also said to permit hard buffing without danger of showing filler-spots.

— RE —

ATR INVERTERS

American Television & Radio Company, St. Paul, Minnesota, announces a complete new line of dc-ac inverters consisting of more than 32 different types for operation on d-c input voltages from 6 to 220 volts and having a-c output of 110-220 volts at various capacities. The new ATR line of Inverters utilizes advanced circuits and new vibrator designs having eight ¼" diameter tungsten contacts mounted on a dual arm arrangement. More complete information may be obtained by writing manufacturer.

— RE —

SINE CURVE PLOTTER

The A. Lietz Company, 913 S. Grand Ave., Los Angeles, California, announce manufacture of a new instrument, the Sine Curve Plotter, which should prove indispensable to electrical engineers. The plotter is simply a chart engraved on a 10"—45° drafting triangle. A sine or cosine curve of any percentage amplitude is plotted in a few seconds by merely moving the triangle to successive points on the curve axis and placing dots at the appropriate edge-graduations. All time consuming construction lines associated with the conventional graphical method are eliminated. Inasmuch as the Plotter chart is incorporated in a high quality drafting triangle, an instrument of double utility results.

— RE —

RCA TUBES

RCA Manufacturing Co., Inc., are making available through their transmitting-tube distributors three new tubes as follows: RCA-1608, r-f power amplifier, oscillator, Class B modulator; RCA-1609, amplifier pentode (low microphonic design); RCA-1610, crystal-oscillator pentode.

The 1608 is a transmitting triode designed to give relatively high power output at low plate voltage. In r-f service, it may be operated at maximum ratings at frequencies as high as 45 megacycles. The maximum plate input for the 1608 is 40 watts and the maximum plate dissipation is 20 watts—both for Class C telegraph service.

The 1609 is a pentode for use as an a-f amplifier in applications critical as to microphonics. As such, it is capable of providing high gain per stage with remarkable freedom from microphonic disturbances. It is designed to have the same filament rating as the low-microphonic triode 864.

The 1610 is a pentode intended for service as a crystal-oscillator and frequency doubler. It has a maximum plate input of 9 watts and a maximum plate dissipation of 6 watts.

OPERADIO MOBILE P-A SYSTEM

The model 132-BAC, 25-watt p-a system uses beam power tubes; has provision for mixing microphone and phonograph inputs; can be used with low-output microphones; includes crystal hand microphone and two 12-inch pm dynamic speakers and has provision for either 6-volt or 110-volt operation.

This combination mobile p-a system has been designed to give the sound man a unit compact and ready to go in almost every instance where a temporary installation is required. It may be used for 110-volt a-c or 6-volt d-c by interchange of packs. By the removal of two thumb screws and a face plate, one pack is slid out of the unit and the other which is carried in an extra carrying case is slipped into place, the face plate returned, the screws tightened and the equipment is ready to go.

Additional information may be obtained from Operadio Mfg. Co., St. Charles, Ill.

— RE —

AUDAX CUTTER

The Audax professional 10-A cutter, engineered and manufactured by Audak

Company, 500 Fifth Avenue, New York, has been recently introduced to the industry. This cutter is available in any impedance up to 500 ohms. Audax 10-A will record maximum sound level on nitrocellulose records with an input of about 18 to 20 db.

— RE —

SYLVALOY FOR OXIDE-COATED FILAMENTS

A new manganese-free silicon-nickel named Sylvaloy is now being supplied to tube manufacturers by the Wilbur B. Driver Company of Newark, N. J. Minimizing chipping and flaking of the coating, this alloy is said to be proving very popular for oxide-coated filament tubes particularly the 80 type rectifiers. The new alloy also permits operation at lower temperature, thereby contributing to the life of tubes.

— RE —

NEW MODEL SPEEDCRAFT WIRE STRIPPER

In line with its plan of motorizing every possible wire stripping operation—operations than can be done profitably on a production basis—The Wire Stripper Co., E. Cleveland, Ohio, announces its new Speedcraft Continuous Operation Stripper.

This machine is a high speed stripper designed for handling short strips of about ⅛" on a single and multi conductor rubber covered wire.

The operation of the machine is continuous—2,000 operations per hour are possible on some types of wire. The operator is free to devote his entire attention to handling the wire as no foot pedal is required. A finger guard protects fingers from the knives.

— RE —

"ROTO-RANGER"

A high-sensitivity set tester has recently been announced by Simpson Electric Company which incorporates the basic mechanism found in a number of set analyzers and tube testers produced by this company. This mechanism, known by the trade-name, "Roto-Ranger," consists of a rotating drum (containing twelve independent scales) which is geared to a twelve-position range selector switch so that the proper scale automatically comes into view to correspond with the position assumed by the switch.

The purpose of the arrangement is to eliminate the multiple scale, to avoid cramped calibrations, and to obviate the necessity for multiplying and dividing when making readings. The manufacturer reports that this new model was brought out because the convenience of the rotary dial had met with so much acceptance in other models that it was decided to project it into a high-sensitivity analyzer.

This new model has a resistance of 10,000 ohms per volt d-c. Its current draw of 100 microamperes is said to be low enough to assure extremely accurate measurements of automatic frequency control, diode balancing circuits, grid currents of oscillator tubes, power tubes, bias of power detectors and a wide range of unusual conditions that cannot be checked by conventional servicing instruments. D-c scales in the new model read 0-10-50-300-1000 volts. A-c scales read 0-8-150-1000 (at 1000 ohms per volt). Resistance ranges are 0-2,000-200,000 ohms—20 megohms. Current readings are 0-10-100-500 milliamperes and 0-100 microamperes. A new bulletin describing the tester (Model 275) has been issued, which can be had by writing to Simpson Electric Co., 5216 W. Kinzie St., Chicago.

— RE —

UNIVERSAL MICROPHONE

On July 1 the Universal Microphone Company, Inglewood, Calif., placed its new dynamic microphone on the market. This unit is self-energizing, with no polarizing voltage or button current needed. The instrument is said to be unaffected by heat or moisture and to have no hum pickup. The frequency response is good from 40 to 8,000 cycles per second. It is available in the following impedances: 33, 50, 200 and 500 ohms. Complete information may be obtained from the above organization.

RADIO ENGINEERING BUYER's GUIDE

A continuous, indexed recording of the reliable sources of supply of

Materials—Component Parts

BASES, VACUUM TUBE

AMERICAN LAVA CORP., Chattanooga, Tenn.
American Phenolic Corp.
ISOLANTITE, INC., 233 Broadway, N. Y. C.
Kurz-Kasch Co.
RCA MFG. COMPANY, INC., Camden, N. J.

BRASS—COPPER

AMERICAN BRASS CO., THE, Waterbury, Conn.
ANACONDA COPPER CO., 25 Broadway, N. Y. C.
Baltimore Brass Co.
Bristol Brass Corp.
Ryerson & Son, Inc.
Scoville Mfg. Co.
WATERBURY BRASS GOODS BR., Waterbury, Conn.

CABINETS—WOOD

Adler Mfg. Co.
Alden Corp
Caswell-Runyan Co.
GUTHMAN & CO., INC., 1036 W Van Buren St., Chicago, Ill
Peerless Cabinet Co.
Superior Cabinet Corp.

CATHODES (See Tubing, Seamless Cathode)

CATHODE RAY—TUBES

DUMONT LABORATORIES, ALLEN B., 542 Valley Rd., Upper Montclair, N. J.
General Electric Co
HYGRADE-SYLVANIA CORP., Clifton, N. J.
RCA MANUFACTURING CO., INC., Camden, N. J.
WESTERN ELEC. CO., 195 Broadway, N. Y. C.
Westinghouse Elec. & Mfg. Co.

CERAMICS

AMERICAN INSULATOR CORP., New Freedom, Pa.
AMERICAN LAVA CORP., Chattanooga Tenn.
CROWLEY & CO., INC., H. L., W. Orange, N. J.
ISOLANTITE, INC., 233 Broadway, N. Y. C.
Kirchberger & Co., Inc., M
Mycalex Corp. of Amer
STUPAKOFF LABORATORIES, INC., 6627 Hamilton Ave., Pittsburgh, Pa.
Tenne see Eastman Co

CHOKES

ACME ELECTRIC & MFG. CO., 1440 Hamilton Ave., Cleveland Ohio
AMERICAN TRANSFORMER CO., 175 Emmet St., Newark, N. J.
General Transformer Co.
HAMMARLUND MFG. CO., 424 W. 33rd St., N. Y. C.
Kenyon Transformer Co., Inc.
UNITED TRANS. CORP., 72-74 Spring St N Y C.

COIL MACHINERY

UNIVERSAL WINDING CO., Providence, R. I.

COILS—POWER

ACME WIRE COMPANY, 1255 Dixwell Avenue, New Haven, Conn.
ANACONDA WIRE & CABLE CO., 20 N. Wacker Dr., Chi., Ill.
American Enameled Magnet Wire Co.
Belden Manufacturing Co.

COILS—RADIO RECEIVER

ALADDIN RADIO INDUSTRIES, INC., 466 W. Superior St., Chicago, Ill.
Alden Products Co.
Automatic Winding Co
FERROCART CORP. OF AMER., Hastings on Hudson, N. Y.
General Mfg. Co.
GUTHMAN & CO., INC., Edwin L., 1036 W. Van Buren St., Chicago, Ill
HAMMARLUND MFG. CO., 424 W. 33rd St., N. Y. C.
MEISSNER MFG. CO., Mt. Carmel, Ill
Norwalk Engineering Corp.
Sickles Company

COILS—SPEAKER

ACME ELECTRIC & MFG. CO., 1440 Hamilton Ave., Cleveland, Ohio
AMERICAN TRANSFORMER CO., 175 Emmet St., Newark, N. J.
ANACONDA WIRE & CABLE CO., Muskegon, Mich.
Chicago Transformer Corp.
Dongan Electric Mfg. Co.
GENERAL TRANSFORMER CORP., 502 S. Throop St., Chicago, Ill.
HALLDORSON COMPANY, 4500 Ravenswood Ave., Chicago, Ill.
JEFFERSON ELECTRIC COMPANY, Bellwood, Ill.
RCA MANUFACTURING CO., INC., Camden, N. J.
STANDARD TRANSFORMER CORP., 854 Blackhawk Street, Chicago, Ill.
THORDARSON ELEC. MFG. CO., 500 W. Huron St., Chicago, Ill
UNITED TRANS. CORP., 72-74 Spring St., N. Y. C.

CONDENSERS, FIXED PAPER

ACME WIRE COMPANY, 1255 Dixwell Ave., New Haven, Conn.
AEROVOX CORP., 90 Washington St., Brooklyn, N. Y.
CORNELL-DUBILIER CORP., S. Plainfield, N. J.
CURTIS CONDS. CORP., 3038 W. 106th St., Cleve., O.
DUMONT ELECTRIC CO., 514 Bway, New York.
ELECTRONIC LABORATORIES, INC., Indianapolis, Ind.
Magnavox Co., Ltd.
MALLORY & CO., P. R., Indianapolis, Indiana
MICAMOLD RADIO CORP., Brooklyn, N. Y.
SOLAR MFG. CORP., 599-601 Broadway, N. Y. C.
SPRAGUE SPECIALTIES CO., North Adams, Mass.
TOBE DEUTSCHMANN CORP., Canton, Mass.

CONDENSERS, FIXED ELECTROLYTIC

AEROVOX CORP., 90 Washington St., Brooklyn, N. Y.
CORNELL-DUBILIER CORP., S. Plainfield, N. J.
CROWLEY & CO., INC., H. L., W. Orange, N. J.
CURTIS CONDENSER CORP., 3038 W. 106th St., Cleveland, Ohio
DUMONT ELECTRIC CO., 514 Bway, New York
Magnavox Co., Ltd.
MALLORY & CO., P. R., Indianapolis, Indiana
MICAMOLD RADIO CORP., Brooklyn, N. Y.
SOLAR MFG. CORP., 599-601 Broadway, N. Y. C.
SPRAGUE SPECIALTIES CO., North Adams, Mass.

CONDENSERS, ADJUSTABLE

HAMMARLUND MFG. CO., 424 W. 33rd St., N. Y. C.
MEISSNER MFG. CO., Mt. Carmel, Ill.
SOLAR MFG. CORP., 599-601 Broadway, N. Y. C.
TOBE DEUTSCHMANN CORP., Canton, Mass.

CONDENSERS, VARIABLE

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General Instrument Co.
GENERAL RADIO CO., 30 State St., Cambridge, Mass.
HAMMARLUND MFG. CO., 424 W. 33rd St., N. Y. C.
OAK MFG. CO., 711 W. Lake Street, Chicago, Ill.
Precise Mfg. Co.

CONTACTS, METAL

Baker & Co., Inc.
CALLITE PRODUCTS CO., 542 39th St., Union City, N. J
General Tungsten Mfg. Co.
MALLORY & CO., P. R., Indianapolis, Indiana
Wilson Co., H. A.

CORES, RESISTANCE COIL

AMERICAN LAVA CORP., Chattanooga, Tenn.
Colonial Insulator Co
CROWLEY & CO., INC., H. L., W. Orange, N. J.
ISOLANTITE, INC., 233 Broadway, N. Y. C.
Steward Mfg. Co.

CORES, TRANSFORMER

THOMAS & SKINNER STEEL PRODS. CO., 1100-1120 E. 23rd St., Indianapolis, Indiana

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BLILEY ELECTRIC CO., 237 Union Station Bldg., Erie, Pa.
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BRUSH DEVELOPMENT CO., E. 40th St. & Perkins Ave., Cleveland, Ohio
RCA MANUFACTURING CO., INC., Camden, N. J.
SCIENTIFIC RADIO SERVICE, University Pk., Hyattsville, Md.

DIALS, ESCUTCHEONS

CROWE NAMEPLATE CO., Chicago, Ill.
GENERAL RADIO CO., Cambridge, Mass.
Magnavox Company, The

ELECTRODES, NEON

EISLER ELECTRIC CORP., Union City, N. J.
EISLER ENGINEERING CO., INC., Newark, N. J.
SWEDISH IRON & STEEL CORP., 17 Battery Pl., N. Y. C.

EYELETS

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United Shoe Mach. Co.
WATERBURY BRASS GOODS BR., Waterbury, Conn.

FIBRE (See Insulation, Laminated)

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Fischer Spring Company, Chas.
White Dental Mfg. Co., S. S.

FUSES

LITTELFUSE LABS., 4244 Lincoln Ave., Chicago, Ill.

GENERATORS

Carter Motor Company
ELECTRONIC LABORATORIES, INC., 122 W. New York St., Indianapolis, Ind.
MALLORY & CO., P. R., Indianapolis, Indiana
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FOX SOUND EQUIP. CORP., 3120 Monroe St., Toledo, Ohio
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WRIGHT-DECOSTER, INC., 2253 University Ave., St. Paul, Minn.

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FERRANTI ELECTRIC, INC., 30 Rockefeller Plaza, N. Y. C.
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GENERAL RADIO COMPANY, Cambridge, Mass.
HICKOK ELEC. INSTRU. CO., Cleveland, O.
RCA MFG. CO., INC., Camden, N. J.
READRITE METER WORKS, Bluffton, Ohio
SIMPSON ELEC. CO., 5218 W. Kinzie St., Chicago, Ill.
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TRIUMPH MFG. CO., 4017 W. Lake St., Chicago, Ill.
WESTERN ELECTRIC CO., 195 Broadway, N. Y. C.
WESTON ELEC. INSTRU. CORP., Newark, N. J.

INSULATION, CERAMICS (See Ceramics)

INSULATION COMPOUNDS

MAAS & WALOSTEIN, 438 Riverside Ave., Newark, N. J.
MICA INSULATOR CO., 200 Varick St., N. Y. C.
STUPAKOFF LABS., INC., 6627 Hamilton Ave., Pgh., Pa
ZOPHAR MILLS, INC., 120 26th St., Brooklyn, N. Y.

INSULATION, FABRIC TUBING

ACME WIRE CO., 1255 Dixwell Ave., New Haven, Conn.
Bentley Harris Mfg. Co.
BRAND & CO., WM., 276 Fourth Ave., N. Y. C.
Glenn & Co., J. J
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MICA INSULATOR CO., 200 Varick St., N. Y. C.
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TRIUMPH MFG. CO., 4017 W. Lake St., Chicago, Ill.
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WESTON ELEC. INSTRU. CORP., 612 Frelinghuysen Ave., Newark, N. J.

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ELECTRO-METALS, INC., 1880 E. 40 St., Cleveland, O.
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General Plate Co.
Goat Radio Tube Parts, Inc.
King Laboratories, Inc.
NEWARK WIRE CLOTH CO., Newark, N. J.
SUMMERILL TUBING COMPANY, Bridgeport, Penna.
SUPERIOR TUBE COMPANY, Norristown, Penna.

PAPER TUBES

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RCA MFG. COMPANY, INC., Camden, N. J.
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PLASTICS (See Insulation, Molded)

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POINTS, CONTACT

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MALLORY & CO., INC., P. R., Indianapolis, Ind.

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Guardian Electric Co.
Heinemann Electric Co., Trenton, N. J.
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Ohio Carbon Co.
OHMITE MFG. CO., 4835 Flournoy St., Chicago, Ill.
STACKPOLE CARBON CO., St. Marys, Pa.
SOLAR MFG. CO., 599-601 Broadway, N. Y. C.
UTAH RADIO PRODS. CO., Chicago, Ill.
WARD LEONARD ELEC. CO., 33 South St., Mt. Vernon, N. Y.
White Dental Mfg. Co., S. S.

RESISTORS, WIRE WOUND

AEROVOX CORP., 90 Washington St., Brooklyn, N. Y.
CLAROSTAT MFG. CO., INC., 287 N. 6th St., Brooklyn, N. Y.
ELECTRAD, INC., 175 Varick St., N. Y. C.
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OPERADIO MFG. CO., 13th and Indiana St., St. Charles, Ill.
OXFORD-TARTAK RADIO CORP., 915 W. Van Buren St., Chicago.
RCA MFG. COMPANY, INC., Camden, N. J.
RACON ELEC. CO., INC., 52 E. 19th St., N. Y. C.
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WESTERN ELECTRIC CO., 195 Broadway, N. Y. C.
WRIGHT-DE COSTER, INC., 2253 University St., St. Paul, Minn.

STEEL

AMERICAN ROLLING MILL CO., Middletown, Ohio
American Steel & Wire Co.
SWEDISH IRON & STEEL CORP., 17 Battery Pl., N. Y. C.

SVEA METAL

SWEDISH IRON & STEEL CORP., 17 Battery Pl., N. Y. C.

TAPE, VARNISHED FABRIC

ACME WIRE CO., 1255 Dixwell Ave., New Haven, Conn.
BRAND CO., WILLIAM, 276 Fourth Ave., N. Y. C.
CRESCENT INSULATED WIRE & CABLE CO., Trenton, N. J.

TRANSFORMERS (Also see Chokes)

ACME ELEC. & MFG. CO., THE, 1440 Hamilton Ave., Cleveland, Ohio
AMERICAN TRANS. CO., 175 Emmet St., Newark, N. J.
Chicago Transformer Co.
FERRANTI ELECTRIC, INC., 30 Rockefeller Plaza, N. Y. C.
GENERAL TRANS. CORP., 502 S. Throop St., Chi., Ill.
HALLDORSON COMPANY, THE, 4500 Ravenswood Ave., Chicago, Ill.
JEFFERSON ELECTRIC CO., Bellwood, Illinois
RCA MFG. COMPANY, INC., Camden, N. J.
STANDARD TRANS. CORP., 856 Blackhawk St., Chi., Ill.
THORDARSON ELEC. MFG. CO., 500 W. Huron St., Chicago, Ill.
UNITED TRANS. CORP., 72-74 Spring St., N. Y. C.

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EISLER ENGINEERING CO., 740 S. 13th St., Newark, N. J.
ELECTRONICS MACHINE CO., 742 S. 13th St., Newark, N. J.
KAHLE ENGINEERING CORP., 941 De Motte St., N. Bergen, N. J.
LEPEL HIGH FREQUENCY LABS., 39 W. 60th St., N. Y. C.

TUBING, SEAMLESS CATHODE

General Plate Company
SUMMERILL TUBING COMPANY, Bridgeport, Pa.
SUPERIOR TUBE COMPANY, Norristown, Pa.

TUNGSTEN—MOLYBDENUM

CALLITE PRODS. CO., 542 39th St., Union City, N. J.
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Fansteel Metalurgical Labs.

VIBRATORS (See Relays)

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SHAKEPROOF LOCK WASHER CO., 2501 N. Keeler Ave., Chicago, Ill.
Thompson-Bremer Corp.
WROUGHT WASHER MANUFACTURING CO., 2263 S. Bay St., Milwaukee, Wis.

WAXES (See Insulation, Compounds)

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ANACONDA WIRE & CABLE CO., 25 Bway., N. Y. C.
Belden Mfg. Co.
CALLITE PRODS. CO., 542 39th St., Union City, N. J.
CORNISH WIRE COMPANY, 30 Church St., N. Y. C.
CRESCENT INSULATED WIRE & CABLE CO., Trenton, N. J.
General Cable Corp.
HOLYOKE COMPANY, INC., THE, Holyoke, Mass.
Hoskins Mfg. Co.
LENZ ELEC. MFG. CO., 1751 N. Western Ave., Chi., Ill.
Roebling's Sons Co., John A.

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CORNISH WIRE COMPANY, 30 Church St., N. Y. C.
General Cable Corp.
Roebling's Sons Co., John A.

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DRIVER CO., WILBUR B., 150 Riverside Ave., Newark, N. J.
Driver-Harris Co.
NEWARK WIRE CLOTH CO., Newark, N. J.
Prentiss & Co., Geo. W.
SWEDISH IRON & STEEL CORP., 17 Battery Pl., N. Y. C.

WIRE, INSULATED

ACME WIRE COMPANY, 1255 Dixwell Ave., New Haven, Conn.
American Braiding Company
American Enameled Magnet Wire Co.
American Steel & Wire Co.
ANACONDA WIRE & CABLE CO., 25 Bway., N. Y. C.
Belden Mfg. Co.
CORNISH WIRE COMPANY, 30 Church St., N. Y. C.
CRESCENT INSULATED WIRE & CABLE CO., Trenton, N. J.
General Cable Corp.
GENERAL ELECTRIC COMPANY, Schenectady, N. Y.
HOLYOKE COMPANY, INC., THE, Holyoke, Mass.
LENZ ELEC. MFG. CO., 1751 N. Western Ave., Chi., Ill.
Rockbestos Products Corp.
Roebling's Sons Co., John A.

WIRE, MAGNET AND LITZ

ACME WIRE COMPANY, 1255 Dixwell Ave., New Haven, Conn.
American Braiding Co.
American Enameled Magnet Wire Co.
American Steel & Wire Co.
ANACONDA WIRE & CABLE CO., 20 N. Wacker Dr., Chi., Ill.
Belden Mfg. Co.
CRESCENT INSULATED WIRE & CABLE CO., Trenton, N. J.
General Cable Corp.
GENERAL ELECTRIC COMPANY, Schenectady, N. Y.
HOLYOKE COMPANY, INC., THE, Holyoke, Mass.
Roebling's Sons Co., John A.

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AMERICAN ELECTRO METAL CORP., Lewiston, Maine
CALLITE PRODS. CO., 542 39th St., Union City, N. J.
Cleveland Wire Cloth & Mfg. Co.
DRIVER CO., WILBUR B., 150 Riverside Ave., Newark, N. J.
Driver-Harris Company
Fansteel Metallurgical Labs.
HOLYOKE COMPANY, INC., THE, Holyoke, Mass.
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