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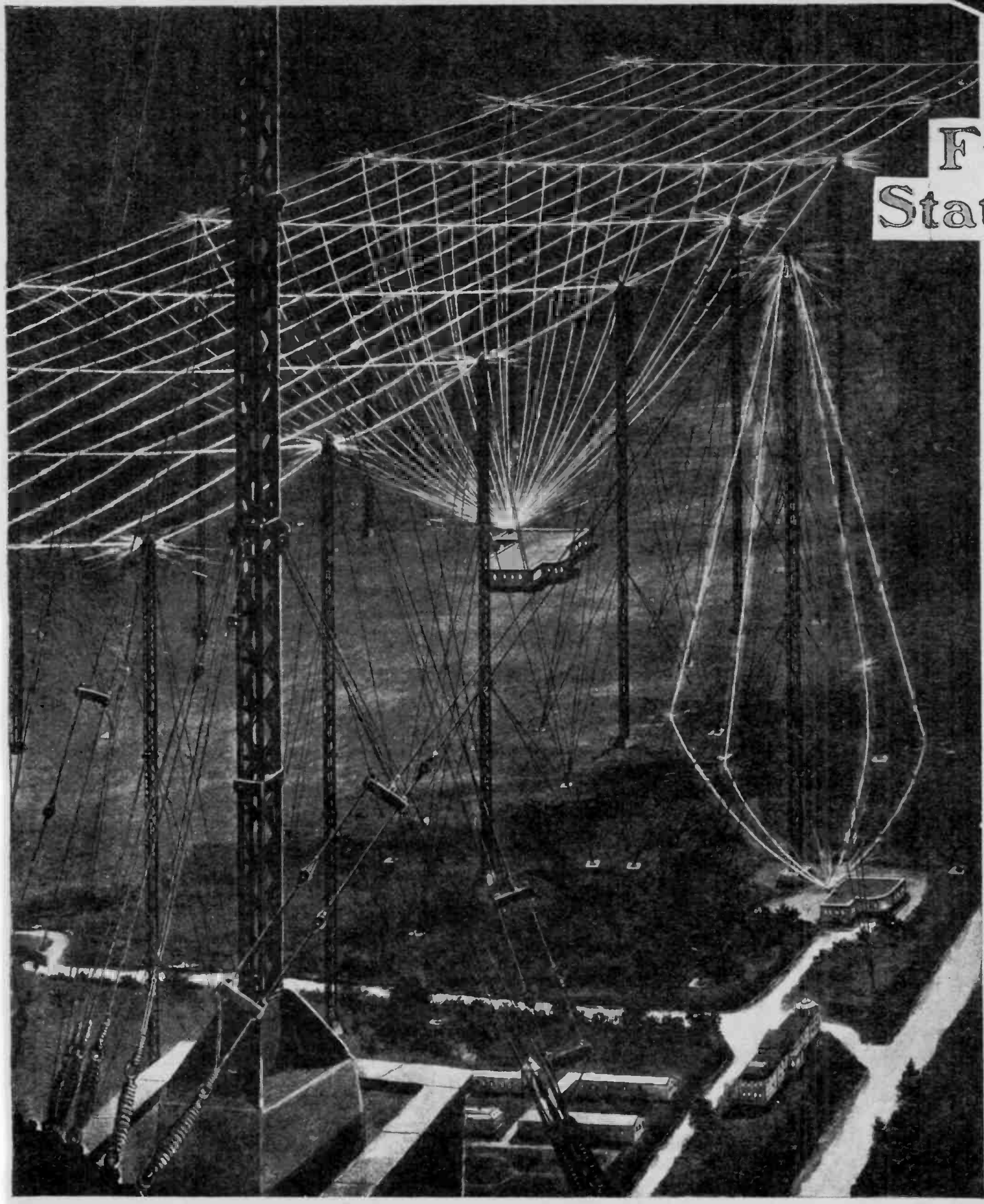
THE HORN SPEAKER

May the joys of this season be yours



In France, at Sainte-Assise, Near Melun, What is Claimed to be the Most Powerful Radio Station in the World Has Been Erected. In Its Transatlantic Antennae it Can Develop One Thousand Kilowatts of Electric Power, Which is About 1,500 Horse-Power. This is Over Three Times the Power of the Famous Nauen Station. It Can Communicate With South America and Asia. The Masts Are 250 Meters High, a Little Over 800 Feet; When in Shape and Complete the Station Will be Able to Transmit Nearly Two Million Words in 24 Hours. To Obtain an Idea of This Figure the Reader Must Know That the Maximum Output of the France-South America Cable is 5,000 Words a Day and That All the Cables Between France and North America Can Only Transmit 18,000 Words a Day. The Effect of the Limited Capacity of the Cables is to Interfere With and to Delay Messages. This Great New Installation it is Hoped Will Remedy These Troubles When it Has Attained Its Full Capacity and When the Last Details of Construction Have Been Attended to. Our Illustration Gives a Good Idea of This Triumph of French Engineering, and in Seeing it and Knowing What it Can do, it Makes One Feel as if the Days of the Submarine Cable Were Indeed Numbered. When Hertz Astonished the World With His Minute Spark, Produced by Electric Excitation at a Distance of a Few Yards and Which Excitation Had Penetrated a Stone Wall, and When Branley Developed His Sluggish Coherer, Which Was Decohered by Mechanical Tapping, and When the Directors of One of the Cable Companies Objected to Marconi's Experiments in Transatlantic Cable Work Being Carried Out on One of the Islands of the Canadian Provinces, Because They Thought it Interfered With Their Cable Monopoly, No One Could Have Foreseen That the Hertz Experiments Would Have Been Forgotten, and That Soon Radio People Would Hardly Remember What a Coherer is, and That Such a Giant Station as the One We Describe Would Bid Fair to Relegate the Transatlantic Cables to a Position of Threatened Insignificance. This View Shows the Antenna at Night All Aglow With Its Brush-Like Discharges.

French Radio Station at Night

The power rating of the 1922 French radio station at Sainte-Assie is impressive to say the least, comparing it to WLW's power of 500 KW in 1938. Moreover, think about the reputation of the borderblaster XERA in 1938 broadcasting from Mexico. XERA was a directional "big gun" station that burned the air with radio frequency explosions that contained sales talks, which sold quick cure medical remedies that were illegal in the United States.

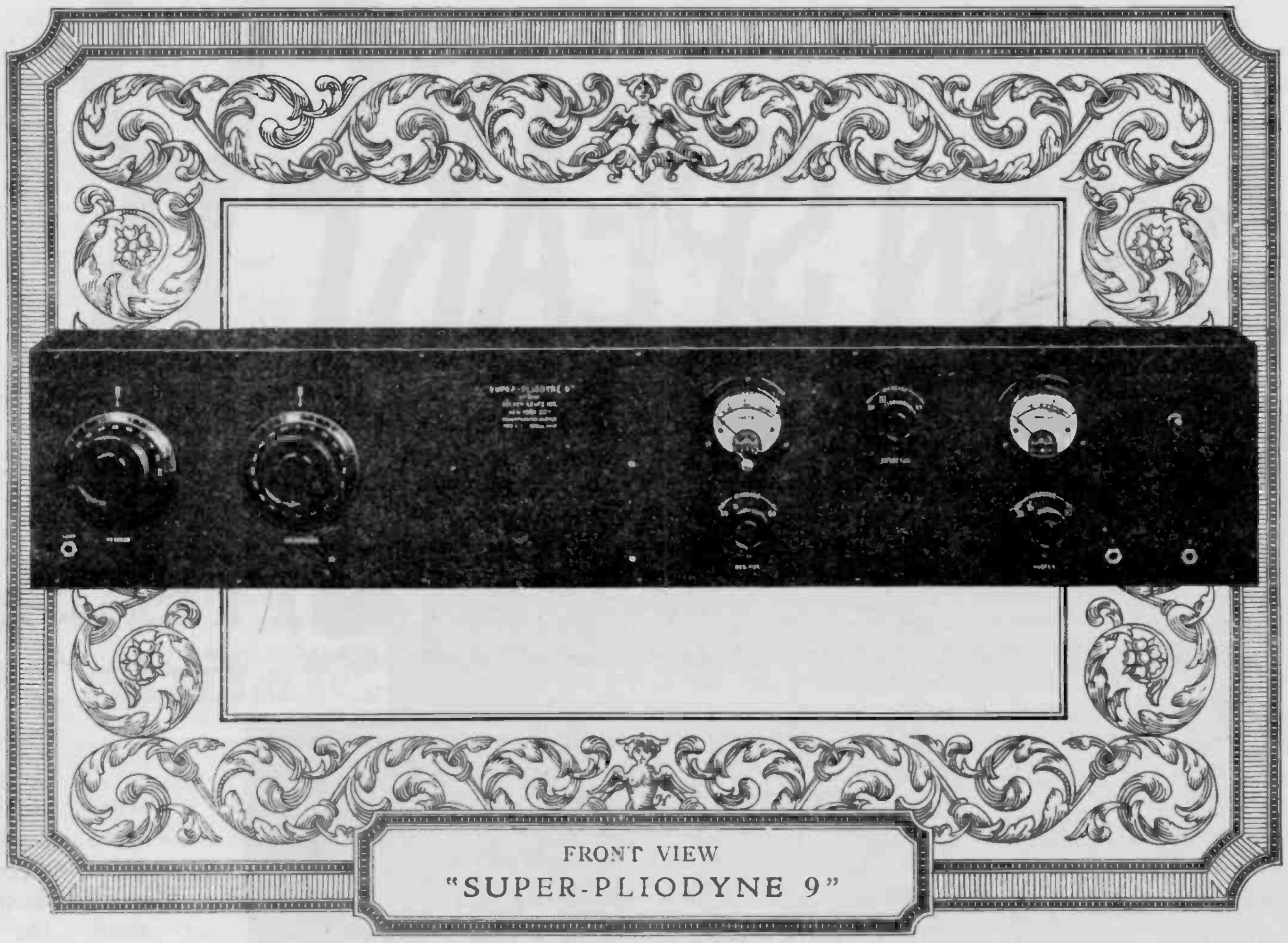
Doctor Brinkley, whose biography THE ROUGISH WORLD OF DOCTOR BRINKLEY by Gerald Carson is a work of "how someone got away with it," was a patron of borderblaster engineers like Bill Branch, Jim Weldon and Nestor Questa. These radio men could manipulate a mean 850 kilowatts of goat gland cures to middle age men willing to buy anything for a cure.

In the article, "Superpowers and Borderblasters, John D. Price wrote that Jim Weldon, president of Continental Electronics in Dallas said... But wait here is the quote from Price's story in B.P.&P.....

When asked the true power of post 1938 XERA, Jim Weldon is quick to say "five hundred kilowatts." Almost too quick. Records from the time show XERA's authorization to be for 850 kw, and it is impossible to assume that Doctor would be content with anything less than the most.

Perhaps the answer lies in the strange antenna which the station used (*see BP&P, May/June, 1979*). It is quite possible that the reflector element behind the main longwire made the effective radiated power a full 850 kw to the north. In any case, Weldon, Nestor Questa and the engineering crew had done their job well. Doctor could snuggle up to the radio of any infirm American from Florida to California, not to mention Devil's Lake, North Dakota.

Science and Invention, July 1922



FRONT VIEW
"SUPER-PLIODYNE 9"

Fig. 157

PLIODYNE RECEIVERS

The standard Neutrodyne Receiver gives two stages of Tuned Radio Frequency Amplification, Detector and Two Stages of Audio Frequency Amplification, a total of five tubes. In some models only four tubes are used, the last audio stage being reflexed on the first radio frequency amplifier tube. During the 1923 Fall season this was the most popular method of reception, the sales of Neutrodynes probably exceeding any other type of receiver. There are three dials to tune the two stages of amplification and this is the outstanding disadvantage as an operator only has two hands, and the three dials must be moved proportionally to change from one wavelength to another. The Radio Frequency Amplifier is balanced by the capacity neutralizing method and this method does not neutralize completely enough to allow over two stages of amplification to be employed without making extensive shielding provisions. Furthermore the balance is very critical and if not properly adjusted the receiver will oscillate, particularly at the low end of the wavelength scale. This is not really a disadvantage as it actually adds regenerative amplification to the radio frequency amplifier, equivalent to adding one or two stages of further amplification. The oscillations, when existing do however cause radiation and the necessity of tuning to the zero beat method. The selectivity of the Neutrodyne is not anywhere as sharp as the selectivity obtainable when using Amplifying Transformers having an independent grid winding, as will be described further on.

The Pliodyne method of neutralizing or nullifying tube capacities is the invention of C. L. Farrand, former Chief Designer of the Marconi Wireless Telegraph Co. of America. (Fig. 163.)

The Pliodyne 6 was designed by the writer with the engineering cooperation of Mr. Farrand and is manufactured by Golden-Leutz, Inc., under Farrand and Hogan Licenses. This receiver is such an ideal instrument and its popularity is proving so great that the details are given in full and should prove very interesting to students of radio reception. There are two stages of non-regenerative Radio Frequency Amplification, Detector and three stages of Audio Frequency Amplification. The disadvantage of three dials is eliminated by tuning two amplifying transformers simultaneously through the medium of two separate condensers mounted on a single shaft. This feature is covered by Hogan Patent No. 1,014,002 and the manufacturers are licensed under this patent.

It would not be possible to use the two condensers, situated so close to each other without shielding them electrically from each other. This feature of condenser shielding is covered by another Patent application of Farrands.

The "Super-Pliodyne 9" a front and rear view of which is shown in Figs. 157 and 158 as manufactured by Golden-Leutz, Inc., was the first broadcast receiver in which several circuits were tuned simultaneously by a single dial. This design was drawn up by the writer about December, 1923, and at that time not another single manufacturer had advertised a receiver having this feature. Since then, however, this original feature of Golden-Leutz, Inc. has been widely copied by many manufacturers.

Tuned radio frequency amplification is known in engineering circles to be the best method for building up weak signals of long distance reception, and although most popular receivers on the market at this

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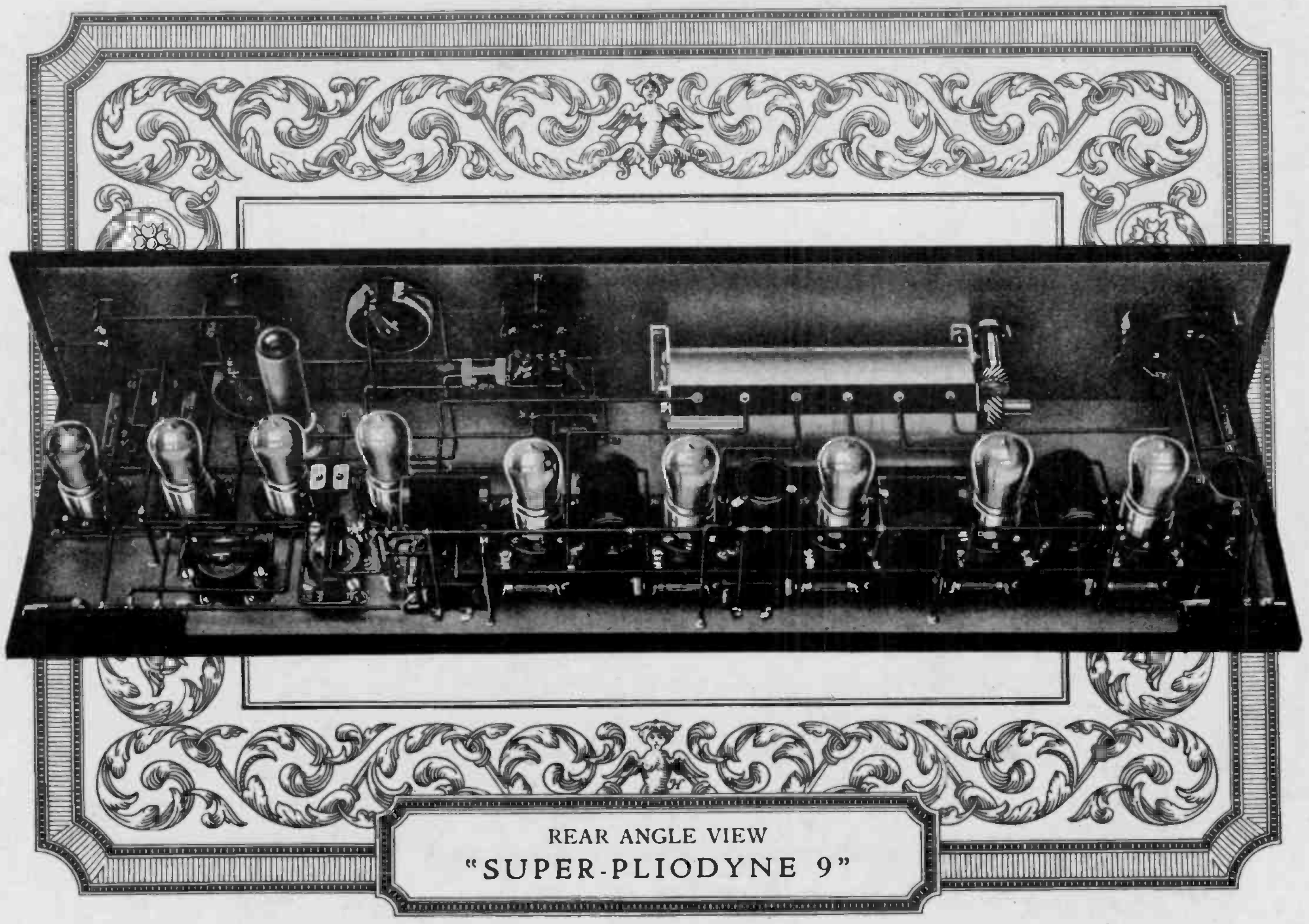


Fig. 158

time employ two stages of tuned radio frequency amplification with detector and two stages of audio amplification, giving very good results, they are lacking in efficiency for bringing in the greatly desired, long range reception which is only possible with additional stages of radio frequency amplification.

Up to the present time no one has been able to design and manufacture a receiver containing more than two stages of tuned radio frequency amplification. There are two good reasons for this: *First,* the former systems of neutralizing the tube capacities would not hold effectively for more than two stages; *Second,* an individual dial was required for each stage and for the detector; that is, for five stages it would require six dials, making operation unreasonably difficult.

The "Super-Pliodyne 9" overcomes both of these difficulties with five stages of tuned radio frequency amplification operated by a single dial, and a vernier to compensate for differences in antennae. Through the use of the Farrand System of nullifying internal tube capacities five stages of tuned Radio Frequency Amplification are used to decided advantage and without any regenerative feed back or local oscillations.

The operation of the receiver is very simple, each station or wavelength has a definite position on the Kilocycle Dial and by turning this dial through a complete turn of 360 degrees the receiver is automatically tuned to each of the stations that are operating at that moment. One "Super-Pliodyne 9" located on Long Island, eight miles from New York City, copied and actually logged 93 different stations in two evenings including KPO San Francisco, KFI Los Angeles and KGW Portland, Ore. All stations were of loud speaker audibility reproduced on a Western Electric 10D Loud Speaker. From a more favorable location in the central west undoubtedly twice this number of stations could be heard in the same length of time.

The use of dry cell tubes is not recommended at the present time for it has been found that the dry cell tubes available are not entirely satisfactory and will not give as good results as the storage battery tubes. While it would be possible to make a self contained receiver including batteries through the use of dry cell tubes, the receiving range and quality of reproduction would be seriously impaired.

The Left Dial marked "Vernier" is the compensating adjustment to take care of variations in Antennae. The "Kilocycle" Dial, or main tuning adjustment, is effective through the entire 360°. The Meter on the left is the Special Voltmeter and the other Meter is the Ammeter. The control between the two Meters is the Detector Filament Adjustment.

The right hand lower control regulates the Amplifier Tube Filaments indicated as "Master." The control to the left of this is the plate voltage regulating Potentiometer for the Detector. The Cutler-Hammer Control Switch is shown in the upper right hand corner. The two Loud Speaker Jacks are located at the right hand lower end of the panel and are designated "1" and "2". If a loop is desired it is connected between Antenna post "L" and ground, and tuned with the "Vernier" dial.

The Special Condenser can be seen aligned in its position and the gears adjusted. Particular note should be made of the wiring which, we believe, is the "neatest" wiring work done in any radio apparatus. The arrangement of wiring is a very important item and in this Receiver the final wiring arrangement was patiently worked out and all succeeding models are being wired as exact duplicates. All joints are locked or soldered and there is no possibility of any parts becoming loose in transit. This view also shows how the interior surfaces are lined with sheet copper for electrical shielding.

Cabinet removed clearly shows the sub-panel and at the extreme right the first Radio Frequency Transformer. Notice that a tube is mounted between each two sockets and that the relation of each Transformer to its neighbor is selected to reduce any stray coupling between Transformers. The Nullifying Resistors, Blocking Condensers and By-pass Condensers are under the sub-panel mounted as units. The Audio Amplifier system is located at the left-hand end of the base.

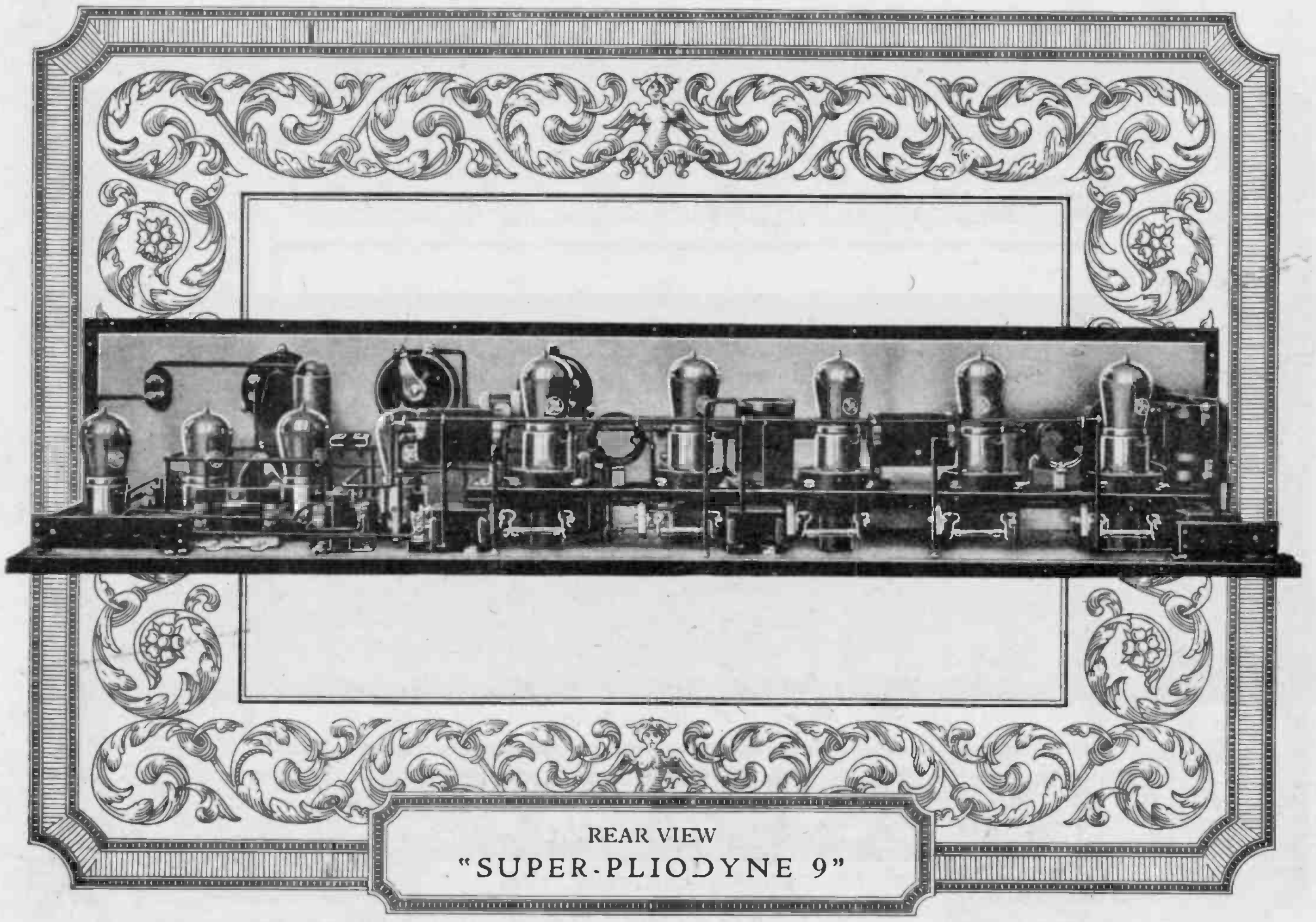


Fig. 159

Fig. 163
C. L. Farrand, Inventor of the Pliodyne Method of Reception. With the Original Golden-Leutz Super-Pliodyne 9, December, 1923.

SPECIAL MULTIPLE CONDENSER

There is a total of six condensers in this unit. Each condenser consists of a rotor unit on a shaft and a stator unit permanently fixed. The plates on the rotor unit are punched from brass and soldered to each other to form a single piece of metal of low contact resistance. The stator plates are assembled in a similar manner. These rotor and stator units are made specially for us by the General Radio Co. employing their superior manufacturing methods. The separating barriers between the condensers and the end plates are machine punched from hard drawn 3/32 inch aluminum sheet. All the rotor units are connected together on a common accurate steel shaft. The stator units are insulated from the barrier and end plates by Grade P Natural Formica which insures a negligible electrical loss. The condenser plates are specially shaped to give a nearly uniform wavelength variation with respect to angular motion of the rotor plates.

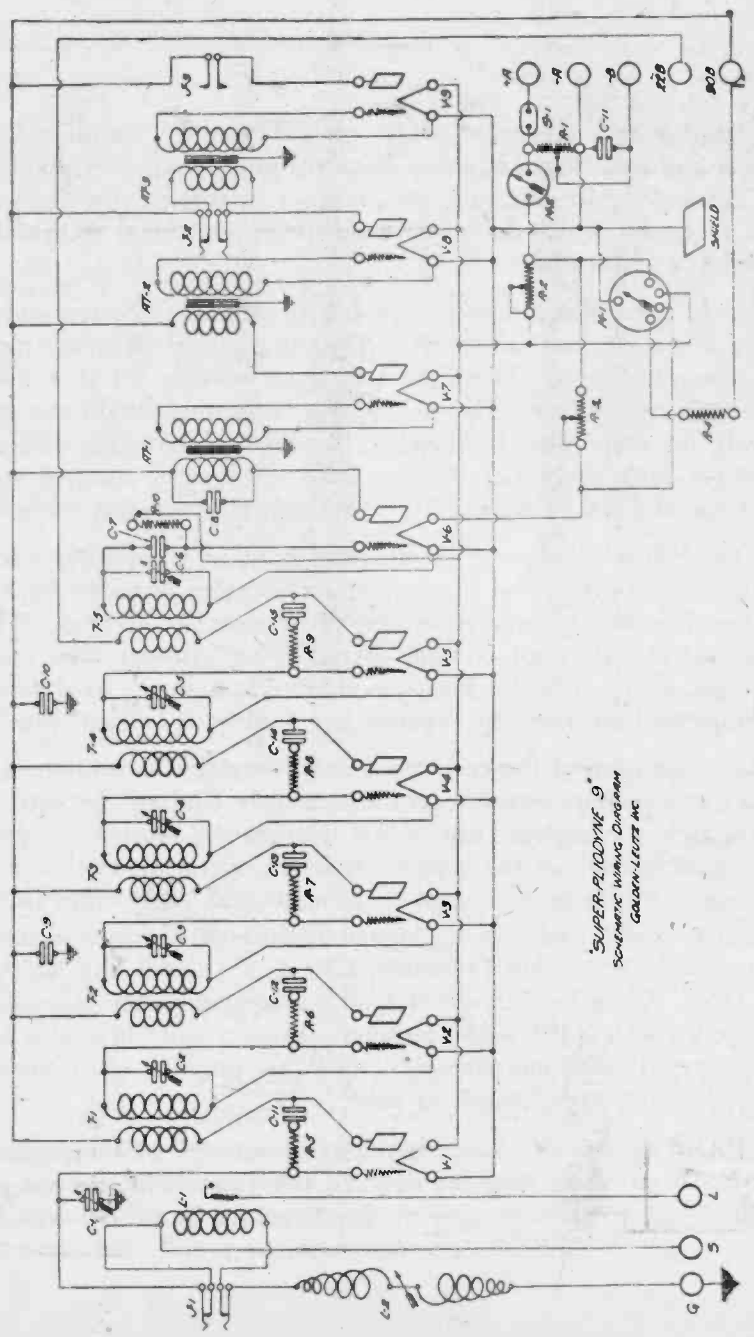
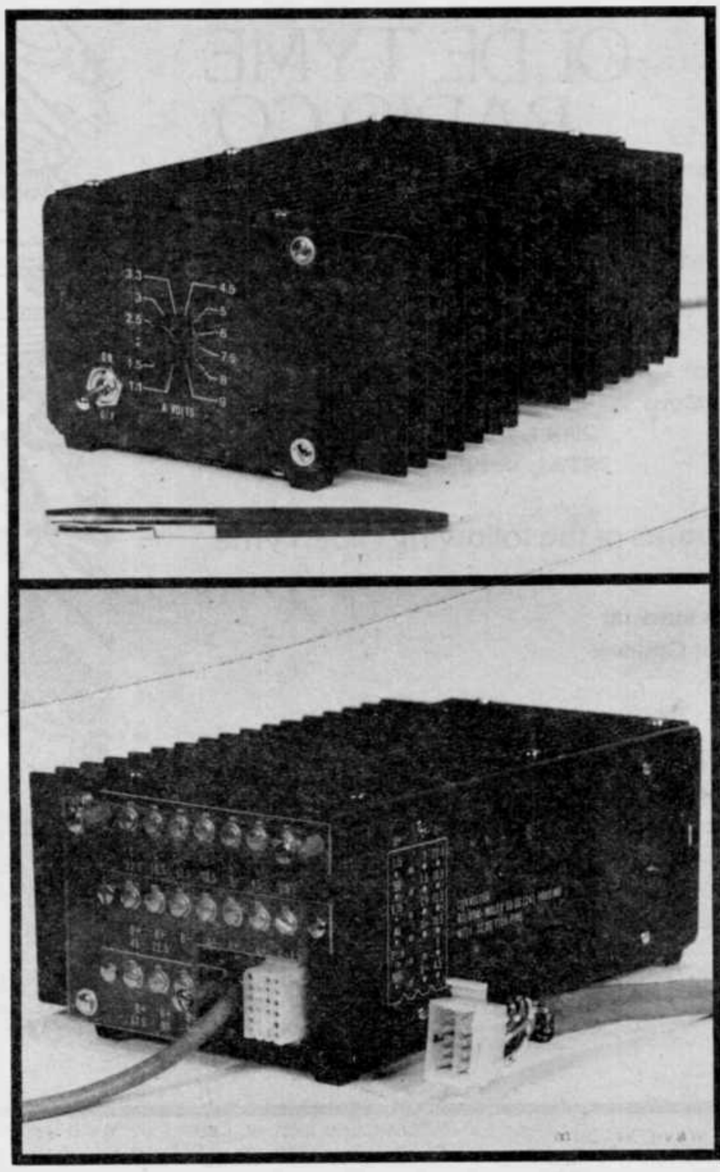


Fig. 161



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The "B" voltages of 22.5, 45, 67.5, 90, and 135V may be used in any combination with a rating of 50 mA.

"C" voltages of 1.5, 3.0, 4.5, 9, 10.5, 13.5, 16.5, and 22.5.

All outputs feature automatic electronic short circuit protection and very low ripple. The H10A operates from 117VAC 50-60HZ. Price is $159.95 UPS prepaid in U.S.A. Canadian customers please add $5.00.

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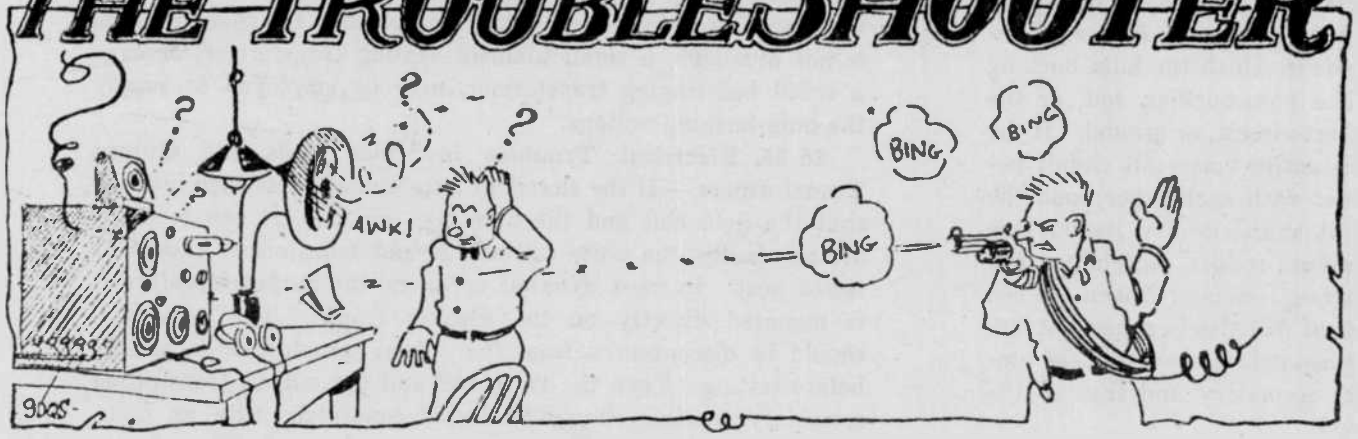
THE TROUBLESHOOTER



Mailbox

Dear Jim,

By the way I have just obtained an AK-10. Something I have always wanted. It's in quite good shape and I am optimistic on what it will look like.

I do need one of the condensers that is tucked in the recess in the bottom of the board. Can you help?

Regards,
Erik
Captain E. J. Lofquist
1820 N.W. 195th #9
Seattle, WA 98177

(Continued from last month)

26-31. **Troubles when Speaker Field is Employed as Filter Choke.**—The most commonly found dynamic speaker field arrangement is that in which the power required for energizing the speaker field is taken from the *B* supply system of the receiver. Economy is secured by this arrangement, for the speaker field also acts as a very effective choke in the *B*-filter

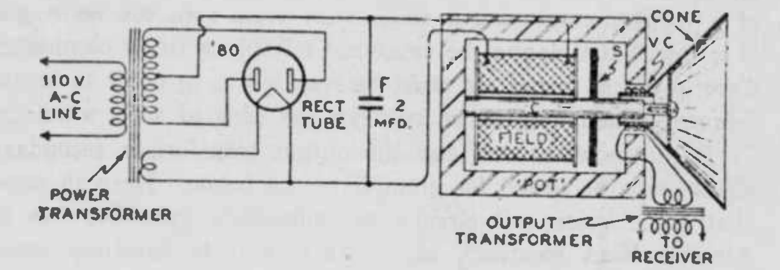


FIG. 26-16.—Here a power transformer and full-wave vacuum tube rectifier operating from the 110-volt a-c line are used to change the a-c to d-c for the field coil of the dynamic speaker. A shading ring *S* prevents line hum.

system. Two arrangements of this kind are illustrated in Fig. 26-17. At (*A*), the speaker field is connected in one leg of the *B* supply circuit, so that the total *B* current flows through it. At (*B*), a tapped field is employed, and it is connected in the *B*-return side of the filter system (see also, Figs. 20-9 and 20-10 in Chapter XX) so that it serves both as a choke and as a source of grid-bias voltage for the output tubes in the receiver. The strength of magnetization of the speaker field in both cases depends upon the load current flowing through it. It is evident that in these two arrangements, the speaker field current will be affected by almost any abnormal receiver circuit condition which tends to affect the total *B* current. Among these may be men-

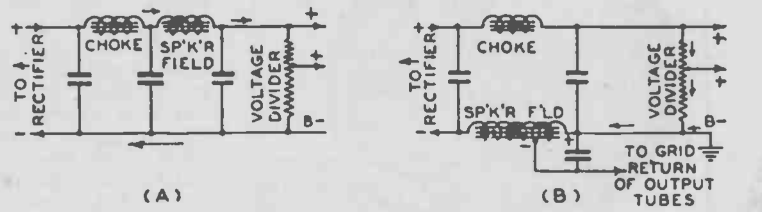


FIG. 26-17.—Two circuit arrangements which are employed in radio receivers for energizing the dynamic speaker field with current from the *B* power supply unit. At (*A*) the speaker field acts simply as a choke; at (*B*) the speaker field is tapped so that it not only acts as a choke but also supplies the negative grid bias for the output stage of the receiver.

tioned, leaky or broken-down filter condensers, a weak rectifier tube, weak amplifier tubes in the receiver, leaky plate or screen by-pass condensers in the receiver, etc.

In receivers designed for 110-volt d-c operation, the field of the dynamic speaker usually obtains its current direct from the line.

26-32. **How Hum Originates in Dynamic Speakers.**—Whenever objectionable hum which has definitely been traced to the dynamic speaker is observed, it is caused either by a poorly filtered field current or by a faulty hum-bucking coil.

Whether the fault lies in the speaker, or in the receiver circuit proper, can be determined easily by removing the output tube (or tubes) from the receiver while the receiver is turned on, so that no signal is fed to the voice coil. If the hum disappears, or greatly diminishes, it is caused by some trouble in the receiver (see Arts. 23-18, 23-19 and 23-20). If the hum persists when this is done, it must be originating from the field portion of the speaker.

The field coil is excited by a supposedly-smooth d-c current which is obtained from a filter system. The various common field-supply arrangements employed in receivers were discussed in Arts. 26-28 to 26-31 inclusive, and are illustrated in Figs. 26-14, 26-15, 26-16 and 26-17. As absolutely perfect filtering is not provided (for reasons of filter economy), the field current is never exactly smooth but contains ripples or variations of either half or the same frequency as that of the power supply, depending upon the type of rectifier system employed. Unless the speaker is provided with special features to greatly reduce the effect of these slight variations in the field current and field magnetism, the resulting variations in the magnetic field react on the voice coil, inducing voltages and currents of the same frequency in its circuit. This causes motion of the coil, at this same frequency, and hence causes a low-frequency (either 60 or 120-cycle) hum to be produced by the speaker. This hum may be drowned out when a musical program is being received, but it may be extremely annoying when receiving weak stations, speech, or in the lull between station announcements.

26-33. **Hum-Elimination Provisions in Dynamic Speakers.**—In many dynamic speakers, a hum-reducing arrangement is already built into the speaker. These hum reducers are of two types, one is an arrangement which *bucks out* the hum voltage induced in the voice coil, the other *prevents it* from being induced there. The hum-bucking arrangement is illustrated in the speaker of Fig. 26-14. A flat *hum-bucking* coil, *H*, consisting of several turns of wire is placed in a space provided for it, usually at the end of the field coil. Naturally, a hum voltage, similar to that induced in the voice coil, will be induced in this hum-bucking coil. The design of the coil and its position in the speaker are carefully arranged to make the hum voltage induced in it exactly equal to that induced in the voice coil. Therefore, by connecting it in series with the voice coil circuit, as shown, so that the instantaneous hum voltage polarities of the two coils buck each other, the two hum voltages will cancel each other, and no hum current will flow in the voice coil circuit. Hence no hum is produced. However, there is no effect on the signal audio-frequency currents. This arrangement effectively minimizes the hum.

The other hum-prevention arrangement consists of a thick-copper disc, *S*, placed between the voice coil and the field coil as shown in the speakers of Figs. 26-15 and 26-16. This acts as a single-turn coil of extremely low resistance in which strong "eddy currents" are induced by any fluctuations of the field magnetism. These eddy currents react on the main field, tending to oppose and suppress any such fluctuations, thereby preventing them from existing and preventing them from inducing any hum voltage in the voice coil. This disc is often called the *shading ring*. This very simple arrangement is widely used, and is very effective.

26-34. Eliminating Excessive Hum in Dynamic Speakers.—Speakers in which the shading ring is used are not subject to as much hum trouble as those in which the hum-bucking coil arrangement is employed. The hum-bucking coil, or the connecting leads to it, may open, short-circuit, or ground. If the hum-bucking coil circuit opens, the entire voice coil circuit becomes open (since they are in series with each other) and the receiver becomes inoperative. If it short-circuits, its bucking effect ceases, and a very noticeable hum results, especially when the receiver is turned on but no program is being received. When a program is being received, the output will also be somewhat distorted because of the resulting mismatching between the impedance of the output transformer secondary and that of the voice coil plus the hum-bucking coil.

If the hum-bucking coil grounds to the speaker core or frame in any way, it may or may not cause trouble, depending upon whether the voice coil circuit of the speaker is already grounded to the speaker frame. In some receivers (as in the Atwater Kent sets) the voice coil is purposely grounded to the speaker housing. Naturally, if the hum-bucking coil in such speakers grounds, it may result in objectionable hum (if part or all of this coil is thereby shorted and made ineffective), or it may result in shorting the voice coil circuit, thereby making the set inoperative. What happens in any particular case depends upon which end of the hum-bucking coil grounds and which end of the voice coil is already grounded.

Tests for grounds, open-circuits, or short-circuits in the hum-bucking coil can be made very easily by means of an ohmmeter.

Occasionally, hum is caused in a dynamic speaker by the induction of hum currents into the windings of the output transformer which is mounted directly on the speaker frame. This trouble is rare, for speaker manufacturers are careful to mount the output transformers where stray fields from the speaker will not affect them. However, it is mentioned here because it is usually overlooked as a possible source of speaker hum.

Although most dynamic speakers in recent models of receivers have some effective hum-reducing arrangement incorporated in them, the service man is often called upon to service some of the

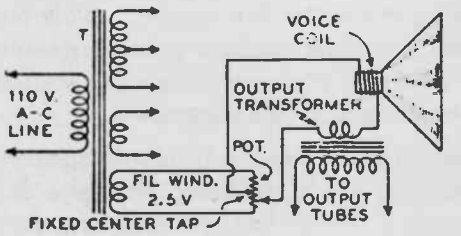


FIG. 26-18. — How a "hum-bucking" potentiometer can be installed to introduce a hum-bucking voltage into the voice coil circuit of an old dynamic speaker not equipped with any hum reducing arrangement. *T* is the power transformer already in the receiver.

early electric receivers in which no such provisions for hum reduction were incorporated. These receivers are notorious for their objectionable hum. While it is not practical to install hum-bucking windings or shading rings in them, because of lack of space, etc., a simple external arrangement can be applied for accomplishing this result. This is illustrated in Fig. 26-18. A potentiometer having a resistance of approximately 20 ohms is connected across one of the low-voltage filament windings of the power transformer, *T*, in the receiver; a 2½-volt winding is satisfactory. Either one of the leads which connect the voice coil to the secondary of the output transformer is now disconnected at the voice coil terminal. This lead is then connected to a fixed tap made to the center of the resistance element of the potentiometer. This tap should be made in a way which does not interfere with the movement of the contact arm past it. The contact arm terminal of the potentiometer is then connected to the open terminal of the voice coil. By means of this arrangement, a small a-c voltage from the filament winding is fed in series with the voice coil circuit in a phase opposite to the hum voltage being induced in it by the speaker field. By moving the arm of the potentiometer to either side of the center tap, the proper phase relation for bucking may be secured; by adjusting its setting on the side at which proper bucking is obtained, the exact amount of bucking voltage necessary to balance out the hum voltage in the voice coil can be secured.

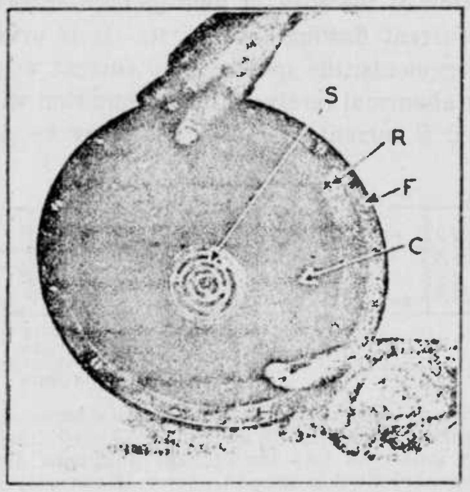
Incidentally, this same arrangement can often be employed for bucking out hum voltages induced in other parts of radio receivers. In such cases, it is usually necessary to employ a filament winding which is not being used in the receiver, so that the circuit conditions will not be disturbed. If a spare winding is not available, a small filament-heating transformer, or even a small bell-ringing transformer, may be employed to supply the hum-bucking voltage.

26-35. Electrical Troubles in Voice Coils and Output Transformers.—If the electrical tests already described indicate that the field coil and the hum-bucking coil (if one is used) are not faulty, the voice coil and output transformer should be tested next. In most dynamic speakers, the output transformer is mounted directly on the speaker frame. The voice coil should be disconnected from the output transformer secondary before testing. Then the voice coil and the output transformer secondary winding should be tested separately with an ohmmeter for continuity. The voice coil may be open internally, or at the flexible leads. Remember that if a hum-bucking coil is employed, its continuity must also be checked, since it is in series with the voice coil.

If the continuity of the voice coil checks satisfactorily, it should be tested for possible short-circuits between its turns, or between its ends (especially if they cross over each other), by measuring its resistance with the low-resistance range of an ohmmeter. The resistance reading obtained will be very low, and it should be compared with the normal resistance specified on the manufacturer's data sheet for the receiver. In the case of a speaker employing a single-turn voice coil, the resistance is so low that it cannot be measured reliably with an ohmmeter. Careful visual inspection must be resorted to in order to locate "shorts" which may occur between the ends of such windings.

Both the voice coil and the output transformer secondary should now be tested for grounds to the frame. Keep in mind that some voice coil circuits are purposely grounded (as in Atwater Kent receivers, etc.). It is well to carefully move the speaker cone in and out with the fingers while the voice coil is being tested for grounds, since a ground may occur only at certain positions of the cone due to rubbing of the voice coil against the pole piece. The repair of faulty voice coils will be considered in Art. 26-39. This completes all of the electrical tests which may be made on dynamic speakers. Any other troubles will be of a mechanical nature. In fact, the majority of troubles which arise in dynamic speakers really are mechanical troubles occurring in the cone, voice coil, or spider.

26-36. Cone, Voice Coil and Spider Troubles.—The cone, *C*, is fastened at its outside edge to a flexible leather or cloth



Courtesy Atwater Kent

FIG. 26-19.—Correct method of holding the speaker frame and cone to determine if the voice coil scrapes against the pole pieces. The cone is gently moved straight in and out with the thumbs of both hands. If a dull scraping sound is heard when this is done, it indicates that the voice coil is not properly centered and is rubbing against the metal pole piece. The main parts of the cone assembly are labeled.

ring, *R*, which in turn is clamped to the speaker frame, *F*, as shown in Fig. 26-19. At its apex, the cone is cemented to the circular voice-coil form. This form and the voice coil wound on it, travel back and forth in the small annular air gap surrounding the round pole-piece of the field. In most cases, the cone is kept aligned to the exact center position by a flexible *spider* support which is fastened to it either at the inside of its small end (later speakers) or around the outside of the outer end of the voice coil form (older speakers). The spider permits more or less unrestricted straight-line movement of the voice coil along the axis of the main pole-piece.

The common causes which are responsible for most dynamic speaker mechanical troubles are:

1. The voice coil may be off center and rubbing against the sides of the pole pieces.
2. The voice coil form may be warped out of round, resulting in its rubbing against the pole pieces.
3. The voice coil wires may be loose from the coil form and scraping against the outer pole piece.
4. The cone or spider may become warped, causing the voice coil to be off-center and scraping.
5. A seam on the cone may loosen, the spider may loosen from the cone where it is cemented, the voice coil wire leads may come loose from the side of the cone to which they are cemented. These troubles all cause "rattling".
6. Chattering may result from broken spiders or spiders which are not stiff enough, and from cones which come loose at the outer edge where they are clamped by the metal ring.
7. Rattling may occur due to a loose spider screw, or other loose screws in the speaker.

These troubles and the remedies for them will now be considered in detail.

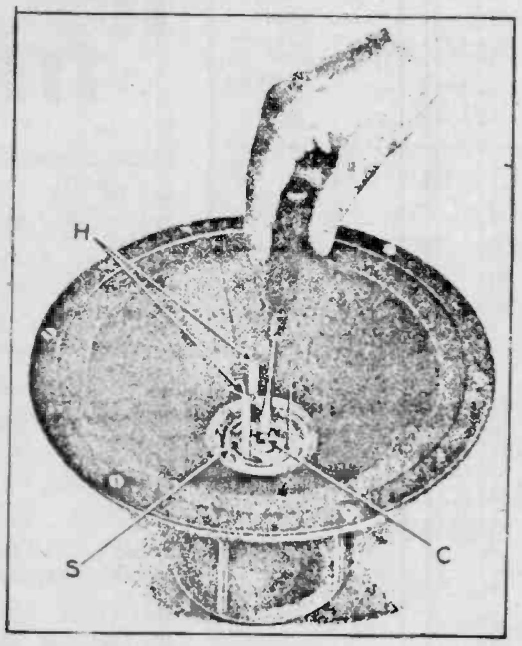
26-37. Recentering Voice Coils.—The circular form on which the voice coil is wound fits into the circular air gap with a very small clearance, and should be centered in it perfectly so that it does not touch the metal poles at any point. If the coil is not properly centered, the wire of which it is wound rubs against the pole pieces. If the friction is sufficient, the insulation of the wire wears away and short-circuits occur between the various turns, at the scraped surface. Then too, the output may be distorted because of the enforced limited movement of the coil caused by the excessive friction. There are two types of voice coil centering arrangements: those in which either an internal or external spider is employed (see Fig. 26-19 for internal type), and those in which waxed string suspensions are used. The former is the most common, and the centering of voice coils in speakers employing it will be considered first.

To find out whether the voice coil needs recentering or not, the cone and frame assembly should be grasped in both hands exactly as illustrated in Fig. 26-19. The cone should be moved straight in and out by pushing gently with both thumbs. If a dull scraping or scratching sound is heard, it indicates that the coil is off center and is rubbing against the pole piece; consequently, recentering is necessary. Care should be taken not to push the cone assembly to one side when doing this, for it is possible to throw the entire assembly off center so that the voice coil scrapes if the cone is pushed on one side only.

Another method for determining whether the voice coil needs recentering is to connect the loud speaker to the receiver and tune in a steady signal of low pitch. An excellent low-pitched sound may also be obtained by disconnecting one or more of the filter condensers in the receiver, and allowing the speaker to reproduce the resulting hum. If the receiver is inoperative, the primary of the speaker output transformer may be disconnected from the receiver and connected to a 110-volt a-c line, in order to produce the hum. With the hum as loud as possible, run the thumb around the edge of the *spider*; press firmly and listen carefully. The *quality* of the hum should be the same for all positions of the thumb. If it is not, the cone must be recentered.

In order to recenter the voice coil, it is necessary to make the spacing between the voice coil and the pole pieces the same at every point. To do this, loosen the screw which passes through the center of the spider and screws into the center core-leg of the field. Now insert three narrow, thin cardboard or paper shims, *H*, of proper thickness in the cut-outs in the spider (see Fig. 26-20), so that they fit in between the voice coil and the center core-leg. This forces the voice coil to take a centered position in the air gap. Now tighten the center screw, so as to clamp the spider in this correct position. At this point, it is well to make sure that the screws in the core-clamping ring at the top are tight. Then remove the shims.

The method of recentering just described is what might be called the *static* method, since no signal is applied and the cone is at rest while it is being recentered. Some service men prefer the dynamic method. The *dynamic* method of recentering is to reproduce the low-frequency hum of the unfiltered power supply, loosen the spider centering screw, insert the shims, and, with the hum coming in strongly, tighten the centering screw and remove the shims.



Courtesy Atwater Kent

FIG. 26-20.—Here the voice-coil centering shims, *H*, are shown in place in the air gap while the spider set-screw *C* is being loosened to allow the voice coil, spider, *S*, and cone to assume a "centered" position.

Some speakers have their spiders at the rear of the cone instead of in front. These spiders have no centering screw, as the spider arms are fastened to the frame of the speaker by screws. In other words, the center of the spider is fastened to the cone, and to the voice coil, while its individual arms are fastened to the frame of the speaker by screws. The process of centering such cones is the same as for the center-screw spider type, except that three or four screws or nuts must be loosened and tightened instead of one. Since these screws are behind the cone, it is usually difficult to get at them and an off-set screwdriver or wrench must usually be employed. The centering shims should be placed at three equally-spaced points 120 degrees apart.

Instead of using a spider to center the voice coil, a few speakers use three thin, waxed strings stretched radially from the voice coil and separated evenly—by 120° arcs. The far ends of these strings fasten to thumb screws which may be tightened or loosened at will. The recentering of these cones is accomplished by using shims in the customary manner and then tightening or loosening the thumb screws to secure the proper position of the voice coil.

The shims used for recentering voice coils should be about 1/8-inch wide and 2 inches long. Suitable shims may be made by cutting strips from an ordinary calling card or other thin cardboard, or from stiff paper. Since the air gaps employed in dynamic speakers vary to some extent, the serviceman will find that three or four shims each of the following thicknesses 0.125, 0.01, 0.0075 and 0.005 inches will take care of all speakers. All the shims of each thickness should be marked so they can be identified easily.

After a voice coil has been recentered carefully by one of the foregoing methods, it should be checked by the method of Fig. 26-19 to find out if it is properly centered. By listening carefully, and by the "feel" of the thumbs, it will be possible to determine if the coil still scrapes.

Mailbox

Dear Jim,

I picked up an old radio that I thought I would never find. I went to a garage sale and bought a DeForest F5 in clean condition. I would like to get some info on this radio if anyone can help with a diagram. There is no loop antenna with this model. It is covered with a fabric. I am remodeling a chicken house for my collection.

R. W. Olmsted
Rt. 11 Box 349
Murfreesboro, TN
37130

HOUSTON VINTAGE RADIO ASSOCIATION, 6110 PECAN LANE, KATY, TEXAS 77449.

INDIANA HISTORICAL RADIO SOCIETY, 245 N. Oakland Avenue, Indianapolis, IN 46201.

THE ANTIQUE RADIO CLUB OF ILLINOIS, one of the clubs that conducts large meets of national prominence in the Chicago area. For more information contact: Joe Willis, P. O. 14732, Chicago, Il 60614.

WELCOME TO SEND IN AN AD ABOUT YOUR CLUB.

NORTHWEST VINTAGE RADIO SOCIETY — Annual dues $12.50. monthly newsletter, THE CALL LETTER and monthly meetings. Write: Ed Charman, Northwest Vintage Radio Society, P. O. box 02379, Portland, OR 97202.

ARIZONA ANTIQUE RADIO CLUB, a lately formed club that publishes RADIO NEWS, a quarterly bulletin with informative articles and ads. Annual dues are: $10.00 for a year. Write: Lee Sharpe, treasurer, Arizona Antique Radio Club, 2224 W. Desert Cove #205, Phoenix, AZ 85029.

CALIFORNIA HISTORICAL RADIO SOCIETY is a popular group that publishes a journal six times a year and provides swap meets four times a year for its members. CHRS, P. O. Box 1147, Mountain View, CA 94042-1147.

SEND IN YOUR CLUB NEWS — EARLY

MID-AMERICA ANTIQUE RADIO CLUB, 9723 CARTER DRIVE, OVERLAND PARK, KANSAS 68212.

THE SOCIETY TO PRESERVE AND ENCOURAGE RADIO DRAMA VARIETY AND COMEDY, P.O. BOX 1587, HOLLYWOOD, CALIFORNIA, 90078.

VINTAGE RADIO AND PHONOGRAPH SOCIETY, an organization that is famous for its yearly conventions in the Dallas area. Also it publishes a journal approximately six times a year. Both phonograph and radio collectors are invited to join this society from all over the country. Dues are $13.50 a year. Write: Vintage Radio and Phonograph society, P. O. Box 165345, Irving, TX 75016. John Lill and Mike Payne won "best of show" trophies at the last VRPS Meet in October 1985. We plan to have pictures of their winning sets in the future. Prices of the VRPS auction will be published as soon as VRPS releases them.

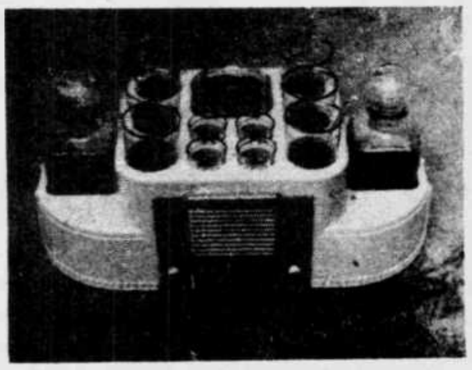
flea market

AK 92, AK 20, STROMBERG CARLSON 1-A, Frost Musette horn, Rider's Vol. #1 thru #23, radio tubes. Stevens, (802) 863-3226, 69 Porters Pt Rd, Colchester, VT 05446.

MSC. PARTS FOR MARCONI, DeFOREST, KENNEDY, AMCO, HALCUN, RADIOLA, SPEAKERS, DRIVERS, MIKES, CRYSTAL DETECTORS. LARGE SASE. JOE HORVATH, 522 THIRD STREET, SAN RAFAEL, CA 94901.

OLD TEST EQUIPMENT, SIGNAL GENERATORS RF AND AUDIO RESISTANCE CAPACITANCE BRIDGES, ETC. Early Western Electric lab galvanometer shunts and other wooden box components wavemeters, etc. Old N.B.C. color camera use and setup procedures. Other N.B.C. memos, etc. from 50's TV broadcasting. 3BP1 scope tube. 2 inch military Western Electric scope. New old image Othicon tube. Transmitting tubes. Early Bunnel relay, wood top. Other goodies. Drop me a line. Vaughn Rudisill, 222-22 Edmore Avenue, Queens Village, NY 11428.

CRYSTAL, TUBE EXPERIMENTER'S catalog - $1.00 - None free. sets, kits, handbooks, plans, coils, supplies, obsolete tube quotations. Laboratories, 1477-H, Garden Grove, CA 92642.



DIVORSED, Selling everything, Sturet Warner bar radio $450.00. Majestic cathedral other old radios. Horn windup phonographs, 29 Edisons, 10 Victors, 10 Columbias, 14 other brands, music boxes, 12 antique clocks, antique guns, parts of phonographs, 30 extra horns, 1200 records, Victor tone arms and back brackets, Columbia tone arms, old 190's TVS. Extra CRTS. T.V., books and schmatics, Call days. (503) 479-4282.

NOTE— The above ad has not been edited. We were instructed not to use a name with the above ad, but it violates our ad policy, so we must expose that it is a Charles Seidel ad from 925 Starlite Pl., Grants Pass, OR 95726.

SELLING 150 EARLY SAMS PHOTOFACT SETS, 100.00 each, postpaid. Send SASE for new list. Many tube types available. Send want list. Craig Larson, 2122 45th Avenue N.E., Minneapolis, MN 55421.

FOR SALE— 8 PAGE LIST RADIO ITEMS— 50 cents and SASE. Krantz, 100 Osage Avenue, Somerdale, NJ 08083.

FOR SALE — CATHEDRAL, BATTERY, AND A. C. radio. Photo list four times per year. Send S.A.S.E. to J. Albert Warren, Box 279, Waverly, PA 18471.

FOR SALE: RCA BERKSHIRE REGENCY radio/ phonograph/ television combination. Full set of operational manuals. Excellent condition. Vintage late 1940's. Any reasonable offer accepted. Goodwill Industries of Pittsburgh, Attn. R. S. Foltz, 2600 Carson Street, Pittsburgh, PA 15203.

TUBES: SELLING 50 YEAR COLLECTION. ALL INQUIRIES INVITED. MILT LEVY, 101 EAST DRIFTWOOD, NUMBER 26, DRIFTWOOD APARTMENTS, FREDRICKBERG, TX 78624.

SALE: UNICO SPECIAL single tube battery receiver (Clapp Eastham). SASE for photo. Wanted: Q meter. TCBA, R3, B181, Glens Falls, Ny 12801.

RADIO SCHEMATICS— $1.25. Give make and model number. Newly printed tube manuals of antique and obsolete tubes, containing specifications, tube diagrams, VT guide and substitution guide. Books, tubes and other parts. Send SASE for list. Willie Housel, 1816 S.W. 12, Lincoln, Nebr. 68522.

FOR SALE: TUBES, SPEAKERS, CAPACITORS, have over 500 types of tubes. Send S.A.S.E. for lists. C. Elmer Nelson, 11 S. Church Street, Princeton, IL 61356.

RIDERS, HOWARD SAMS, RCA, PHILCO PLUS OTHER SERVICE DATA. TUBES PARTS, TEST EQPT. SASE FOR LIST. WRITE WANTS AND SASE. KRANTZ, 100 OSAGE AVENUE, SOMERDALE, NJ 08083.

ARE YOU LOOKING FOR A SPECIFIC ANTIQUE RADIO? I have many, beautifully restored and in good working condition. Also hundred of old tubes, battery and electric. SASE, Ira L. Witthaus, Warrenton, MO 63383.

SALE:::: RADIOLA II ..$250; RADA ..$150; RA tuner, no box ..$55; Freshman, slant front ..$50; Philco 16B and parts radio ..$210; Clarion Jr. and parts radio ..$195; Neutrowound ..$275; RCA 103 speaker ..$50; Magnavox M-3 horn ..$75; AK "L" horn ..$75; "Brown" horn ..$85; Temple "air chrome" speaker ..$80; Crosley RFL 60 ..$150; Steinite coil, original box ..$10; Daven amp., chipped tube socket ..$50— Will trade anything listed for crystal sets or one tube radios. —— Anthony Caserta, 47 Vista Lane, Levittown, NY 11756. (516) 731-7175.

B and W YOKES AND FLYBACK 14HRV 267 Thordarson .. $15.00 postpaid. Don Aldred, 39 E. 8th Street, Jacksonville, FL 32206.

KENNEDY MODEL 311 PORTABLE, $200. ONE TUBE MICHIGAN, WORKS, 125. MUCH AK DEALER LITERATURE INCLUIDING- "SALES BOOK", SIX FOOT STORE BANNERS (NEVER USED), AND THREE BOOK SET SERVICE MANUALS. INQUIRE. EVAN HAYDON, 4308 N. 15, LINCOLN, NE 68521. (402) 435-4083.

RIDER TROUBLE SHOOTING MANUALS, VOL. FIVE THRU SIXTEEN, $15 PLUS SHIPPING EACH. SENT UPS. WILLIAM L. HOWELL, 5724 GIBBONS DRIVE, CARMICHAEL, CA 95608.

FOR SALE: RIDER'S T.V. 3-4-5 $15 EACH P.P.D. RIDERS RADIO VOL. 6 THRU 18 $10 EACH P.P.D. 7 AND 9 PIN MINATURES, NEW IN ORIGINAL BOX RCA, I.T.T. STLV.'S GIVE 2ND AND 3RD CHOICE, 50 FOR $20.- P.P.D. OCTAL BASE TV TUBES, NO HORZ. OUTPUTS 30 FOR $20.- P.P.D. GIVE 2ND 3RD CHOICE. WRITE WANTS FOR OTHER TUBES AND SERVICE INFORMATION. C. F. ENGLAND, 98 MONTAGUE, SO. ZANESVILLE, OH 43701.

3 BLACK AND WHITE PHOTOS, 24 X 20 OF RADIO EQUIPMENT OF THE WORLD WAR II ERA from the Kessler A. F. Base, Biloxi, MS. Also S-40A Hallicrafter radio. Russell Schoen, R#1, Bx 22, Clentonville, WI 54929. (715) 823-6744.

SELLING: 380 RADIO MAGAZINES, 1919-1927. RADIO NEWS, RADIO, RADIO AGE, WIRELESS AGE, WIRELESS WORLD, POPULAR RADIO, RADIO BROADCAST. SASE FOR LIST. W6ME, 4178 CHASIN STREET, OCEANSIDE, CA 92056.

FOR SALE: THINWALL, BLACK BAKELITE TUBING. 4" DIA $3.75/FT. 3 1/2" DIA $3.50/FT. 3" DIA $3.00 PER FT. WILL CUT TO ANY SIZE, 12" MINIMUM. BOB, W6ME, 4178 CHASIN STREET, OCEANSIDE, CA 92056.

FOR SALE. RIDERS, HOWARD SAMS, RCA, PHILCO, ZENITH SERVIE DATA. RADIO PARTS, TUBES TEST EQUIPMENT. LIST 3/85 50 cents AND SASE. UNLISTED ITEMS SEND WANTS AND SASE.

KRANTZ, 100 OSAGE AVENUE, SOMERDALE, NJ 08083.

FOR SALE- CATHEDRAL, battery and AC radios. List four times a year. Send S.A.S.E. J. Albert Warren, Box 279, Waverly, PA 18471.

FOR SALE: TUBES, PARTS, SCHEMATICS, custom power supplies. SASE for list to: Los Locos, 1201-74 Monument Blvd., Concord, CA 94520.

NOW! TWO BOOKS
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ALL ABOUT METERS. History of the development of electrical meters; build simple meters representive of the historical types.
ALL ABOUT CRYSTAL SETS. Theory and construction of crystal set radios.
$7.95 each, ppd USA. Send to Dept. H, P. O. Box 4155, Fremont, CA 94539.

RIDER RADIO AND TV SERVICE MANUALS. HOWARD SAMS, RCA, PHILCO, ZENITH, PLUS MORE. RADIO PARTS, KNOBS, DIAL BELTS, TUBES, SPEAKERS, TUBE TESTERS, SIGNAL GENERATORS, VOLUME CONTROLS. WRITE WANTS. SASE. KRANTZ, 100 OSAGE AVENUE, SOMERDALE, NJ 08083.

WANTED

BEITMAN SUPREME TV MANUALS, 1949 and 1952. In good condition. Fred Emerson, 627 Illinois Avenue, Elgin, IL 60120.

ARVIN (NOBLITT SPARKS) model 1427 or 1427B. Prefer no push buttons and good cabinet. Art Corbus, 5704 11th Avenue N.W., Seattle, WA 98107. Ph. (206) 783-6151.

WANT ATWATER KENT BREADBOARD AND PARTS. TENNESEE AND KENTUCKY COLLECTORS PLEASE WRITE ME A LETTER. — NEW HOBBY — K4UJZ, RUSS OLMSTED, RT 11 BOX 349, MURFREESBORO, TN

WANTED — LOOP ANTENNA for DeForest D-12 Radiophone. Any other loop also wanted. Wanted, granfather clock with radio. Gordon Wilson, 11108 - 50 Avenue, Edmonton, Alberta, Canada, T6H 0H9.

"SIGNAL CORP RADIO PAMPHLETS #1-30 needed, prefer originals but Xerox OK. Also WWI Signal Corps. equipment, glass display battery set, 1920s portables, DeForest sets, Kellogg / early AC sets and fancy horns. Cash or trade. Mel Rosenthal, 507 S. Maryland Avenue, Wilmington, DE 19804. (302) 994-0874.

WANTED DIAL FACE for Zenith model #85661, Gary Cothron, 3143 E. H-4, Lancaster, CA 93534. (805) 946-1177.

DeFOREST D12 front panel and cabinet, or junker set. P. A. Kinzie, 713 E. Beale, Kingman, AZ 86401.

WANTED: RADIO TUBES (45'S, 50'S), Western Electric Tubes, Amps., Consoles, Drivers, Horns, Speakers, Parts and Tannoy Speakers, McIntosh or Marantz Tube Amps. David Yo, P.O. Box 382, Monterrey Park, CA 91734. Tel. (818) 576-2642.

WANTED: DYNASCAN 1000 IN STILL GOOD CONDITION. OK ON SMALLER TUBES MISSING. CONDITION ON C.R.T. IF KNOWN?. IT MAY BE REJUVINATED IF NOT COMPLETELY DONE IN, SHOULD HAVE SOME EMISSION, NO SERIOUS SCREEN DEFECTS LIKE HALOS OR SILVERING. KNOWN SUBSTITUTE?. DYNASCAN PICKUP AND RF GENERATOR USING 931-A. GOOD CONDITION PREFERABLE. OK ON MISSING TUBES SAVE PHOTOMULTIPLIER. CBS COLOUR WHEELS, COLOUR SLAVE 15"-17" GOOD CONDITION. COLOUR PHOTOS, SLIDES 16MM COLOUR MOTION PICTURES FROM STUDIO MONITOR OR OTHER. WOULD WELCOME CORRESPONDENCE FROM COLLECTORS OF CBS MATERIAL. D''ARCY BROWNRIGG, P. O. BOX 292, CHELSEA, QUEBEC, MONITOR OR OTHER. WOULD WELCOME CORRESPONDENCE FROM COLLECTORS OF CBS MATERIAL. D''ARCY BROWNRIGG, P. O. BOX 292, CHELSEA, QUEBEC, CANADA, J0X 1N0.

VINTAGE AUDIO TUBES AS 2A3, 50 W.E.'S 101B/F, 104B/D/F, 205B/D/F, 211D/E, 242A/C, 252A, 262A, 274A/B, 275A, 276A, 284D, 300A/B, 301A, 347A, 348A, 350B, 351A, VT-2, VT-4B, VT-25, VT-25A, VT-52, D-86326, D-86327. New condition are welcome. SHIGERU MIURA, 5-14 3 CHOME, TOKIWADAI ITABASHI-KU, TOKYO JAPAN— P.S. VT-62, 801A, PX25, 6B4-G, DA30, RE604, R120, TM100 WELCOMED TOO.

WANTED: ELECTRON TUBES AND EARLY audio/ stereo equipment. Ex. — Marantz, McIntosh, W.E., etc. Tubes - 50, 250, 350, 450, 45, 245, etc. — plus many W. E. types. Please contact me with anything of interest. Charles Dripps, 4331 Maxson Road, El Monte, CA 91732 (818) 444-7079.

WANTED Crystal set radios, varible condensers, coils, variometers, crystal detectors, carborundum detectors, galena crystals, cat whiskers, headphones, terminals, tap switches, headphones, circuit diagrams, pictures, books, detector holders, coil forms, etc. Starting vintage radio company to supply kits, plans, parts to interest young people in radios instead of just computers. MIDCO, 660 North Dixie Highway, Hollywood, FL 33020.

SUPERHETERODYNE U. S. RADIO AND TV, model 19, class B, 60 cycle, 85 watts, Leslie Dorety, Stripping, Refinishing Repairing, 1129 Valleyview, Hurst, Texas, 268-5051. (no zip or area code given).

"WANTED: Glass display radio, prefer factory made. Cash or trade. Also want WW I equipment, portables and early AC sets. Mel Rosenthal, 507 S. Maryland Avenue, Wilmington, DE 19804 (302) 994-0874."

CLEAN, COMPLETE, WORKING Zenith Trans-oceanic, model 7G605 with airplane on grill cloth. Brian Rhodes, 90 Frances Avenue, Stanhope, NJ 07874.

WANTED: pre- 1950 TV's, small screens, channel #1, Pilots, Predictas, unusual sets. Also, my first illustrated list of over 50 radios— Large S.A.S.E. please. Harry Poster, Box 1883, South Hackensack, NJ 07606.

INSTRUCTION MANUAL for "Precision tube tester model 612, to be Zeroxed or original. Also latest charts and adaptors for same." Kindly estimate charges." Frank Hoffert, 19605 Chardon Road, Cleveland, OH 44117.

WANTED: RECORD/ PLAYBACK HEAD for Webster Chicago Wire Recorder. Roy Schmitt, Route 1, Box 800, Lot 84, Converse, TX 78109. (512) 658-2669.

WANTED: SILVER MARSHALL PLUG IN COILS TYPE 114, PLUGS INTO RING TYPE SOCKET. COIL FORMS OK. ALSO HAMMARLUND OR SHORTWAVE AND TV LABS COIL FORMS. BOB, W6ME, 4178 CHASIN STREET, OCEANSIDE, CA 92056.

WANTED - ZENITH RADIO SIGNS. DISPLAYS, ADVERTISING, ETC. PRE 1935. CALL MONDAY THRU FRIDAY. 8 TO 5. (312) 357-4955.

S.A.S.E. is a self addressed stamped envelope.

EICO MODEL 147 SIGNAL TRACER in excellent condition with probes and manual. Also want Motorola Portable Radio Model 5A5. Roy Schmitt Rt. 1, Box 800 Lot 84, Converse, TX 78109. (512) 658-2669.

WANTED, INSTRUCTION MANUAL OR ANY other set manual, including schematic for Kennedy 110. Zerox OK. Bill Pugh, 2126 E. Myrtle, Phoenix, AZ 85020.

classified ad

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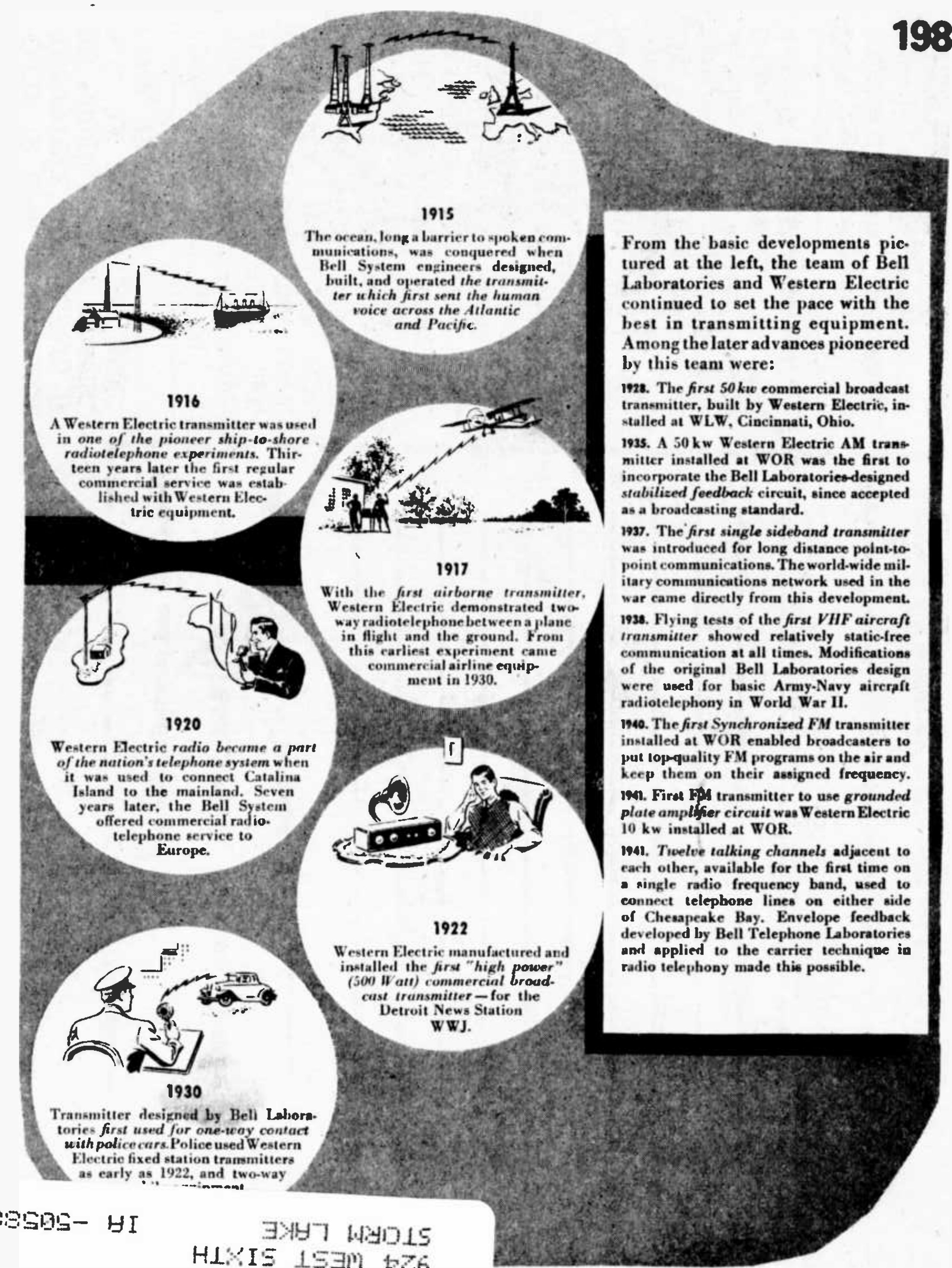
DECEMBER

THE HORN SPEAKER

1985



From the basic developments pictured at the left, the team of Bell Laboratories and Western Electric continued to set the pace with the best in transmitting equipment. Among the later advances pioneered by this team were:

1928. The *first 50 kw* commercial broadcast transmitter, built by Western Electric, installed at WLW, Cincinnati, Ohio.

1935. A 50 kw Western Electric AM transmitter installed at WOR was the first to incorporate the Bell Laboratories-designed *stabilized feedback* circuit, since accepted as a broadcasting standard.

1937. The *first single sideband transmitter* was introduced for long distance point-to-point communications. The world-wide military communications network used in the war came directly from this development.

1938. Flying tests of the *first VHF aircraft transmitter* showed relatively static-free communication at all times. Modifications of the original Bell Laboratories design were used for basic Army-Navy aircraft radiotelephony in World War II.

1940. The *first Synchronized FM* transmitter installed at WOR enabled broadcasters to put top-quality FM programs on the air and keep them on their assigned frequency.

1941. First FM transmitter to use *grounded plate amplifier circuit* was Western Electric 10 kw installed at WOR.

1941. *Twelve talking channels* adjacent to each other, available for the first time on a single radio frequency band, used to connect telephone lines on either side of Chesapeake Bay. Envelope feedback developed by Bell Telephone Laboratories and applied to the carrier technique in radio telephony made this possible.