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1930

RADIO

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WORLD

The First and Only National Radio Weekly

432nd Consecutive Issue—NINTH YEAR

Performance of the New MB-30 AC Tuner

A Test of Taste in Tone Quality

Magnetic Experiments with Parallel Circuits

Design of a Super for Short Waves Only

Debate on TRF versus Regeneration

Clay Model Shows Radio City's Beauty

Three Sue to Prevent Tax on Radio Sets

Why Reception Is Better Than in Previous Summers

30 Stations in Danger of Ouster for Law Defiance

Balkite Push-Pull Receiver



The Balkite A-5 Neutrodyne, one of the most sensitive commercial receivers ever developed, uses tubes, including 280 rectifier. Wholly AC operated, 105-120 v., 50-60 cycles; in a table model cabinet, genuine walnut, made by Berkeley & Gay.

Three stages of tuned RF, neutralized, so there's no squealing; easy tuning; operation on short piece of wire indoors perfectly satisfactory; no repeat tuning points; no hum; phonograph pickup jack built in; excellent tone quality; good selectivity. Two posts are accessible for connecting the field coil of a DC dynamic speaker.

The parts of which this receiver is made are all ace-high and the wiring is done with extreme expertness, by Gillilan. The power supply is exceptionally fine, the set being worked at 50% less than the rated capacity of the power transformer and chokes, assuring long life. There is no hum, as filtration is remarkably good.

The illuminated drum dial, at center, reads 0-100 at left, and at right has a blank space in which to write call letters. The little knob at left is the volume control, and the one at right is the AC switch. Each RF stage is filtered and bypassed individually, and the RF coils, tuning condenser and power transformer are separately and totally shielded. The lead from antenna binding post to antenna winding of the first coil is of shielded wire that is grounded. Also, the receiver as a whole is totally shielded, with metal chassis and metal under-cover, so there is no stray pickup. Cat. BAL-A5, list price \$135; net price.....

\$44.00

Silver-Plated Coils

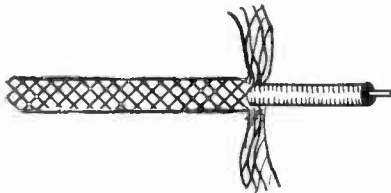


Wound with non-insulated wire plated with genuine silver, on grooved forms, these coils afford high efficiency because of the low resistance that silver has to radio frequencies. The grooves in the moulded bakelite forms insure accurate space winding, thus reducing the distributed capacity, and keep the number of turns and separation constant. Hence the secondary reactances are identical and ideal for gang tuning.

The radio frequency transformer may be perpendicularly or horizontally mounted, and has braced holes for that purpose. It has a center-tapped primary, so that it may be used as antenna coil with half or all the primary in circuit, or as interstage coupler, with all the primary on a screen grid plate circuit, or half the primary for any other type tubes, including pentodes. The three-circuit tuner has a center-tapped primary, also. This tuner is of the single hole panel mount, but may be mounted on a chassis, if preferred, by using the braced holes. Pair consists of RF transformer and three-circuit tuner, both for 0005 mfd. only. Order Cat., G-RF-3CT, list price \$5.00; net price.....

\$2.48

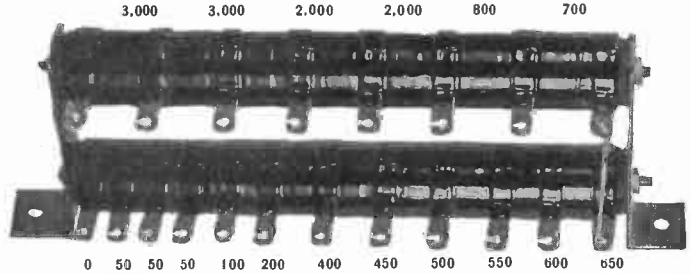
Shielded Lead-in Wire



No 18 solid wire, surrounded by a solid rubber insulation covering, and above that a covering of braided copper mesh wire, which braid is to be grounded, to prevent stray pick-up. This wire is exceptionally good for antenna lead-in, to avoid pick-up of man-made static, such as from electrical machines. Also used to advantage in the wiring of receivers, as from antenna post of set to antenna coil, or for plate leads, or any leads, if long. This method of wiring a set improves selectivity and reduces hum. This wire is now appearing on the general market for the first time although long used in the best grade of commercial receivers. Order Cat. SH-LW. List price 9c per ft.; net price per foot

5c

New Multi-Tap Voltage Divider



The resistance values between the twenty taps of the new Multi-Tap Voltage Divider are given above. The total is 17,100 ohms and affords nineteen different voltages.

The Multi-Tap Voltage Divider is useful in all circuits, including push-pull and single-ended ones, in which the current rating of 100 milliamperes is not seriously exceeded and the maximum voltage is not more than 400 volts. Higher voltages may be used at lesser drain.

The expertness of design and construction will be appreciated by those whose knowledge teaches them to appreciate parts finely made.

When the Multi-Tap Voltage Divider is placed across the filtered output of a B supply which serves a receiver, the voltages are in proportion to the current flowing through the various resistances. By making connection of grid returns to ground, the lower voltages may be used for negative bias by connecting filament center, or, in 227 and 224 tubes, cathode to a higher voltage.

If push-pull is used, the current in the biasing section is almost doubled, so the midtap of the power tubes' filament winding would go to a lug about half way down on the lower bank.

Order Cat. MTVD, list price \$6.50, net price.....

\$3.90

R-245 Set and Tube Tester

With the R-245 Tube and Set Tester you plug the cable into a vacated socket of a receiver, putting the removed tube in the tester, and using the receiver's power for making these tests: Plate current, on 0-20 or 0-100 ma. scale, changed by throwing a built-in switch; 0-60, 0-300 v. DC, changed by moving one of the tipped cables to another jack; filament or heater voltage (AC or DC), up to 10 volts, or any other AC voltage source, measured independently, up to 140 volts, including AC line voltage. Also screen grid voltage and screen grid current may be read by following connections specified in the new 8-page instruction sheet.

Each meter may be used independently. The two test leads, one red, the other black, with tip jack terminals, enable quick connections to meters for independent use.

With this outfit you can shoot trouble in receivers and test circuits using the following tubes: 201A, 200A, UX199, UX120, 210, 171, 171A, 112, 112A, 245, 224, 222, 226, 227, and pentodes.

When the R-245 is plugged into the vacated socket of a set and the removed tube is placed in the proper socket of the Tester, the receiver's power supplies all the voltages and currents. You see the vital tests made right before your eyes, all three meters registering immediately, all three reading at the same time.

Here are some of the questions answered by the Tester when plugged into the receiver:

What is the filament or heater voltage (no matter if DC or AC)? What is the plate voltage at the plate itself? What is the plate current drawn by the tube? Is the tube in good condition or does it require replacement? What is the grid bias voltage? What is the cathode voltage? What is the screen grid voltage? Besides, when meters are used independently, you can answer these questions: What is the screen grid current? What is the line voltage (no matter if AC or DC)? Is the circuit continuous or is it open? What is the total plate current drawn in the receiver? What are the respective B voltages at the B batteries or voltage divider?

Order Cat. R-245. List price, \$20; net price.....

\$11.40

Fixed Condensers

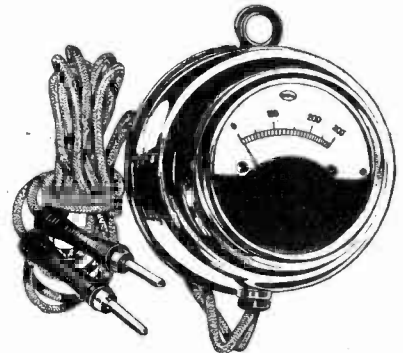


Dubilier Micon fixed condensers, type 642, are available at following capacities and prices:

.0001 mfd.	10c	.006	20c
.00025 mfd.	10c	.00025 with clips.	20c
.0003 mfd.	10c	All are guaranteed	
.00035 mfd.	15c	electrically perfect and	
.001	17c	money back if not	
.0015	17c	satisfied within five	
.002	18c	days.	

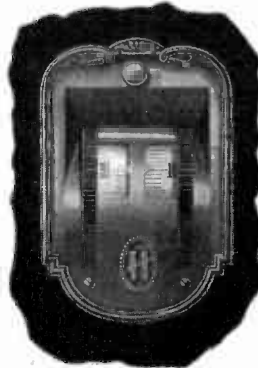
Order Cat. MICON .0001 etc. at prices stated.

High-Voltage Meters



0-300 v., 200 ohms per volt. Cat. F-300 @ \$2.59
 0-500 v., 253 o.p.v. Cat. F-500 @ 3.75
 0-600 v. AC and DC (same meter reads both); 100 ohms p.v. Order Cat. M-600 @ 4.95

Double Drum Dial

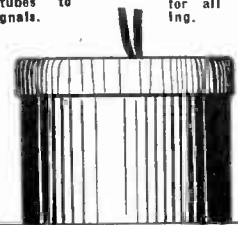


Hammarlund double drum dial, each section individually tunable. Order Cat. H-DDD. List price \$6.00; net price **\$3.00**

Shielded RF Choke

Excellent in detector plate circuit or in B-plus RF leads of radio frequency tubes to purify signals.

An efficient radio frequency choke in a shielded case. Inductance, 50 millihenries. Useful for all RF chocking.



In some instances one outlead is connected to case, so use this lead for B-plus or for ground, otherwise ground the case additionally. Order Cat. SH-RFC. List price, \$1.00; net price **50c**

Guaranty Radio Goods Co., 143 West 45th St., New York, N. Y. (Just East of Broadway)

Enclosed please find \$..... (Canadian must be express or post office money order, for which please ship:

- | | | |
|--|---|---|
| <input type="checkbox"/> BAL-AS @ \$44.00 | <input type="checkbox"/> Ft. of SH-LW | <input type="checkbox"/> M-600 @ \$4.95 |
| <input type="checkbox"/> MTVD @ 3.90 | @ 5c p. f. | <input type="checkbox"/> F-300 @ \$2.59 |
| <input type="checkbox"/> G-RF-3CT @ 2.48 | <input type="checkbox"/> H-DDD @ \$3.00 | <input type="checkbox"/> F-500 @ 3.75 |
| <input type="checkbox"/> R-245 @ 11.40 | <input type="checkbox"/> SH-RFC @ 50c | <input type="checkbox"/> MICON @ |
| <input type="checkbox"/> If C.O.D. shipment is desired put cross here. | | <input type="checkbox"/> MICON @ |

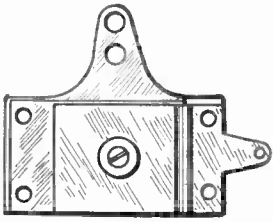
Your Name

Address

City State

Accurate Tuning Condensers and Accessories

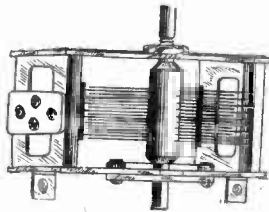
EQUALIZER



CAT. EQ-100 AT 35c

The most precise and rugged equalizing condenser made, with 20 mmfd. minimum and 100 mmfd. maximum, for equalizing the capacity where gang condensers are used that are not provided with built-in trimmers. Turning the screw alters the position of the moving plate, hence the capacity. Cross-section reveals special threaded brass bushing into which screw turns, hence you can not strip the thread. Useful in all circuits where trimming capacity of 100 mmfd. or less is specified. Maximum capacity stamped on

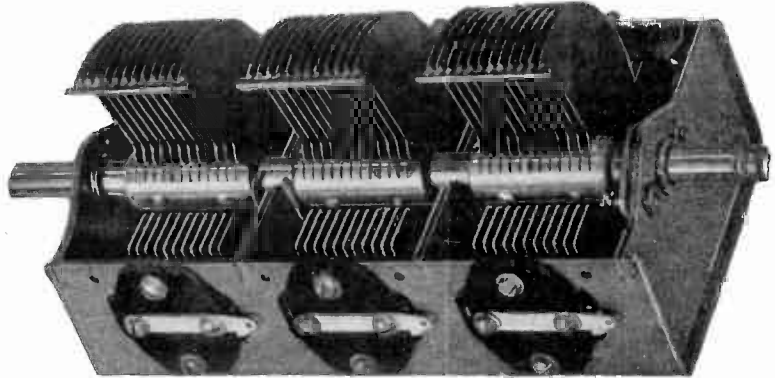
SINGLE .00035



CAT. KH-3 AT 85c

A single .00035 mfd. condenser with nonremovable shaft, having shaft extension front and back, hence useful for ganging with drum dial or any other dial. Shaft is 1/4 inch diameter, and its length may be extended 3/8 inch by use of Cat. XS-4. Brackets built in enable direct sub-panel mounting, or may be pried off easily. Front panel mounting is practical by removing two small screws and replacing with two 3/34 screws 3/4 inch long. Condenser made by Scovill Mfg. Co.

THREE-GANG SCOVILL .0005 MFD.



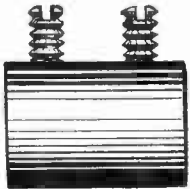
One of the finest, strongest and best gang condensers ever made is this three-gang unit, each section of full .0005 mfd. capacity, with a modified straight frequency line characteristic. The net weight of this condenser is 3 3/4 lbs. Cat. SC-3G-5 at \$4.80.

HERE is a three-gang condenser of most superior design and workmanship, with an accuracy of at least 98% per cent. at any setting, rugged beyond anything you've ever seen. Solid brass plates perfectly aligned and protected to the fullest extent against any displacement except the rotation for tuning. It has both side and bottom mounting facilities. Shaft is 3/8 inch diameter and extends at front and back, so two of these three-gangs may be used with a single drum dial for single tuning control. For use of this condenser with any dial of 1/4" diameter bore, use Cat. XS-8, one for each three-gang. Tension adjusters shown at right, either side of shaft.

SALIENT FEATURES OF THE CONDENSER

- (1)—Three equal sections of .0005 mfd. capacity each.
- (2)—Modified straight line frequency shape of plates, so-called midline.
- (3)—Sturdy steel frame with rigid steel shields between adjacent sections. These shields minimize electric coupling between sections.
- (4)—The frame and the rotor are electrically connected at the two bearings and again with two sturdy springs, thus insuring positive, low resistance contact at all times.
- (5)—Both the rotor and the stator plates are accurately spaced and the rotor plates are accurately centered between stator plates.
- (6)—Two spring stoppers prevent jarring when the plates are brought into full mesh.
- (7)—The rotor turns as desired, the tension being adjustable by set-screw at end.
- (8)—The shaft is of steel and is 3/8 inch in diameter.
- (9)—Each set of stator plates is mounted with two screws at each side of insulators, which in turn are mounted with two screws to the frame. Thus the stator plates cannot turn sideways with respect to the rotor plates. This insures permanence of capacity and prevents any possible short circuit.
- (10)—Each stator section is provided with two soldering lugs so that connection can be made to either side.
- (11)—The thick brass plates and the generous proportions of the frame insure low resistance.
- (12)—Provision made for independent attachment of a trimmer to each section.
- (13)—The steel frame is sprayed to match the brass plates.
- (14)—The condenser, made by America's largest condenser manufacturer, is one of the best and sturdiest ever made, assuredly a precise instrument.

RIGID AND FLEXIBLE LINKS



CAT. RL-3 AT 12c

The rigid link, Cat. RL-3, has two set-screws, one to engage each shaft, and is particularly serviceable where a grounded metal chassis is used, as the returns then need no insulation.



CAT. FL-4 at 30c

Flexible insulated coupler for uniting coil or condenser shafts of 1/4 inch diameter. Provides option of insulated circuits.

EXTENSION SHAFTS, TWO SIZES



CAT. XS-4 AT 10c

Here is a handy aid to salvaging condensers and coils that have 1/4" diameter shafts not long enough for your purpose. Fits on 1/4" shaft and provides 3/8" extension, still at 1/4". Hence both the extension shaft and the bore or opening are 1/4" diameter. Order Cat. XS-4.

For condensers with 3/8" diameter shaft, to accommodate to dials that take 1/4" shaft, order Cat. XS-8 at 15c.

.00035 TWO-GANG

A two-gang condenser, like the single type, KH-3, but consisting of two sections on one frame, is Cat. KHD-3, also made by Scovill. The same mounting facilities are provided. There is a shield between the respective sections. The tuning characteristic is modified straight frequency line. Order Cat. KHD-3 at \$1.70.

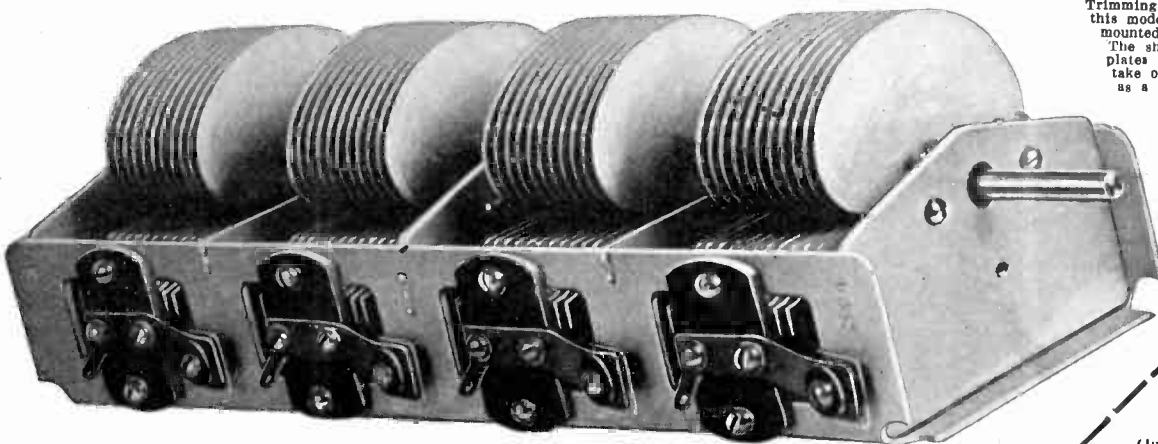
DRUM DIAL

CAT DD-0-100 @ \$1.50

A suitable drum dial of direct drive type is obtainable for 1/4" shafts or 3/8" shafts, and with 0-100 scales. An escutcheon, is furnished with each dial.



FOUR-GANG .00035 MFD. WITH TRIMMERS BUILT IN



Trimming condensers are built into this model. The condenser may be mounted on bottom or on side. The shaft is removable, also the plates are removable, so you can take out one section and operate as a three-gang.

Four-gang .00035 mfd. with trimmers built in. Shaft and rotor blades removable. Steel frame and shaft aluminum plates. Adjustable tension at rear. Overall length, 11 inches. Weight, 3 1/2 lbs. Cat. SPL-4G-3 @ \$3.95.

SHORT WAVES

Tuning condensers for short waves, especially suitable for mixer circuits and short-wave adapters. These condensers are .00015 mfd. (150 micro-microfarads) in capacity. They are suitable for use with any plug-in coils. Order Cat. SW-S-150 @ \$1.50. To provide regeneration from plate to grid return, for circuits calling for this, use .00025 mfd. Order Cat. SW-S-250 @ \$1.50.

A four-gang condenser of good, sturdy construction and reliable performance fits into the most popular tuning requirement of the day. It serves its purpose well with the most popular screen grid designs, which call for four tuned stages, including the detector input. Ordinarily a good condenser of this type costs, at the best discount you can contrive to get, about twice as much as is charged for the one illustrated and even then the trimming condensers are not included. The question then arises, has quality been sacrificed to meet a price? As a reply, read the twenty-six points of advantage. The first consideration was to build quality into the condenser. The accuracy is 99 3/4 %.

GUARANTY RADIO GOODS CO., 143 West 45th St., N. Y. C. City (Just East of Broadway.)

Enclosed find \$.....for which ship designated parts:

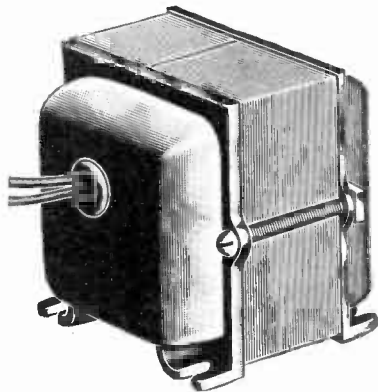
Street Address..... City..... State.....

the following merchandise as advertised:

- Cat. XS-4 @ 10c
- Cat. KH-3 @ 85c
- Cat. XS-8 @ 15c
- Cat. KHD-3 @ \$1.70
- Cat. RL-3 @ 12c
- Cat. DD-0-100 @ \$1.50
- Cat. EQ-100 @ 35c
- Cat. SC-3 G-5 @ \$4.80
- Cat. SPL-4 G-3 @ \$3.95
- Cat. FL-4 @ 30c
- Cat. SW-S-150
- Cat. SW-S-250

ALL PRICES ARE NET

New Polo Power Transformers and Chokes

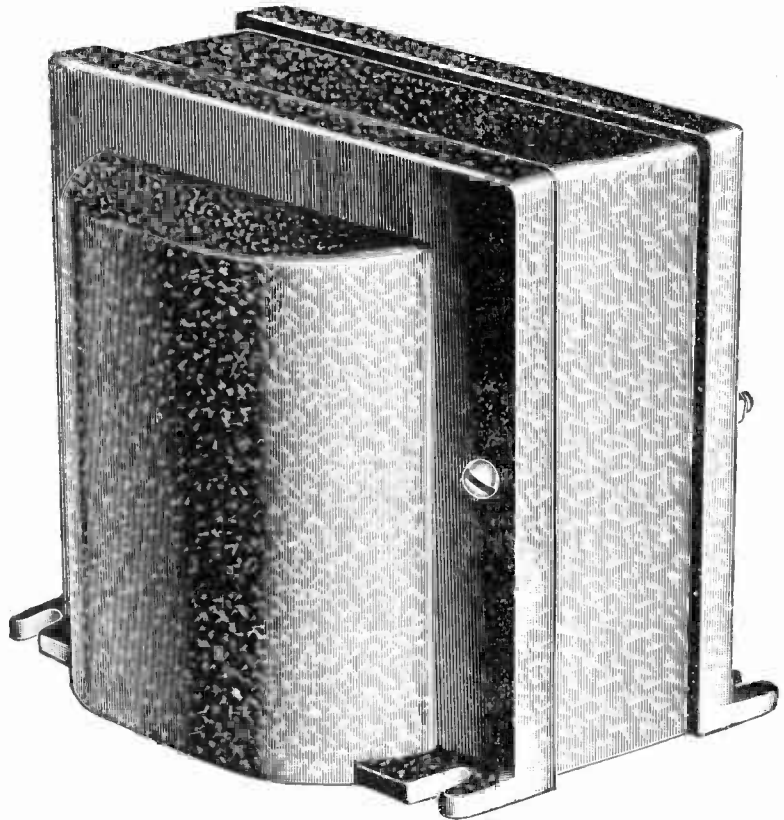


Shielded single choke, 200 ohms D.C. resistance, non-saturable at 100 milliamperes, with two black outleads, each 6 inches long. For filtration of B supplies. Inductance, 30 henrys. Cat. SH-S-CH, price.....\$5.00

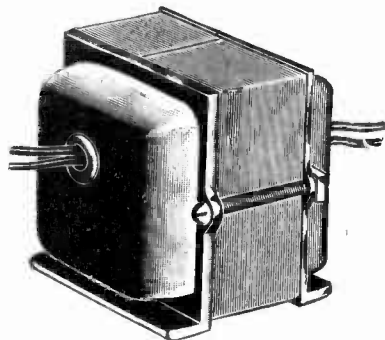
The shielded single choke will pass 100 ma. One will suffice if the current is 100 ma. or less, for filtration of B supplies, provided the capacity at the filter output is 8 mfd. or more. Use two such shielded chokes if less than 8 mfd. is used at the filter output. Also, the shielded single choke may be used as in the power tube circuit for an output filter. In this connection use at least 2 mfd. for the capacity section of the filtered speaker output. Order Cat. SH-S-CH @.....\$5.00

The shielded double choke may be used for filtration where the B current is 60 ma. or less, with relatively small filter capacities, no less than 4 mfd. at the output, however. This choke consists of one winding, center-tapped. Its use is especially recommended for 1Y1, 171A, 245 or 210 push-pull output. Connect the black leads (extremes of windings) to plates of the push-pull tubes, red center tap to B plus, and the speaker may be connected directly to plates without any direct current, but only signal current, flowing through the speaker. This system is applicable only to push-pull. Order Cat. SH-D-CH @.....\$6.00

In the same type of case a 20-volt secondary filament transformer, for 110 volts, 50-133 cycle, may be obtained for use in conjunction with dry rectifiers, such as Kuprox, Westinghouse, Benwood-Linze and Elkon, in dynamic speakers or A battery eliminators. Not made for 25 or 40 cycles. Order Cat. SH-F-20 @.....\$2.50



245 Power Transformer for use with 280 rectifier, to deliver 300 volts D.C. at 100 milliamperes, slightly higher voltage at lower drain, and supply filament voltages. Cat. 245-PT price.....\$8.50

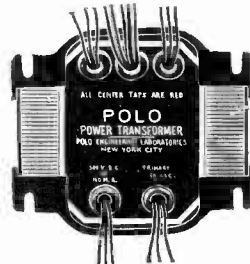


Twenty-volt filament transformer, 110 v. 50-133 cycle input, for use in conjunction with dry rectifiers. It will pass 2.25 amperes.

In a different type case, square, of cadmium plated steel with four mounting screws built in, size 4 1/4 inches wide by 3 3/4 inches high by 4 inches front to back, a 50-60 cycle filament transformer is obtainable with the same windings as the 245 power transformer, except that the high voltage secondary is omitted. Order Cat. 245-FIL @.....\$4.50
 For 40 cycles order Cat. 245-FIL-40 @.....7.00
 For 25 cycles order Cat. 245-FIL-25 @.....8.50
 [Any of the above three in the same case as the 245 power transformer, @ \$1.00 extra. Add PTC after the Cat. number.]

A single choke, unshielded, 65 ms rating, 30 henrys inductance, for B filtration or single output filter of speaker, is our Cat. US-S-CH @.....\$1.25

The Polo 245 power transformer is expertly designed and constructed, wire, silicon grade A steel core and air gap large enough to stand the full rated load. The primary is for 110v A.C., 50-60 cycles, tapped for 82.5 volts in case a voltage regulator, such as a Clarostat or Amperite, is used. The black primary lead is common. If no voltage regulator is used, connect black lead to one side of the A.C. line, green lead to the other side of the line, and ignore red lead, except to tape the end. For use with a voltage regulator (82.5-volt primary) use red lead and ignore the green except to tape the end. The secondaries are: high voltage for 280 plates, with red center tap to ground; 2.5 volts, 3 amperes, red center tap to C plus, for 245 output, single or pushpull; 5 volts, 2 amperes, red center tap, as positive B lead, for filament of 280 tube; 2.5 volts, 16 amperes, red center tap to ground, for 224, 227 and pentode tubes, up to nine heater type tubes. Hence there are five windings.



Bottom view of the 245 power transformer. All leads are plainly marked on the nameplate, including the top row.

A special filament transformer, 110 v., 50-60 cycles, with two secondaries, one of 2.5 v. 3 amp. for 245s, single or push-pull, other 2.5 v. 12 amperes for 224, 227, etc., both secondaries center-tapped. Shielded case, 6 ft. AC cable, with plug. Order Cat. F-2.5-D @.....\$3.75

The conservative rating of the Polo 245 power transformer insures superb results even at maximum rated draw, working up to twelve tubes, including rectifier, without saturation, or overheating due to any other cause. This ability to stand the gaff requires adequate size wire, core and air gap, all of which are carefully provided. At less than maximum draw the voltages will be slightly greater, including the filament voltages, hence the 16 ampere winding will give 2.25 volts at maximum draw, which is an entirely satisfactory operating voltage, increasing to 2.5 volts maximum as fewer than a total of nine RF, detector and preliminary audio tubes are used.

The avoidance of excessive heat aids in the efficient operation of the transformer and in the maintenance of good regulation, for excessive heat increases the resistance of the windings.

The transformer is equipped with four slotted mounting feet and a nameplate with all leads identified. It is one of the very finest instruments on the radio market.

Highest Capacity of Filament Secondary

SPECIAL pains were taken in the design and manufacture of the Polo 245 power transformer to meet the needs of experimenters. For instance, excellent regulation was provided to effect minimum change of voltage with given change in current used. Also, the 2.5 volt winding for RF, detector and preliminary audio tubes, was specially designed for high current, to stand 16 amperes, the highest capacity of any 245 power transformer on the market. Hence you have the option of using nine heater type tubes. The shielded case is crinkle brown finished steel, and the assembly is perfectly tight, preventing mechanical vibration.

The power transformer weighs 11 1/2 lbs., is 7 inches high, 4 3/4 inches wide, and 4 1/4" front to back, overall.

Elevating washers may be used at the mounting feet to clear the outleads, or holes may be drilled in a chassis to pass these leads, and the transformer mounted flush.

Advice in Use of Chokes and Condensers in Filter

With the 245 power transformer either one or two single chokes should be used, or a shielded double choke, depending on the current drain and the capacity of filter condenser used. Where the capacity at the output is 8 mfd. or more for a drain of 65 to 100 ma., a single choke will suffice (Cat. SH-S-CH), but where smaller output capacity than 8 mfd. is used on such drain, two such chokes should be used in series. Next to the rectifier, in either instance, use a 1 or 2 mfd., 350 A.C. working voltage rating condenser (D.C. rating, 1,000 volts). You may use your choice of capacity at the midsection.

If the drain is to be 65 milliamperes or less, the double choke, Cat. SH-D-CH, may be used for filtration, instead of two single shielded chokes.

The Polo 245 power transformer may be obtained for 25 cycles or 40 cycles on special order, as these are not stocked regularly, and remittance must accompany order. The same guaranty attaches to them as to all other Polo apparatus—money back if not satisfied after trial of five days. In these the primary and secondary voltages and taps are the same, only the case is deeper (front to back) because of larger core and wire for lower frequency.

For 40 cycles order Cat. 245-PT-40 @.....\$9.50
 For 25 cycles order Cat. 245-PT-25 @.....\$12.50

[Note: The filter for 40 cycles should consist of two shielded single chokes, Cat. SH-S-CH, with 2 mfd. next to the rectifier and 4 mfd. minimum at the joint of the two chokes and at the end of the filter. For 25 cycles the same holds true, except that the output capacity at end of chokes should be 8 mfd. minimum.]

We Make Special Transformers to Order

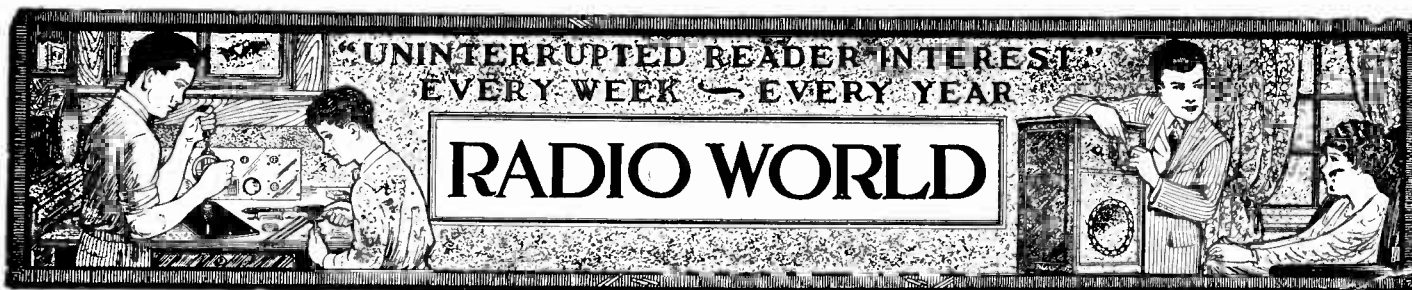
Polo Engineering Laboratories, 143 West 45th St., New York, N. Y.

- Enclosed please find \$_____ for which ship at once:
- | | |
|---|--|
| <input type="checkbox"/> Cat. 245-PT @.....\$8.50 | <input type="checkbox"/> Cat. 245-FIL @.....\$4.50 |
| <input type="checkbox"/> Cat. 245-PT-40 @ 9.50 | <input type="checkbox"/> Cat. 245-FIL-40 @ 7.00 |
| <input type="checkbox"/> Cat. 245-PT-25 @ 12.00 | <input type="checkbox"/> Cat. 245-FIL-25 @ 8.50 |
| <input type="checkbox"/> Cat. SH-S-CH @ 5.00 | <input type="checkbox"/> Cat. SH-F-20 @ 2.50 |
| <input type="checkbox"/> Cat. SH-D-CH @ 6.00 | <input type="checkbox"/> Cat. UN-S-CH @ 1.25 |
| <input type="checkbox"/> F-2.5-D @.....3.75 | |

Note: Canadian remittance must be by post office or express money order.

If C.O.D. shipment is desired, put cross here. No C.O.D. on 25 and 40 cycle apparatus. For these full remittance must accompany order. The 25 and 40 cycle apparatus bears the 50-60-cycle label, but you will get actually what you order.

Name.....
 Address.....
 City..... State.....



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NINTH YEAR
 Latest Circuits and News
 Technical Accuracy Second to None

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Results on New MB-30

By Neal Fitzalan

[In the June 21st issue of RADIO WORLD were published sensitivity and selectivity curves of the new MB-30, and last week, in the June 28th issue, were published the circuit diagram and two views of the receiver, together with a list of parts and a discussion of design features. Herewith are additional details.—Editor.]

THE isolation of the several cathode, screen grid, and plate circuits has been done thoroughly in the MB-30 by using individual grid bias resistors for all the tubes, radio frequency choke coils in all the screen and plate return leads and in the plate circuit of the detector, and a relatively large by-pass condenser for every resistor and choke.

This thorough filtering of the circuits insures steady voltages on the elements with respect to signal variations and thus it also insures stability as far as feedback through the voltage supply is concerned. And there is yet another filter that must be mentioned. In the plate circuit of the detector there exist radio frequency signal currents as well as audio frequency currents. These radio frequency currents are of considerable magnitude, and they must be kept out of both the audio amplifier and the voltage supply. Therefore a low-pass filter consisting of two .00025 mfd. condensers C22 and C23 across the line and a radio frequency choke in series are used.

This type of filter is many times more effective than a single by-pass condenser which is ordinarily used. In fact, an extremely small fraction of the radio frequency current gets past it. Thus the radio frequency currents are thoroughly prevented from getting into the voltage supply.

Shielding

It would be of no avail to isolate the bias resistors, the screen circuits, and the plate circuits by means of by-pass condensers and choke coils if no provision were made for eliminating inductive and capacitive back coupling. In super-sensitive circuits like this it is necessary to do a very thorough shielding job for the slightest coupling between one stage and a preceding stage would be sufficient to upset stability.

Since it is absolutely necessary to carry the isolation of the stages to the coils, tuning condensers, and the tubes in order to prevent back coupling, every coil is put inside an aluminum shield can of as large dimensions as practical. This shielding completely eliminates all capacity coupling among the coils and thus does away with one chance for oscillation. It also prevents inductive coupling to a high degree, so that there is practically no coupling remaining.

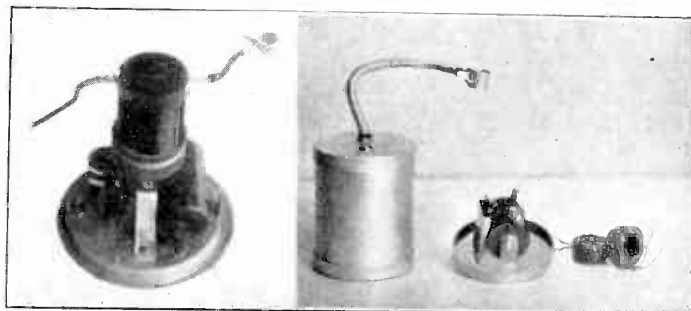
But the shielding does not stop with the coils. It is also carried to the tubes themselves so that capacity and inductance coupling between the elements of any two tubes is eliminated. Even the tuning condenser units are surrounded by shields, which eliminate, or effectively reduce, electric coupling between the stator plates of any two condenser sections.

As the radio frequency amplifiers in the circuit are of the screen grid type there will be practically no back coupling between the plate and the grid of any tube, since this has been minimized by the internal shielding. Thus every avenue of feedback has been closed. There remains a stable circuit, and the fourth principal characteristic for a good radio frequency tuner and amplifier has been met.

Refinements of the Circuit

The primary of the antenna coupler is tapped for long and short antennas. This helps to equalize the characteristics of different antennas with respect to the receiver.

The amplification in the receiver is controlled with a 10,000 ohm potentiometer by means of which the screen voltage on three of the screen grid tubes may be varied up to 67 volts, or up to whatever voltage is applied across the potentiometer.



A VIEW OF ONE OF THE TUNED RADIO FREQUENCY TRANSFORMER USED IN THE MB-30 TUNER. AT THE TOP ARE THE LEADS THAT GO TO THE CONDENSER STATOR AND THE GRID CAP. AT THE BOTTOM ARE THE RADIO FREQUENCY CHOKE AND BY-PASS CONDENSER ASSOCIATED WITH THE COIL.

VIEW OF THE UNTUNED RADIO FREQUENCY TRANSFORMER USED IN THE MB-30 TUNER. AT LEFT IS THE COMPLETE ASSEMBLY, IN THE MIDDLE THE COIL AND CONDENSER AS THEY APPEAR WHEN THE SHIELD IS REMOVED. AT RIGHT ARE THE TWO WINDINGS.

It will be noted that the screen of the first tube is connected directly to the intermediate voltage tap and that this is not included in the volume control. The object of this is to prevent cross talk. If the screen voltage is always the optimum for amplification there will be practically no detection in the first tube, and since there is no detection cross talk will not be present.

The reason the first band pass filter is put before the first tube is also that this eliminates cross talk since the band pass filter accepts the desired station only and suppresses any signal that might cause cross talk. If the untuned transformer were placed first and the band pass filter second, there would be no discrimination ahead of the first tube and considerable cross talk would result when there is a strong undesired station present. This cross talk would be especially noticeable when the strong station is operating on a frequency half as great as the frequency to which the receiver is tuned, or very nearly one half. Such possibilities are many for all stations above 1,100 kc would be subject to cross talk interference, as well as stations operating on this frequency.

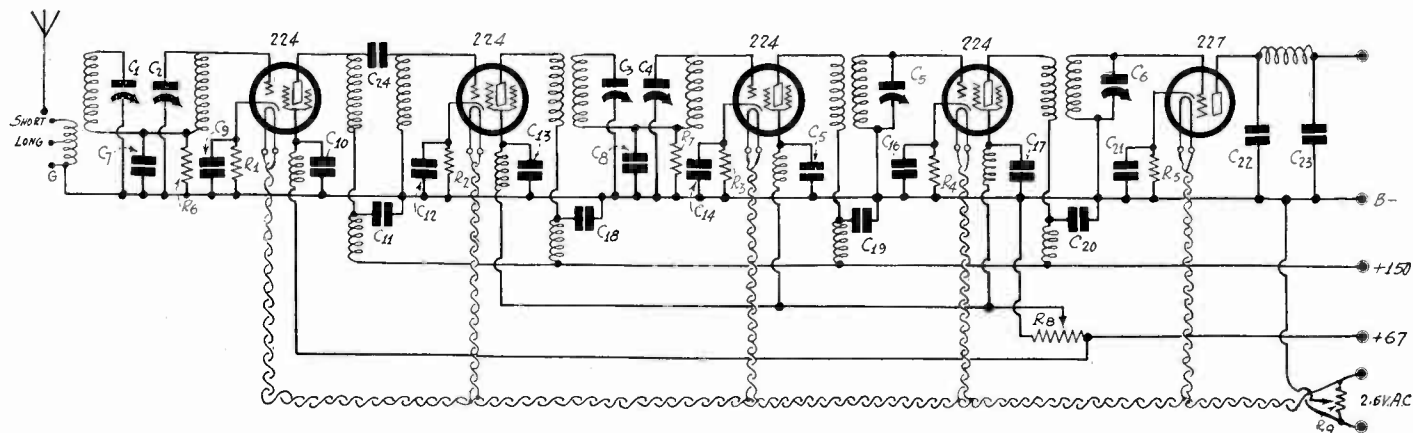
The possibility of cross talk due to detection in the first tube is practically eliminated by the simple method of tuning the input to the first tube very sharply.

Thus two precautions have been taken to prevent cross talk, namely, tuning sharply ahead of the first tube and maintaining optimum screen voltage on the first tube.

Stopping of Oscillation

In the process of design of the MB-30 it was found that when a mid-tapped resistor was connected across the heater circuit and the tap grounded, as is customary in this type of circuit, the amplifier oscillated and no adjustment in the circuit would stop it. Then it was discovered by accident that when a large condenser was connected between the center-tap and ground the oscillation stopped.

This led to the suspicion that the inductance in the halves of



THE CIRCUIT DIAGRAM OF THE MB-30 TUNER AND RADIO FREQUENCY AMPLIFIER. NOTE THAT ALL THE HEATER LEADS ARE TWISTED TO PREVENT HUM FROM ENTERING THE SIGNAL CHANNEL AND ALSO TO PREVENT THE HEATER CIRCUIT FROM ACTING AS A MEANS OF RADIO FREQUENCY COUPLING.

the center-tapped resistance constituted a common impedance among the circuits, and this suspicion proved to be correct. Consequently a non-inductive center-tapped resistance was substituted, which worked without any condenser from the center tap to ground. Hence the circuit diagram shows only the resistance. It is understood that this resistance is non-inductively wound.

It was also found that the circuit oscillated if the tuning condensers were not shielded. Consequently in the final design the two condenser gangs are encased in metal boxes. Again, it was found that the tubes had to be shielded and that the shielding had to extend considerably above the caps of the screen grid tubes. The object of this shielding was not only to prevent oscillation in the circuit but also to prevent direct pick-up of signals by the grids.

Even Appearance of Broadness Avoided

If considerable direct pick-up exists the tuner appears to be broad because not all the signal is forced through the pre-selector. When the tubes and the screen leads were well shielded there was practically no pick-up by the tubes or the grids, which was proved by the fact that when the antenna binding post was shielded no signals at all could be picked up. Thus all the signal that entered the circuit entered by way of the antenna.

There is one precaution that must be taken when shields are put around the tubes, and that is to provide ventilation to prevent the tubes overheating. The ventilation is secured by the chimney effect of the shields, a number of small holes being cut near the base of each tube and one hole on the top. Thus the heat generated in the tube is carried away by a continuous draught of air. The hole through which the grid lead enters the shield also helps in carrying away the heated air.

Trimmer Adjustment

On the cover of each condenser housing are three small holes. Directly under each hole is the adjusting screw of a trimmer condenser and the object of the holes is to provide access to these trimmers after the condenser housings have been put in position. The method of adjusting the trimmers was illustrated in the photograph on the front cover of the June 28th issue, which showed an operator in the act of making an adjustment with a dielectric screwdriver.

The construction of the tuned radio frequency transformers is illustrated in Fig. 3. At the top are the leads to the grid cap and to the condenser stator. The long winding on the inside tube is the secondary and the short winding near the bottom of the coil in the slot of the outside tube is the primary. This transformer is raised above the bottom shield by means of two brackets, one of which is visible. At the left of the transformer, in the background, is the radio frequency choke coil that is connected in series with the primary, and on the right is the by-pass condenser that is connected between the junction of the primary and the choke and ground. Over this assembly one of the larger diameter shield cans fits.

This shielding of both the transformer and the filter effectively prevents any signal current or magnetic and electric fields from escaping. All the transformers are treated in the same manner.

The untuned radio frequency transformer is contained in a smaller shield can and is illustrated in Fig. 4. At the left of the figure is the complete assembly, in the middle, the transformer as it is mounted inside the can together with the condenser C24 and at the right are the two coils of the untuned transformer.

Band Width Constant

A valuable feature of the MB-30 tuning characteristic is that the band width of the band pass filter is essentially constant throughout the whole broadcast spectrum. This constancy is brought about by using capacity coupling between the tuned cir-

cuits in the band pass filters and inductive coupling in the radio frequency transformers. When the coupling is inductive the band width is directly proportional to the frequency, and therefore it would be nearly three times as wide at 1,500 kc as at 550 kc. When the coupling is capacitive the band width is inversely proportional to the frequency and for that reason would be nearly three times as wide at 550 kc as at 1,500 kc. When the two types of coupling are combined, and when the degree of coupling of each kind is properly adjusted, the band width is the same throughout the broadcast spectrum.

The detection system employed in the amplifier is the power type, that is, high negative bias. This was selected because it is hard to overload. There is a slight deviation in the design of the detector from the MB-29. A single resistor R5, with a large condenser across it, is used for bias. The method of augmenting the direct current used in the MB-29 is not used in the MB-30. Consequently the value of the bias resistor is 20,000 ohms. In order to make this work as a power detector it is necessary to apply a rather high voltage to the plate of the detector tube, say 180 volts.

The volume is controlled with a 10,000 ohm potentiometer (not 50,000) placed across the 67-volt section of the B supply. The slider of this potentiometer is connected to all the screen grids except the first. The control is effective in adjusting the amplification without being very critical.

Performance of MB-30

The MB-30 is especially suitable for those who delight in tuning in distant stations, for it is both very sensitive and very selective. One of these sets was connected up in a fairly good location near Boston one afternoon and in a few minutes 29 stations were picked up. In the evening stations may be heard without interference from each other on nearly all divisions of the dial, provided atmospheric conditions are such that too much static is not picked up when the volume control is advanced.

A standard type of AC switch is mounted on the chassis, symmetrically with the volume control, so that it may be used, if desired, for controlling the power amplifier unit. This is convenient when the audio amplifier and the power supply are placed at some distance from the tuner, say in a closet or down in the cellar.

In this connection it is well to call attention again to the radio frequency output filter in the plate circuit of the detector. It consists of a .00025 mfd. condenser across the line, a radio frequency choke of special design in series with the line, and finally another .00025 mfd. condenser across the line. This filter separates the radio and audio frequency components in the plate circuit of the detector, passing the radio frequency components to ground and letting practically no part of them to the audio amplifier, and passing the audio components to the audio amplifier without attenuating any of them.

This filter has a practical bearing on the separation of the tuner and the audio frequency amplifier. Since the radio frequency currents are effectively excluded from the high signal voltage line to the audio amplifier, there will be no radiation even if the line is quite long. And since there is no radiation there is no feed back between the antenna and the output. The amplifier is not converted into an oscillator.

Location Hints

If the tuner and the audio amplifier are to be separated a considerable distance, the filament transformer feeding the tubes in the tuner should be near the tubes it serves. The necessity for this is obvious. The heater current is very high so that if the secondary leads have considerable length the voltage drop in these leads would be very great. Consequently the filament transformer should be near the tuner and RF amplifier and the primary leads should run over to the rest of the power supply. It is an easy matter to wire the circuit so that the switch on the chassis can be used for turning on and off both the transformer and the rest of the power supply apparatus, even when the two parts of the circuit are some distance apart.

A Gauge of Tone Taste

By *J. McWilliams Stone*

President, Operadio Manufacturing Co.

GOOD tone quality has always been one of the three or four outstanding prerequisites of any radio set. Today, a set, no matter how selective, sensitive, or beautiful in appearance, cannot be sold if the tone quality is inferior. A great deal of research has been done by the entire industry during the past year to determine exactly what tone is wanted by the American public. The loudspeaker is the mouthpiece, and it has fallen to the loudspeaker manufacturer to determine just what the public wants. This has been done in various ways; by close co-operation with the public's pulse, by independent research, and by scientific blindfold tests. The latter method is perhaps the most commonly used, and is invariably the final court in the matter of tone taste.

What Is Public's Taste?

Thousands upon thousands of dollars have been spent to determine what this taste is; for example, to simulate the exact conditions under which we listen to the radio at home, some manufacturers have taken over apartments for the sole purpose of making these tone tests.

One of the most comprehensive tests the writer knows of is as follows: In a living room of normal size were placed twelve of the most popular radio receivers. They were arranged side by side on an arc of a circle. At the center of the circle was an easy chair and a row of twelve buttons. The listener could instantly shift, by merely pressing a button, from one receiver to another. The sets were all back of a curtain, no one knowing the order of arrangement.

Automatic volume controls kept all sets on exactly the same sound output so that there could be no confusion between quality and volume.

Tone Taste Determined

A special broadcast from an excellent local station was arranged for several nights at the same hour. The first num-

ber was a piano solo; the next a piano and violin; and then came a vocal solo, and so forth, working in the various instruments up to a complete orchestration, and the voices to a chorus, then combinations of both.

This test consisted of one hundred and four votes. Among the voters were renowned musicians—people who enjoyed music, and many whose musical education had come since the advent of radio.

Test Took Full Week

Each person cast his vote—first, second and third choice—at different volumes.

This test took a week to complete, but the final graph of the various votes showed a curve which gave a comprehensive cross-section of the average tone taste.

Interesting changes have come about during the past year. The over-accentuated, boomy bass that has been so common in most radios during the past two years, will be less conspicuous. People have been wanting too much bass because they were deprived of it entirely in the early days of radio. The pendulum is coming to rest now and the loud speakers this year will be more scientifically correct than ever before.

Greater Speaker Sensitivity

The moving coil type, or popularly known as the electro-dynamic speaker, will be used practically exclusively throughout the industry during 1930. Its field strength has been increased to give it greater efficiency. Its moving parts have been lightened so that its sensitivity at the very low volumes is most acute. You will be delighted at the way a low organ note comes through distinctly, and in proportion, when the receiver is operating very, very softly.

The speakers have been made more rugged. In the past many "terrible sounding" sets were not terrible at all, but had been condemned because of mechanical difficulties in the loud speakers.

Laughs Greet Claim Of Byrd's Operator

The reception to Rear Admiral Byrd and his officers and crew on their return from the Antarctic was broadcast through two large chains to the nation.

Howard F. Mason, of Seattle, Wash., Byrd radio operator, was caught in a crowd jam and couldn't get into an automobile at the Battery for the procession to City Hall. When he protested to bystanders that he was a member of the Byrd expedition they laughed in his face. "He took the subway uptown to 'The New York Times' office and without informing any one of his plight asked for the radio room. He had frequently talked to 'The Times' operators from Little America, and, after making a face to face acquaintance with men he felt he knew, he asked permission to listen to the City Hall reception.

When it was over he philosophically remarked:

"I guess I enjoyed it better from here."

GOLENPAUL JOINS AEROVOX

Charles Golenpaul, well known in the radio trade as an effective and courteous salesman, is now with Aerovox. He is in the sales department and is concentrating on electrolytic condensers for power supplies and vitreous wire resistors, besides other leading Aerovox products.

JENKINS APPOINTS AYER

Oliver Ayer has been appointed sales manager of the Jenkins Television Corporation of Jersey City, N. J. Mr. Ayer formerly was with Fada.

WNYC Makes New Full-Time Bid

Washington.

Another attempt is being made by WNYC, the station owned by the City of New York, to obtain full time. It now shares 570 kc (526 meters) with WMCA. Between this channel and WEAJ, on 660 kc (454 meters) is WGBS, 600 kc (500 meters), due to a court order having enjoined the Federal Radio Commission from shifting WGBS back to its former position. Hence there is a difference of 30 kc between WGBS and the pair on 570 kc.

Edward L. Corbett, special assistant corporation counsel, acting for the city, saw Commissioner William D. L. Starbuck about the new application.

The Commission previously denied the request and the Supreme Court refused to review the case.

Arctic Transmission To Begin in October

The schedule of transmission to the Bartlett East Greenland Expedition by KDKA, Pittsburgh, has been announced. This is the eighth annual Arctic broadcast series.

The station will send messages to Capt. Bartlett and officers and crew each Saturday on 305.9 meters (980 kc), beginning about 11 p. m., from October 4th to February 14th, inclusive.

Oil Company Claims It Needs Channels

Washington.

Petroleum companies operating in the Southwest are entirely dependent on radio for communication because land-wire service in the barren country cannot be obtained or maintained on account of the prohibitive cost, according to a brief filed with the Court of Appeals of the District of Columbia by the Western Radio Telegraph Company in support of the grant of channels to it.

The Western company was formed to take over and operate the radio stations of the Skelly Oil Company, Phillips Petroleum Company, Continental Oil Company, and the Texas Pipe Line Company, the attorneys for the company, Fayette B. Dow and Horace L. Lohnes, stated in the brief.

The brief was filed because four companies which were applicants before the Federal Radio Commission for blocks of frequencies, and were denied either in whole or in part, have appealed from the Commission's action in giving frequencies to the Western Company.

NEW CORPORATIONS

Finestone Radio Corp.—Atty. J. R. Kweller, 270 Broadway, New York, N. Y.
Federal Radio, Inc., Camden, N. J.—Atty. Oscar B. Redrow, Camden, N. J.
Abelotz Radio Shop—Atty. A. Honig, 25 West 43rd St., New York, N. Y.
Master Radio System, Inc., Newark, N. J., Radio supplies—Filed by company.
Hawley, Inc., Wilmington, Del., radios, wireless—Corp. Service Co.
Sheridan Radio Sales Co.—Attys. Otterbourg, Steindler & Houston, 200 5th Ave., New York, N. Y.

[This is one of a series of articles on experiments for novices.—
Editor.]

A MAGNETIC field acts radially outward or inward, i. e., away from or toward the conductor whence it originates, depending of course on whether the current about the wire is increasing or decreasing. And we have seen that the current changes in one conductor affect the electrical condition of a neighboring circuit, in proportion to the strength of the current in the exciting conductor but in addition also inversely as the square of the distance between them.

The magnetic effect of current flow in parallel circuits is the next step. Fig 1A shows a scheme the experimenter can copy very easily. The wire and switch may be obtained cheaply.

Figs. 1A, 1B and 1C provide one of the most vivid demonstrations of the resultant mechanical displacement that occurs when a current flows along a few coils of wire so arranged that they may slide along a broomstick easily.

When a current of electricity flows along a wire the conductor flux is "up" on one side and "down" on the other, with respect to the observer who looks at right angles to the conductor's path. In consequence the adjacent conductor fluxes are opposite in direction. As oppositely acting fluxes always attract, because they represent dissimilar poles, the wires of the loosely distributed coil turns are drawn together with a quick snap directly the switch is closed, as per Fig. 1B.

Responsive to Weak Impulses

Fig. 1C shows the coils of Fig. 1A split up and a portion of them has been removed from the broom handle and replaced again reversely with respect to the original winding direction. The result is that if the switch be closed again the coils now fly apart in two parts. One at each end of the broom-handle now.

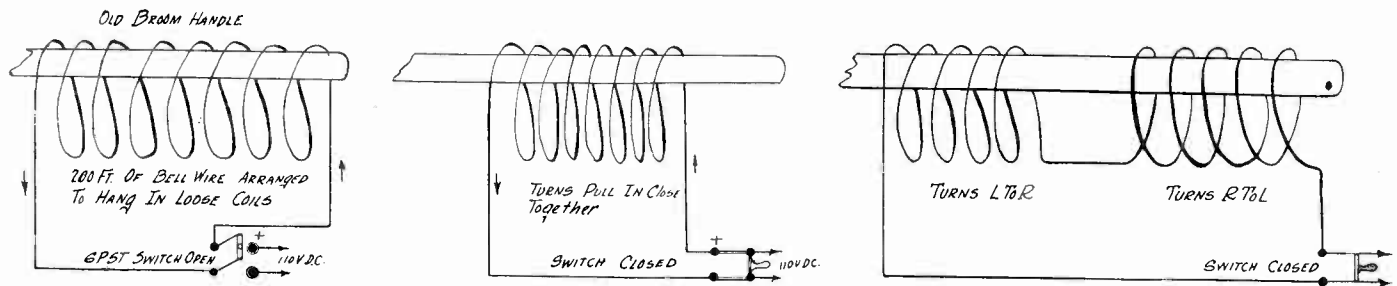


FIG 1A (left)

ARRANGEMENT OF A CIRCUIT TO SHOW THE EFFECT OF PARALLEL CURRENTS.

FIG 1B (center)

WHAT HAPPENS WHEN SWITCH IS CLOSED

FIG 1C (right)

REVERSAL OF PORTION OF TURNS CAUSES REPULSION PROVING THAT PARALLEL CURRENTS ATTRACT.

QUESTIONS

- (1)—A sensitivity as great as $\frac{1}{4}$ microvolt per meter is quite unattainable in practical receivers because long before this sensitivity is reached the circuit becomes unstable.
- (2)—The selectivity of a receiver is always greater at 550 kc than at 1,500 kc.
- (3)—The need for high selectivity is always greater at 1,500 kc than at 550 kc.
- (4)—Just as good a circuit can be built with DC tubes and for battery operation as with AC tubes and for alternating current operation.
- (5)—The photo-electric cell can be applied to exact matching of color shades and the matching done by means of it is closer than matching done by human eyes.
- (6)—In building short-wave receivers it is not necessary to place tuning coils so as to minimize inductive coupling between them because short-waves do not travel far enough to cause any undesired interaction.
- (7)—Whenever an alternating current flows in a wire there is an alternating electromotive force (voltage) induced in conductors placed near the current-carrying wire.
- (8)—If one prong of a strong horseshoe magnet is thrust into a coil of wire the terminals of which have been joined an electric current flows in the coil as long as the magnet is moving. If the magnet is alternately moved in and out of the coil an alternating current flows in the coil.
- (9)—"Tin horn music" results when the bass notes are suppressed from the signal.
- (10)—Booniness in the output of a receiver results from the suppression of the high frequencies and the accentuation of the bass.
- (11)—It is not possible by means of radio frequency transformers to couple tubes so that the sensitivity is practically constant over the entire broadcast band. The amplification is always greater at the high frequency end.
- (12)—Five tuned circuits, each having a selectivity of 100 and accurately adjusted to the same frequency, are more effective in cutting out station interference and cut sidebands less than one tuned circuit having a selectivity of 500.

Magnetic E

By John C.

I have no doubt given the impression that magnetic flux lines are something akin to strong and inflexible though invisible bands that surround a conductor carrying a current. Actually this is not so. The strong magnetic effects are just as much subject to the action of weak displacing forces as they are to magnetic effects of their own magnitude.

The earth on which we live is being constantly guided along its orbit by enormous attractive forces that are so carefully balanced one against the other that only a very minute resultant change in the values of these forces would be required to throw the system out of balance.

Let us imagine a 10-ton bar suspended so that it is exactly horizontal. A piece of paper when placed at one end of it will seriously upset its equilibrium. Also if the bar be of iron a bell magnet placed under one end of the bar will likewise upset the balance. Therefore a magnetic flux can be more readily likened to a set of very flexible bands that, like rubber bands, exert a continual tendency to draw another object to its common center.

Commercial Uses

Hence it can be shown that magnetic forces act in a manner similar to gravitational forces, i. e., all tend to draw other bodies toward their originating center. Thus did Newton reason when idling under a tree in the Summer when the apple fell to earth.

Right or

- (13)—A short-wave converter does not work satisfactorily with battery tubes because these tubes are too microphonic and noisy.
- (14)—A Kerr cell is a light valve by means of which a beam of light can be varied in intensity by applying a varying electric potential. It is used for recording sound on film and for reconstructing a television image.
- (15)—There is no other suppression of the high modulation frequencies than that effected by the tuners. That is, there is no suppression in the detector or in the audio amplifier.

ANSWERS

- (1)—Wrong. When proper shielding is used in a receiver there is almost no limit to the attainable sensitivity. A sensitivity of $\frac{1}{4}$ microvolt per meter has been attained in a stable and selective receiver which is soon to be announced.
- (2)—Right. This is true because the selectivity of a receiver depends on the inductance, the frequency and the radio frequency resistance, and the radio frequency resistance increases faster than the frequency.
- (3)—Right. The stations are placed 10 kc apart throughout the broadcast band and the need for selectivity depends on frequency ratios rather than on frequency. The two closest stations at the low frequency end of the band have frequencies of 560 and 550 kc, the ratio of which is 1.018, and the two closest stations at the other end have frequencies of 1,490 and 1,500 kc, the ratio of which is 1.0067. The greater the ratio is the easier it is to separate the stations. When the ratio is unity it is not possible to separate the stations at all.
- (4)—Right. Not only can equally good receivers be built with DC tubes, but quieter receivers can be built since batteries will not introduce so much noise.
- (5)—Right. Photo-electric cells are affected differently by different colors. And they also respond more the brighter the light, whatever the color may be. Successful color graders

xperiments

Williams

Parallel magnetic attractions and attractive magnetic forces due to parallel currents have many interesting commercial uses, the shaded pole motor, the repulsion motor, the damping of electric meters (or watt-hour meter discs) and other devices that utilize the so called Foucault currents are all examples of this parallel current effect.

The experimenter perhaps may like to try the following. Obtain an old 6-volt DC dynamic speaker pot and excite this by means of a 6-volt battery (a storage battery preferred) and then grasp a solid copper plate firmly and pass it over the excited magnet pole as closely as you can without touching it, and also as fast as possible. You will not fail to notice the sudden braking effect as you pass the plate over the pole.

This effect can be made large enough to stop an automobile or a train and has one cardinal advantage: if the flux is strong the brake effect will never fail when a copper brass aluminum or any other non-magnetic disk or plate is pushed past the pole of a magnet the following effect occurs:

The edge of the plate enters the field of the magnet (a conductor cutting a field at right angles). The current induced in the edge of the plate produces a field around itself that tends to oppose the field of the magnet and thus is the braking effect produced.

Fig. 2 shows how the respective currents and their fluxes operate to produce this effect.

Brake Used in Meters

Delicate and accurate electrical measuring instruments use the above described electrical brake to obtain the necessary dead beat characteristic that enables the needle to be brought to a stop at the indicated value quickly and without any sudden jarring.

This same kind of a "brake" is used in some AC operated dynamic speakers as a means of reducing cone hum.

Parallel currents contain endless amounts of material for experiment. Many of the principles previously written about, and experimental facts shown, are contained or otherwise involved in the operation of commercial electrical machinery as well as the smaller electrical devices.

Here is a rectifier that the novice can construct by using some left-over parts. A study of its operation by means of two or three inexpensive meters should prove very interesting and instructive.

The parts required are an old magnetic speaker permanent magnet, or if it be of the twin magnet type, then use both

magnets— $\frac{1}{4}$ pound No. 32 DCC magnet wire, an armature from an old fire bell, together with spring mounting and contacts. You should make a choke by using some old audio transformer E iron and fill the winding space with No. 20 single cotton covered wire.

You are to mount the magnet on some hard insulating material, preferably a piece of switch board slate. Arrange the magnet in a horizontal position. Then make a loosely fitting insulating sleeve with ends, like a spool, and wind on about 6 layers of No. 32 DCC wire, and bring out two terminals. Having already provided the choke, the next item is to mount up the bell armature and associated contacts. It will be found necessary to arrange two adjustable spring tensions, one on either side of the armature to adjust its period of vibration to correspond closely to that of the frequency of the exciting circuit.

Fig. 3 shows the essential arrangement and circuit diagram of this simple device which is in effect a type of relay, and provides half-wave rectification. It is nevertheless an effective device and may be used to charge batteries and will be found inexpensive to operate. It is called a magnetic rectifier.

Its operating principle is the modulation of a unidirectional magnetic flux by an alternating flux induced in the magnet by the No. 32 DCC wire coil—when the inducing flux agrees in character with that of the magnet the armature is attracted, but upon the reversal of the inducing flux the armature springs back past its normal position of rest, due to its inertia, and the contacts close, permitting current to flow in the DC output circuit, but the inducing flux reverses again and the armature is attracted and so the current flows in the output circuit ceases.

Thus it is seen that the DC output is pulsating. But the choke helps to "even out" the pulsations somewhat. The rate of vibration of the armature is always slightly slower than the exciting frequency and the more current you rectify up to a certain limiting value (set by contact resistance mostly) the greater the time lag of the armature will be.

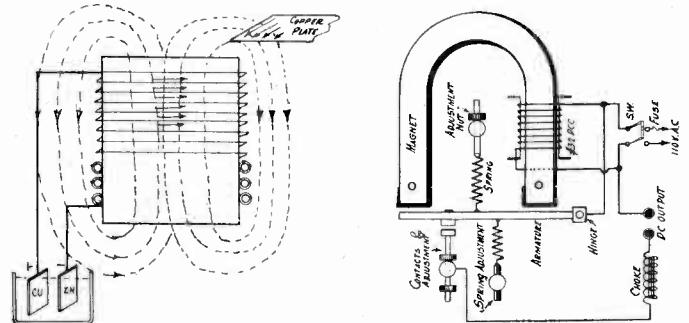


FIG. 2
PRINCIPLE OF THE MAGNETIC BRAKE.

FIG. 3
A DEVICE THAT THE NOVICE CAN CONSTRUCT EASILY.

Wrong?

have been built utilizing photo-electric tubes. Indeed, photo-electric cells are used extensively in industry to grade products according to color.

(6)—Wrong. It is more important to place the coils properly in short wave receivers than in broadcast receivers. Even if it were true that short waves do not travel so far as other waves, the importance would not be minimized. The coupling is a matter of mutual inductance and frequency, and for a given mutual inductance between two coils the greater the frequency the greater the coupling.

(7)—Right. This is the principle upon which all electrical transformers are based and most electrical machinery as well.

(8)—Right. This is the principle of the magneto and of many other electric devices. Some of the early electric generators were made by spinning a permanent magnetic near a coil or by spinning a coil in the field of a permanent magnet.

(9)—Right. Thin metallic music can be produced on any radio set by merely suppressing all the bass notes, just as they were suppressed by the old phonograph and the early radio receivers.

(10)—Right. This can be demonstrated by cutting out the high notes by means of filters and by bringing out the bass by regeneration in the tuner and by resonance in the audio amplifier and the speaker.

(11)—Wrong. It is quite easy by combining tuned and untuned radio frequency transformers to get an overall sensitivity curve which is practically uniform from one end of the broadcast range to the other, because tuned transformers have a rising characteristic with frequency and untuned transformers can be made so that the characteristic is just the reverse.

(12)—Right. This was shown in last week's issue of Radio World by means of computed curves. The lowest curve in Fig. 1, page 8 of that issue is for a tuned circuit having a selectivity of 500. The dotted curves is the result of five tuned circuits, each having a selectivity of 100. Curves cross

just below 5,000 cycles, showing that the suppression of sidebands is less below about 5,000 cycles for the five-circuit curve than for the single circuit curve. The dotted curve falls much lower at 10,000 cycles than the curve for Q equals 500, which shows that the five circuits will separate stations on adjacent channels much better than the single circuit.

(13)—Wrong. The battery operated short-wave converter usually works better than the AC operated converter because line noises are absent. Aside from the line noises, however, there is practically no difference.

(14)—Right. The principle of the Kerr cell is explained by Meyer Eisenberg in last week's issue. It works on the principle that polarized light in passing through a vessel of nitrobenzene twists under the influence of an electric field and that plane polarized light can pass through a certain crystal when the light strikes it in a given way. Plane polarized light is light which vibrates in one plane only. Ordinary light vibrates in all planes.

(15)—Wrong. The grid condenser in the detector also suppresses the high notes. So do the inter-electrode capacities of the amplifier tubes.

A New Edition

Practical Radio Construction and Repairing, new second edition, by James A. Moyer and John F. Wostrel. (\$2.50). McGraw-Hill Book Co.

This is an excellent volume for the student of the practical phases of radio receivers. It tells how to build, how to use, how to test and how to understand the radio receiver. It describes all the standard types of circuits and exemplifies them with circuit diagrams and lists of parts. The book is brought up to 1930 and therefore contains not only the circuits and accessories that were in vogue when the first edition came out in 1927, but also those that have come into use after that date. It contains a valuable chapter on trouble shooting, which anticipates nearly all the troubles that may arise in any receiver.

A Short-Wave Tuner

By Brunsten Brunn

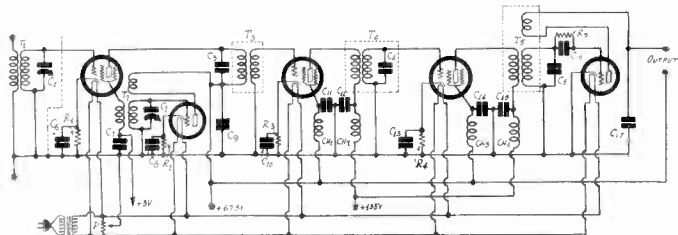


FIG. 1

THE DIAGRAM OF A SUPERHETERODYNE TYPE SHORT-WAVE RADIO FREQUENCY TUNER AND AMPLIFIER EMPLOYING AN INTERMEDIATE FREQUENCY OF 1,500 KC

WHEN short-wave reception must be relied on for a considerable part of the radio entertainment, it seems to be preferable to use a complete short-wave tuner rather than an adapter or a converter. This is particularly so when most high-sensitivity receiver kits come in the tuner form, that is, they stop with the detector tube. An audio amplifier and a suitable power supply are supposed to go with such an outfit.

If the audio amplifier and the power supply are available there is little trouble in associating with them a short-wave tuner that will turn the combination into an excellent short-wave signal getter.

In order to get a high sensitivity it is necessary to use a high degree of stable radio frequency amplification. But to do so at the very high frequencies is next to impossible, owing to the difficulty of preventing oscillation where none should be. The simplest way to do it is to adopt the Superheterodyne principle and a relatively high intermediate frequency. Then most of the amplification can be secured in the intermediate frequency level, as well as most of the selectivity.

Regeneration In Intermediate

In order to make the circuit exceptionally sensitive, that is, to make the amplification in the intermediate frequency level very high, two stages of intermediate amplification and a regenerative detector are desirable. As is well known, regeneration properly adjusted increases the gain more than a stage of amplification.

When the intermediate frequency is low, say less than 100 kc, regeneration does not work out so well in a Superheterodyne, but when it is of the order of 1,500 kc it works astoundingly well.

In Fig. 1 we have a short-wave tuner working on the Superheterodyne principle. It has one tuner at the high frequency, using plug-in coils, an oscillator, also using plug-in coils, two

LIST OF PARTS

T1—One set of plug-in short-wave coils as described in the June 7th article referred to.

T2—One set of plug-in short-wave coils as described in the June 7th article.

T3—One intermediate transformer with tuned primary as described, with shield.

T4—One intermediate transformer with tuned secondary as described, with shield.

T5—One intermediate three-circuit tuner as described.

R1, R2, R3, R4—Four 300 ohm grid bias restorers.

R5—One 1 megohm grid leak.

P—One center-tapped 20 ohm resistor, or Humdinger.

C1, C2—Two Hammarlund straight frequency line condensers.

C3, C4, C5—Three Hammarlund 100 mfd. trimmer condensers.

C6, C7, C8, C9, C10, C11, C12, C13, C14, C15—Ten .01 mfd. by-pass condensers.

C16—One .00025 mfd. grid condenser with grid leak clips.

C17—One .00025 mfd. by-pass condenser.

Ch., Ch2, Ch3, Ch4—Four 50 millihenry choke coils.

One filament transformer with 2.5 volt, 12 ampere secondary.

Six UY sockets (one for T2).

One UX socket (for T1).

fixed tuners operating at 1,500 kc and one regenerative, or three-circuit, tuner working at the 1,500 kc frequency.

Up to the intermediate frequency amplifier the design of the circuit is the same as that of Fig. 2, page 7, in the June 7th issue of Radio World. After that part of the circuit the design is that of a tuned radio frequency amplifier adjusted to respond to 1,500 kc signals only.

The first intermediate transformer T3 has a tuned primary, because it is desirable to provide a by-pass condenser in the plate circuit of the modulator tube. C3 serves both as by-pass and as tuning condenser. The second intermediate has a tuned secondary, as has the third T5.

Coil Data for Intermediates

The tuned intermediate windings may be wound on a bakelite form 1.75 inches in diameter, with No. 28 double silk covered wire. The tuning condenser across each should be a midget condenser of 100 mmfd. capacity. This will require 48 turns for each tuned winding.

The secondary of T3 should have fifty turns of the same kind of wire, or finer wire if available, and should be wound on a form that fits over the primary. The primary of T4 should consist of twenty turns of the same or finer wire also wound on a form that fits over the tuned winding. It should be placed near the ground end of the tuned winding to minimize capacity coupling between the two windings. Or if the form is long enough the primary turns may be put on the same tubing as the tuned winding at the ground end of that winding.

T5 may be exactly the same as T4, with the exception that it should be provided with a tickler winding. This should be wound on a form which fits inside the tuned winding form so that it may be moved in and out of that form to adjust the tickling. Twenty turns on the tickler will be sufficient if the tickler form fits snugly inside the tuned winding form. The same wire may be used for the tickler as for the tuned winding or as for the primary, if they are different.

The correct adjustment of the tickler will depend on the voltage applied to the plate of the detector tube, as well as on the heating of the cathode of the tube. Therefore the tickler should be adjusted for a given applied voltage so that the circuit will not oscillate when only the detector tube is in the circuit. Then when the other tubes are inserted there will be a safe margin between the operating point and the oscillation point. If this adjustment is not made a regeneration control has to be provided, which may be in the form of a 30,000 ohm resistor in series with the tickler leads.

Shielding

The three intermediate frequency coils should be surrounded by metal shields of a diameter not less than 3 inches. The radio frequency coils T1 and T2 should not be surrounded by metal shields but they should be separated by a metal shield placed as far from the two as the layout permits.

The disposition of the free screen return on the modulator was explained in the article cited, but in this circuit the lead is marked plus 3 volts. If there is plenty of amplification in the intermediate channel this lead may be connected directly to the cathode of the first tube. However, a little greater efficiency will be obtained if it is connected to a low positive voltage approximately 3 volts. The value that gives the best results depends on many factors and can best be found by trying several different voltages. The adjustment is not critical and for that reason the cathode connection mentioned gives good results. If the screen lead be returned to a potentiometer as was explained in the article cited, this potentiometer can be used as a volume control. Moreover, it can also be used for finding the most sensitive adjustment in all instances, which cannot be done if the lead is run to a battery.

Intermediate Leads Filtered

In each of the screen and plate leads of the two intermediate frequency amplifiers is a 50 millihenry choke coil, and each of these chokes is by-passed with a .01 mfd. condenser. These four filters prevent oscillation in the intermediate amplifier. Additional by-pass condensers are used wherever there would be a chance for feedback. Thus there is a .01 mfd. condenser across each grid bias resistor, one of the same value across the screen voltage supply of the modulator, and another across the plate supply of the oscillator and the modulator. This condenser, C9, should be placed as shown. Another condenser of much larger value, say 1 mfd., should be connected from ground to the 67.5 volt tap on the voltage supply near the binding post. This is usually put in the B supply and for that reason it is not shown in the circuit.

The Earth's Magnetism

By Lester Chadwick

A RECENT news item described the experiences of two observers relative to the study of the radiator pattern of a particular transmitter. The article dealt in a general way with the experiences of the two observers, equipped with a loop battery operated receiver. A statement was made that while exploring around the base of a certain hill a point was reached where all signals ceased and upon transporting the receiver to the apex of the hill the receiver was operative again, substantially tending to show, therefore, the presence of a substance in or near the hill that produced very pronounced absorption.

If a stone be dropped vertically into a still pool of water that has a surrounding sloping sandy beach, and no intervening objects on the surface or near its under side, that a primary pulse is set up, and it travels radially outward until it meets the beach, where it is absorbed and the pool is calm again. This same phenomenon is generally true of radio transmission too. If we set up a transmitting antenna that is non-directional, in a location such that an exploring receiver can be moved to different equal radii, and observations made, it will be found that if, as in the case of the pool, the absorbing medium for the radio waves is radially equidistant from the transmitter, the second "field" of equipotential reception will be substantially circular. (Equipotential reception means all points where the field strength is the same.)

Full Explanation Still Awaited

Now if the given area (which by this time is assumed to have been plotted and found substantially circular) be now inspected for the presence of substances which are supposed to have a deterrent effect on radio wave propagation, we may find some substance of quasi-magnetic nature. Yet the effect of this local deposit may be comparatively small compared to the complete blanketing of radio signals.

Transatlantic transmission of telegraph and telephone signals via "insulated" wire cables, is often marred by fadeout, and although much is known about the probable cause of this phenomenon, its effects are so varied that a complete analysis has not yet been made.

Radio transmission over a very long air line distance registers effects that are not comparable in any magnitude with those that are the result of propagation at short range, and as a consequence those who attempt to describe and formulate general principles as a foundation to the exposition of observed laws, with short range transmission effects in mind, are likely to reach an unscientific result.

A conductor carrying a current of electricity has associated with it under this condition a radial magnetic field which is effective in all directions at right angles to the conductor's path.

Both Follow Current Laws

In the case of a steady unidirectional current flow along the wire the character of this field obeys the laws that govern

all cases of this kind, and in the case of alternating currents flowing in the wire the character of the field about the wire also obeys the fundamental governing principles.

Therefore as radio "waves", or radiations, are sinusoidal magnetic fluxes that are maintained at given volumes of average flux density under given conditions at any one place, and since these flux changes are what "cut" across our receiving antennas, they thereby induce the weak alternating emfs that we subsequently amplify and transform into sound output at the loudspeaker.

The only thing that can affect an alternating magnetic flux, or any kind of a magnetic flux, is another co-existent magnetic field.

As it is well known, the density of a magnetic field is somewhat modified by the presence of substances that present less magnetic resistance (or reluctance) but as the physical dimensions of the short circuiting substance (say used iron) usually bear a close relationship to the circumscribed area of the denser portion of the magnetic field at most times and under practically all conditions, it is apparent that an enormous slab of iron would be required completely to divert the radiated flux of, say WJZ, at any point within its effective transmitting radius.

Effect of Earth's Magnetism

Of far greater effect on the division (or refraction) of radiated high frequency magnetic fluxes in the open spaces is the earth's own magnetic flux. When magnetic disturbances take place, for instance the more or less regularly recurring "magnetic storms," they often interfere very seriously with long-distance radio reception and are undoubtedly the primary cause of "fading" over land also.

The strength of the earth's magnetic field varies from point to point over the earth's surface, but at New York the writer has had occasion to observe that the declination of the earth's field as indicated by an ordinary dip needle compass was about 40 degrees, and thus you see there are present here two well-defined earth field components.

A few years ago the writer was temporarily located in Northern Ontario for the Winter and was incidentally engaged in testing radio receiving sets on regular broadcast reception at night. One night in particular all the more distant southerly American stations were received with unusual ease. I listened to Havana, Fort Worth and Mexico, and at 1:30 a.m. I quit for the night and on extinguishing all lights noticed that the outside was fairly light, and upon emerging from the building saw the whole northerly horizon wonderfully illuminated. I had never seen such a display of Northern Lights, or Aurora Borealis. The display was on view for three successive nights, and on all three the radio reception was phenomenal. Afterwards night reception of New York City and Chicago stations was about the best we could do.

So this is a pretty good illustration of how a magnetic disturbance not very distant actually acted as a wonderful help.

Baffles, "Dead" or "Alive," Are Useful

When we select one or two sample baffles from a large number of baffles all of the same shape but made of different material, we have made our selection on the basis of certain acoustic absorptive properties of the materials of which they are made.

Fig. 1 shows a baffle made of Celotex, a semi-hard compressed substance that is quite "dead", acoustically speaking. This means that if a slab of such material is suspended so that it may vibrate freely, it will not give out a musical note, or any sound frequency that lies within the usual "acoustic range."

The influence of such material on the acoustic output quality of a speaker is that of interposing resistance between the front and rear surfaces of the speaker cone.

Fig. 2 shows an arrangement that is quite different. In this case a baffle of material that contributes somewhat to the quality of acoustic output is sought and realized by the use of a piece of hard wood. All woods are acoustically "alive", as is readily proved by the fact that ordinary yellow pine sticks may be made into tuned vibrators by simply whetting them carefully. Thus it is possible to make oneself a set of musical sticks that agree with the musical frequencies of the piano scale.

Fig. 2 illustrates a type of speaker with principal vibrating element a large paper diaphragm. This paper cone by itself has a very poor acoustic quality and range—as has any cone—

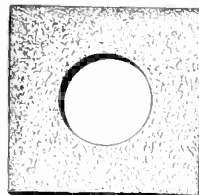


FIG. 1
AN APERIODIC
BAFFLE FOR
A CABINET
DYNAMIC
SPEAKER.

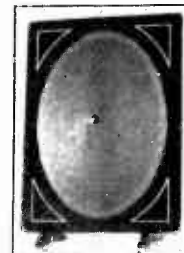


FIG. 2
A TUNED
BAFFLE

and the air column on either side of the cone is virtually aperiodic also, hence the use of a selected sample of wood that is rich in harmonics when vibrated by the speaker mechanism.

Where the air column on either side of a speaker cone is not aperiodic, it is customary to choose a baffle material that is aperiodic and when the reverse occurs some form of sounding board is usually selected.

Resolved, Multi-Tuner Receiver

AFFIRMATIVE

By Haddon Brockway

IF WE are to go by the trend in design of modern receivers the multi-tube, multi-tuner receiver has all the advantages, for nearly all manufacturers turn out such receivers. If we are to go by the history of radio receiver design and by the performance in the past of receivers having a stage of tuned radio frequency and a regenerative detector, the simpler circuits challenge the more complex for a place in the picture. Just what type of receiver is the better, the multi-tube, multi-tuner or the regenerative circuit with one or two stages of tuned radio frequency?

Perhaps the answer depends on the purpose of the receiver more than on other considerations. Some receivers are designed to receive local broadcast stations only, and receive them with clarity and quality. Other receivers are designed to receive distant stations.

If the object is to receive distant stations it would seem that multi-tube receivers are superior, since only such receivers can bring in distant stations consistently. If the object is to listen only to local stations it would seem that the less pretentious sets would be more economical and consequently superior.

Of Universal Application

But when we have selected an inexpensive and modest receiver for the reception of local stations we have cast the die and cannot receive distant stations should we so desire. On the other hand, if we have selected a multi-tube, multi-tuner receiver we have a set of universal application. If we want to listen to distant stations we can do so, for we have both the requisite selectivity and sensitivity. If we want to listen to local stations with this receiver there is nothing to prevent us, for this receiver will bring them in just as well as a more modest receiver.

One of the arguments against a multi-tuner receiver is that it is too selective to bring in any stations with good quality, whereas the simpler receiver is capable of first-rate quality on all stations within its reception range. This argument is utterly fallacious.

Any receiver can be designed with any given selectivity. A receiver having many tuned circuits is subject to greater flexibility in the hands of the engineer who designs it. He can do almost anything he desires with it in respect to selectivity and sensitivity. A receiver with a few tuners, on the other hand, is quite rigid in that it does not allow the designer much leeway. Such a receiver seems to tell the engineer: "Take me or leave me, but if you take me, take me as I am." The multituner receiver tells the engineer a different story. "I am subject to your wishes and skill. What can you do with me?"

Greater Station Selectivity

Sideband suppression has always been considered the limiting factor in the increase of selectivity. Quality and selectivity have been considered reciprocal characteristics. We could have either in any desired degree, but we could not have both at the same time in the degree that modern conditions require. To some extent this is still true, but not to the same extent when many tuners are involved as when only two or three are involved.

It has been proved that a tuner composed of many moderately selective circuits is more selective as between two adjacent broadcast channels and less selective in respect to sideband cutting than a receiver composed of one or two highly selective circuits. The reader need go no further than the June 28th issue of RADIO WORLD for this proof. This is a very strong point in favor of the multi-tuner receiver because it partly nullifies the old contention that high selectivity and good quality are inconsistent.

Gang Tuning Convenience

With many moderately selective circuits we can have very good discrimination between two stations separated by 10 kc without at the same time cutting the sidebands of the station desired to any appreciable extent. Such selectivity is just what is desired and is that strived for in devising band pass filters. It cannot be achieved with a few highly selective circuits but it can be with many moderately selective circuits.

One point of superiority of the multi-tube and multi-tuner

receiver is that it is practicable to gang condensers, thus simplifying tuning. This can be done without any appreciable decrease in the effective selectivity. While the ganging of many tuned circuits tends to broaden the overall selectivity near the carrier frequency, it has just the opposite effect on frequencies away from the carrier. That is, it broadens the circuit where it should be broad and sharpens it where it should be sharp. One would expect that a multi-tuned circuit controlled by gang condensers would result in much better quality and much better station discrimination. And one is not disappointed in this expectation.

If the ganging is improperly done, so that there is an appreciable decrease in the selectivity, this may be offset by making each tuned circuit slightly more selective than it would have to be if all the condensers were lined up accurately.

That ganging of condensers is well worth while is obvious when one tries to tune a non-ganged receiver having no more than two tuned circuits. And when there are three or more non-ganged tuners the circuit is simply impossible and comparison is defied. No one would have the temerity to rig up a multi-tuner receiver without ganging the condensers.

The Question of Cost

A multi-tube and multi-tuner receiver costs more than a simpler receiver, but the increased cost is not important, compared to the superior characteristics. The money value is there. A man may have just sufficient money to buy a receiver having two tuners. He compares directly this receiver with a modern multi-tuner receiver and he immediately decides to wait until next month or so, for then he will have enough more to pay the difference. Therefore the higher cost of a multi-tuner receiver is rarely a determining factor against this type of receiver. Indeed, there is no factor against it, if we are to judge by the relative number of sets of the different types sold.

Th fans who are still in favor of the simple regenerative circuits point to the great DX records made in the past by these receivers. They forget, however, to call attention to the elaborate antennas that must be used with them in order to get anything. They forget that after every windstorm they have to go out and erect the antenna anew, that after every rainstorm they have to go out and check over the connections in the antenna to find where that short to ground is, that short which renders the set noisy but otherwise quite dead. They forget that they have to have switches in the antenna circuit, and loading coils, wave traps, and other contrivances to make the receiver sensitive and reasonably selective. They forget all the unpleasant things about those sets. They only remember that under the most favorable conditions possible, and not present today, those sets did bring in audible signals from distant stations.

Consistent DX Results

Now with a multi-tube and multi-tuned receiver distant stations can be brought in under practically all conditions of reception. While the signals are not always clear, that is not the fault of the set. If the other receiver could bring in the same signals with the same intensity there would be just as much noise.

And what kind of antenna is needed with the multi-tube receiver? Nothing but a short wire a few feet long in the same room as the receiver. This wire never blows down in a windstorm, it never gets wet in a rain or snowstorm, and it is never out of order so that signals cannot be received from a large number of stations. If for any reason it gets out of order it takes only a minute to fix it up again. It is not even necessary to miss the program that is on at the time the mishap occurs.

The ground is another item to be considered. With the old type receiver a good ground was a necessity. Indeed, the set was no better than the ground. In order to receive any worthwhile signals it was necessary to run the ground wire to a cold water pipe, or to use an elaborate counterpoise system, or to bury a lot of metal in moist earth and run the ground wire to that. With the modern set the ground is not so important. In fact it is of no more importance than the antenna. A few feet of wire under the set are sufficient, or no wire at all, if the set is shielded. If the set is connected to the house wiring, as nearly all multi-tube sets are, then a satisfactory ground is established in most instances without any other provision.

However, just because the multi-tube receiver will work satisfactorily without an elaborate ground and antenna system, we are not compelled to omit either the ground or the antenna. If the modern receiver will work well without a long and high antenna, it may work much better with one.

Receivers Excel Regenerators

NEGATIVE

By Edward C. Frother

WHEN it was found that one stage of tuned radio frequency amplification improved the selectivity and sensitivity of a regenerative three-circuit receiver, another tuned radio frequency amplifier was added on the theory that if one addition made a notable improvement two equal additions would make a still greater improvement. And possibly it did in some instances. If it did, why shouldn't still more radio frequency amplifiers improve the receiver in direct proportion to the number of stages and tuners? Is there any good reason for stopping with two, or three, or four? The more tubes that are added the greater the amplification; the greater the amplification, the greater the sensitivity; the greater the sensitivity, the greater the distance-getting ability of the receiver. This being true, there is no reason for stopping the chain until the set is so sensitive that it would become an oscillator by virtue of the signals it picked up after they had circled the globe.

A high selectivity is admittedly desirable. If one tuner gives a certain selectivity, two will give much greater selectivity, and three will give still greater. Then if a high selectivity is necessary why should not the number of tuners in the circuit be increased indefinitely? Why not have ten tuners between each pair of radio frequency amplifier tubes if the receiver becomes impractical with a large number of tubes?

Digging Ditches

In practice it does not work out the way ill-considered theory does. The sensitivity of a receiver is not proportional to the number of radio frequency stages. Neither is the selectivity proportional to the number of tuned circuits. There is a certain definite limit to the sensitivity that may be used in practice. Likewise there is a definite practical limit to the selectivity.

Building a receiver with many tuned radio frequency amplifier stages is like digging a ditch and filling it up again because there is a limit to the length of the ditch. If the digging is to continue it is necessary to fill it up again in order that there may be something to dig.

It is also like stepping on the accelerator of a car to make it go fast and at the same time stepping on the brake to keep it from going so fast.

In the case of ditch-digging the process results in nothing but waste of human or mechanical energy. In the case of the car it results in nothing but waste of fuel and wear on the mechanism. In the radio case the only result is waste of electrical energy.

Nobody can be so blind as to think that the addition of an unlimited number of tuned radio frequency stages results in an increase in the practical amplification. If there be one, all he has to do is to compare directly a multi-tube, multi-tuner receiver with one comprising one tuned radio frequency amplifier and a regenerative detector.

We refer again to the accelerator-brake sequence. An amplifier tube is an accelerator in that it steps up the signal voltage, but where is the brake? Well, we have rheostats in series with the filament or heater circuit, rheostats in series with the plate circuit, potentiometers in the grid circuits, grid suppressors in the grid leads, lossers in the tuned circuits, tight-fitting shield cans around the coils, and reverse feedback. In fact we have so many brakes in the average multi-tube receiver that the overall gain in the signal voltage is almost negligibly small. All these devices mentioned are for no other purpose than to undo what the amplifier tubes have done. The net results is not a high sensitivity but a low efficiency. One has to pay ten prices for the net amplification.

DX Records

With what kind of receiver have the various distance-getting records been achieved? With the modern multi-tube and multi-tuner receivers? They have not. They have been achieved with the old circuits comprising one stage of tuned radio frequency amplification and regenerative detector type of circuit.

Those who have multi-tube receivers take it for granted that they can reach out but they are rarely put to the test. When they are tested and found wanting, the lack of distant stations on the log is ascribed to bad reception conditions. The receiver happens to be located in a dead spot, the an-

nouncers from the distant announcing the stations tuned in and the receiver operator had no patience to wait for them, the night happened to be so bad that static crashed out the announcements. These are just a few of the alibis offered for the set that is supposed to get the distant stations and does not.

It is true that a multi-tuner receiver provided with a ganged condenser is convenient to tune, since there is only one knob to turn for moving from one station to another. But a crystal set is also convenient, especially when there is only one tuned circuit. And many multi-tuner receivers are no more selective than an old crystal receiver which was hopelessly broad. Take any well-advertised receiver of the gang-controlled type and note how many stations can be heard at one setting of the control. At least two stations can be heard with equal intensity at some point in the tuning range. And these two stations are not 10 kc apart but more likely 100 kc apart.

If many tuners cannot separate local stations 100 kc apart then what is the advantage of having such a receiver? Obviously none as far as selectivity is concerned. A crystal set can separate two local stations operating 100 kc apart.

Effect of Regeneration

The regeneration in a circuit using one tuned radio frequency amplifier and a regenerative detector is worth more than three tuned radio frequency amplifiers as used in multi-tube receivers, both when compared on the basis of selectivity and on the basis of sensitivity. Since selectivity depends directly on the resistance in the tuned circuit at the resonant frequency, and since the resistance can be reduced almost to nothing with regeneration, without sacrificing stability, it is clear that the selectivity of such a regenerative circuit can be increased almost without limit. In any practical case it can be increased as much as is required.

Moreover, as the selectivity is increased by regeneration the sensitivity is increased at the same time, and the two characteristics increase in about the proportion they are required. True, it takes a very good control of the regeneration to get the maximum of sensitivity and selectivity out of the circuit, but that is no disadvantage, for it is just as easy to rig up a regeneration control that works smoothly as one which works in jumps and spurts. One might say that the circuit is not regenerative unless the regeneration can be controlled without difficulty. There is regeneration in multi-tube receivers, too, but the trouble with them is that it is uncontrollable. Any receiver with uncontrolled regeneration is a dud, and most of the duds are found in those "supersensitive" receivers having many tuned circuits and many radio frequency amplifier tubes.

Antenna Equipment

The fact that no elaborate antenna and ground system is needed with a multi-tube receiver is pointed out as an advantage. What is so elaborate about a wire 100 feet long strung up on a pole and insulated from it? What is so elaborate about a wire run from the receiver to the nearest cold water pipe, or to a pipe driven into the ground? What can be so elaborate about a system that costs at most \$1.50, less than the cost of a tube, or a tuner? What can be so elaborate about a system that can be installed, and installed permanently, in an hour? It takes less time to install this \$1.50 antenna-ground system than it takes to keep the extra tubes in order in the multi-tube set. If the antenna is installed with reasonable care it is installed permanently and at most needs attention only once a year, in the Spring.

And how much better is a first class antenna-ground system than the system ordinarily used with multi-tube receivers? Fully as good as one extra radio frequency amplifier. We arrive at this on the assumption that the average good antenna is 10 meters high and that the indoor antenna has an effective height of one meter. The signals will therefore be 10 times as great on the higher antenna, and this is about the amplification of a screen grid tube stage in practice. This comparison really favors the short antenna because there are other factors that were not taken into account.

Sideband Cutting

It is frequently argued that a regenerative detector that is adjusted for maximum amplification is excessively selective and consequently that it cuts sidebands so seriously that signals from distant stations cannot be understood or enjoyed. This would be an argument in favor of the multi-tuner receiver if it were also argued that the multi-tuner receiver is not so selective as the regenerative circuit. But it is usually argued that it is more selective. That kills the validity of the argument entirely.

One advantage of the regenerative set is that sideband cutting occurs only on remote stations.

Liquid Resistances

By James A. McGovern

IN considering the question of purifying the signal of radio and audio wave, we must broaden our research into the molecular and atomic structure of the metallic conductors such as wire, etc. We have in our voice coils, transformers, and choke coils much length of wire, and also from 60 to 200 feet in an antenna.

The laminations of iron in our chokes and transformers cause sparking in the molecular intervals, which is bound to be reproduced slightly with the signal in dynamic speakers.

We know from our fundamental knowledge of physics that when a metal body is heated by a current of electricity, no matter how small, the atoms of the body, whether metal or dielectric, draw themselves away from the kernel of interatomic force that held the metal etc. in stable contour or structure, wander around in vibratory oscillation out of symmetry or alignment to the material equilibrium.

Become Gaseous

They move from this controlling kernel of force, as I call it, and the speed and distance that they move are governed by the degree of temperature.

At a very high temperature they stray so far as to lose contour to such a degree as to become a fluid, and when a certain temperature is reached go into a gaseous state.

When a small current of electricity passes through the metal conductors of the radio system, the migratory atom vibrates and increases in amplitude equal to the amount of heat generated by the current, being hindered en route by ohmic resistance in the metal.

Whether the crackling is caused by the current bridging the intervals between the atom or electrons as it separates from the interatomic kernel of force, or whether it is caused by the vibrations or oscillations of the atoms in collisions, we do not know.

Arcings Reproduced

Whether this causes the crackling or frying sound when no other annoyance can be detected we do not know, but it is my opinion that the receivers of today amplify, and dynamic

speakers reproduce these minute arcings that were unheard from the radio speaker of earlier days.

Uses Liquid Resistance

I can show that a new type of liquid resistance and condenser and grid leak would take away the shock of excess vibration as a spring or pneumatic tire does in an automobile.

The liquids acting as resistance could be made variable by densifying the conductive properties blended in the liquids and reducing the dielectric of these liquids.

I have found that by using liquid resistances and liquid conductors that I reduced 70% of the crackling and frying noises heard from the radio speaker known as static. There was a certain percentage of this static, that I proved had emanated from the atomic structure of the metal conductors themselves such as the wiring circuit, etc.

I found that by substituting resistances of fluid contents that I nearly completely neutralized the remaining percentage. I have made research into these probable causes for static and found that arcings and spark emission from electrical devices such as section insulators on railways and thermostatic control devices, telegraph transformers, etc., being a lower impulse to a transmitted wave were entirely neutralized in the liquids that I used in the tubes in series or shunted into the receiver antenna, or the closed circuit in the receiver.

Neutralized "Atmospherics"

I have proved this to be so by testing in more than 200 different localities in and around the city of New York. I have received verification from many radio engineers to that effect. I have made deep research into this problem of eliminating static and entirely dissembled many machines to prove this theory.

I have tested these instruments in series or shunt in many receivers where the weather held different temperatures and in the hot weather when the air was highly ionized and the dielectric value of the air was further reduced by a humidity and the static had reached a peak, that I entirely neutralized this atmospheric annoyance, by this type of filter.

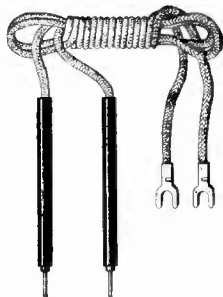
Although the amplification factor was reduced a certain percentage, the music or speech from the receiver was clarified 85%.

Test Leads Should Be Long, Well-Insulated

Test leads constitute an article that most radio experimenters see and, having seen, desire to own, but more often than not

fail to act on the desire. Test leads should be long, to enable the user to locate the instrument to which they are connected well out of the range of easily dropped heavy tools that all too often break meter crystals.

The leads should be very well insulated and especially so near the prods, to be exceptionally safe to use when making tests on high tension voltage devices, and voltage divided circuits. Why experimenters continue to use old lengths of poorly insulated wire, mostly odds and ends, with perhaps a bare spot here and there, is difficult to understand.



OVERTONES OF PIANO STRINGS

ARE THE overtones of a piano string exact multiples of the fundamental tone? Some say that they are exact multiples, while other say that they are not. I don't know whom to believe.—O. L.

Overtones of a piano string are not exact multiples of the fundamental. The amount of deviation depends on the amount of damping there is on the string. The quicker the tone dies down after the string has been struck, the more do the overtones deviate from exact multiples. The same holds true of every sound that is damped. For example, a xylophone sound has overtones differing considerably from exact multiples of the fundamental. When the divergence becomes too great the sound ceases to be musical. Violin and organ tones, which are sustained, have overtones that are exact multiples. However, the sound made when a violin string is plucked contains overtones differing more from being exact multiples than the sound from a piano because the tone does not last so long.

Principle of Operation of Photo-Electric Cell

WILL you kindly explain how a photo-electric cell works? I know that the current through the tube depends on the amount of light that enters the cell, but I don't know why.—E. H. S.

Nobody knows why the current varies with the amount of light that enters the photo-electric cell. All anybody knows is how. It has been discovered that when light falls on certain metals electrons are given off, just as electrons are given off when they are heated. It has also been found that when the metals are put in vacuum the number of electrons emitted by a given metal with a given amount of light is greater. Also, it has been found that certain metals emit electrons more readily than others. For example, the alkali metals—sodium, potassium, and caesium—emit electrons copiously, and for that reason these and related metals are used in photo-electric cells. The photo-electrically active metals are deposited in a thin layer over the inside wall of the glass envelope of the cell and the light is admitted through a hole in this layer. Another metal electrode is placed in the center of the tube and a high voltage is impressed between the central electrode and the thin metal layer, with the positive terminal on the central electrode. For a given voltage between the electrodes the number of electrons is, within certain limits, directly proportional to the amount of light energy that enters the cell. It is this proportionality that makes the cell particularly useful where freedom from distortion is essential. Another of its valuable properties is that the changes in the current through the cell vary instantaneously with changes in the amount of light.

URNS FOR 1½-INCH DIAMETER

HOW many turns of No. 32 double silk covered wire are required on a form 1.5 inches in diameter to cover the broadcast band with a .0005 mfd. condenser?—R. H. G.

You will need 66 turns. This number assumes that there is no distributed capacity in the circuit. Since there will be a little the proper number of turns will be slightly smaller than that specified, but it is impossible to determine just how many to use unless the exact value of the distributed capacity is known. Just wind 66 turns and remove a turn at a time, if necessary.

A Question and Answer Department conducted by Radio World's Technical Staff. Only Questions sent in by University Club Members are answered. The reply is mailed to the member. Join now!

RADIO UNIVERSITY

Annual subscriptions are accepted at \$6 for 52 numbers, with the privilege of obtaining answers to radio questions for the period of the subscription, but not if any other premium is obtained with the subscription.

Communication on Light Frequencies

WOULD it be possible to communicate over short distances by means of voice-modulated light beams? If so, will you kindly outline how it can be done?—R. M. M.

It is not only possible but it has been done, by ultra-violet, visual, and infra-red light. After the beam of light has been modulated there is no difficulty in receiving, for all that is necessary is to conduct the modulated beam into a photo-electric cell and then connect this cell to an audio amplifier. The question of modulating the beam is a little more difficult. If the source of light is a neon tube this may be put in the output circuit of an audio frequency amplifier, to the input of which a microphone is connected. If white light is used it may be modulated by means of a Kerr cell. How this works was explained in the June 28th issue of Radio World by Meyer E. Eisenberg.

Phase Difference Explained

WHAT is meant by phase difference between a voltage and a current? Has it anything to do with the wave form?—R. S. E.

The phase difference between a voltage and a current may be defined as the time difference between corresponding phases. The voltage rises and falls, going through all values from maximum in one direction to maximum in the opposite direction. The current resulting from the alternating voltage goes through corresponding changes. If the two are in phase, that is, if the phase difference between them is zero, the maximum value of the current occurs at the same time as the maximum value of the voltage. Also the two are zero at the same time? When there is a phase difference a given value of the current may occur either before or after the corresponding value of the voltage. In a pure inductance the current lags a quarter period behind the voltage. In a condenser the current leads the voltage by a quarter period. A quarter period is equal to 90 electrical degrees.

Coils for 500 Kc. Intermediate Channel

COULD good 500 kc intermediate frequency coils be wound with No. 36 double silk covered wire on forms 1.75 inches in diameter? If so, please give the number of turns that should be used when the condenser across the coil is .0005 mfd. and a small trimmer is used for tuning? Should the primary winding be put on the same form or would it be better to put it on a smaller form that fits inside the other?—G. A. N.

Very good intermediate coils can be made this way. If the intermediate frequency is 500 kc and the tuning capacity is .00055 mfd. the inductance should be 184.5 microhenries. The capacity can be obtained by using a fixed condenser of .0005 mfd. and a trimmer of .0001 mfd., using half of the trimmer capacity. Fifty-five turns will be required for the tuned winding. When this size of wire is used on such a large diameter it is probably best to put the primary winding on the same form. Twenty-one turns of the same size wire wound next to the secondary should be about right for screen grid tube coils.

Whistle Due to Audio Coupling

THERE is a steady whistle in my set and the signals are not clear. This whistle has a pitch considerably higher than middle C and it is heard on all stations. Can you tell me where the trouble may be?—J. A. D.

The whistle is undoubtedly due to an oscillation in the audio amplifier due to feedback through the B supply, a high frequency motorboating. It may be augmented by oscillation in the audio amplifier due to close acoustic coupling between the detector and the loudspeaker. If the trouble is due only to acoustic feedback there should be a sharp ring when the detector tube is tapped and the whistle should vary with positions of the speaker. If the trouble is due to feedback through the B supply more by-pass condensers across the voltage taps should stop it.

Region of Suppression by Selectivity

HOW is it that high frequencies can be heard when the radio frequency tuner is so selective that it is supposed to cut the higher side frequencies? I have a superheterodyne which is about as selective as they come, yet I can hear the higher tones from piccolos, violins, and pianos very clearly.—L. W. S.

The higher musical tones cannot be called high frequencies in

a discussion of sideband suppression. They are really less than medium. The highest frequency on the piano is around 4,000 cycles and the highest frequencies on the other two instruments mentioned are not much higher. The frequencies suppressed greatly by a tuner lie between 5,000 and 10,000 cycles. Moreover, no frequency is completely suppressed by any tuner, not even the 10,000 cycle frequency in a super-selective Superheterodyne.

Factors Determining Size of Wire

IS THERE any size of wire that is best for tuning coils? If so, what is the size? Is it advisable to use litz wire in making tuning coils for multi-tube receivers?—J. S.

There is no one size of wire that is best for tuning coils. As a rule the heavier the wire the less the resistance, but this does not hold throughout the frequency scale employed in radio. It is usually said that for coils to be used in the broadcast band it is not necessary to use heavier wire than No. 24. For higher frequencies heavier wire is preferable. In a multi-tube receiver having many tuned circuits even No. 24 wire is too heavy, mainly because of the bulk of the coils made with this wire. No. 28 wire is quite satisfactory when there are many tuned circuits in the receiver. There is no object of using litz when there are many tuned circuits, but when there are only one or two tuners in the receiver it is advantageous to use litz.

RF Resistance of Coils

IN WHAT manner does the radio frequency resistance of a coil vary with frequency? Is it higher the higher the frequency, or does it change in the opposite direction? What is the main reason for resistance change?—C. B. J.

The radio frequency resistance increases as frequency increases, and the rate of increase increases as well as the resistance. That is, the resistance is greater at 1,500 kc than it is at 550 kc, and the increase between 550 and 1,000 kc is considerably less than the increase between 1,000 and 1,500 kc. The main cause for the increase of resistance is the skin effect, which means that high frequency currents travel in the outer layer of the wire. This layer is thinner the higher the frequency, and consequently the resistance is higher the higher the frequency.

Automatic Volume Control

WHAT is the principle on which automatic volume controls work? Can they be attached successfully to receivers already built and not provided with such control?—E. E. M.

The radio frequency voltage, that across the detector grid, may be impressed on the grid of the volume control tube, which tube is adjusted so that it works as a grid bias detector. Therefore the rectified current in the plate circuit of this tube is higher, the higher the radio frequency voltage applied to the grid. The rectified current is filtered so that no radio frequency components remain. Then the current is sent through a resistor which is used as a grid bias resistor on the tubes ahead of the detector. The steady bias is adjusted so that the amplification is normal. When any additional bias is impressed the amplification decreases. Thus the higher the signal voltage on the detector, the greater is the bias on the radio frequency amplifier tubes and the lower is the amplification. Hence there is a continuous and automatic check on the amplification according to the strength of the signal. The filter in the plate circuit of the volume control tube must not respond so rapidly that the volume control wipes out the audio modulation. It must only respond to slow changes in the intensity of the radio frequency signal. It is possible to install an automatic volume control in a receiver not provided with one, but it is not a simple undertaking.

Receiver Squawks, He Wonders Why

THERE is a continuous squawk in my receiver which entirely spoils reception. This began one time when static was very severe. What do you think it is?—N. O. L.

In the absence of greater detail it is difficult to say what the trouble might be because there are many different noises that are called squawks. But it may be due to an open grid, and the opening might have occurred when a heavy crash of static came through the amplifier. Extremely high voltages are sometimes generated in the secondaries of audio transformers under such conditions, high enough to break down the insulation. Check all the grid circuits for continuity from the grid to the cathode or filament.

MODEL IN CLAY SHOWS BEAUTY OF RADIO CITY

Some idea of the beauty with which the architecture of the radio capitol, to rise in the heart of New York City's midtown section, was gained from a tentative clay model, disclosing a general purpose to erect a 60-story skyscraper sectionally. There will be a wide corridor, three stories high, interconnecting the sections, which will be held together artistically, as well as mechanically. Yet the skyline will more than peep through for dozens of times, in a bold effect of relieving the monotony that might otherwise prevail, due to the extensiveness of the building and adherence to the rigid setback style of architecture that city ordinance virtually requires for tall buildings, to afford bountiful light to the lower stories.

Wants to Relieve Unemployment

The radio capital is to be built by the Rockefeller interests, the whole work being under John D. Rockefeller, Jr., who is keenly desirous of having an early start made, so as to give work to many now unemployed. All the cost of land and buildings, as well as of the ornamentation of a gorgeous garden plaza, with costly statuary and fountains, will be borne by the Rockefeller interests, and will run into several hundred million dollars.

The site is between Forty-eighth and Fifty-first Streets, as north and south boundaries, and between Fifth and Sixth Avenues. A small but beautiful oval building, with shops on the ground floor and a terraced restaurant on the roof, will face Fifth Avenue, but the skyscraper will not be erected to the very building line on Sixth Avenue. The tall building will receive wide shafts of afternoon sunshine directly on a greensward that will separate its westerly exposure from the Sixth Avenue building line.

Some Houses Being Demolished

Some of the brownstone houses that were purchased as part of the assembly of the lot are being demolished now. When the project gets fairly under way it will give employment to 10,000 men steadily for the three years of the operation, and at operation peaks will give work to as many as 25,000 men, all directly concerned with the actual work of construction. Besides, several thousands more will be given work during at least part of the three years, through the added activities of the engineering, architectural, legal and other agencies, while the new equipment and furnishings to be used by the 27 broadcasting studios, four or five theatres and the hundreds of offices in the building will create a great sales outlet.

The studios will be those of the National Broadcasting Company. Member companies of the radio group will have offices in the building, the Radio Corporation of America moving its executive offices into the new structure.

The one theatre that is uncertain, which would constitute the fifth one in the skyscraper, would be for symphonic concerts. It was reported Leopold Stokowski, director of the Philadelphia Symphony Orchestra, was slated for the post, but his manager said that Stokowski's contract with the Philadelphia Orchestra has four years to run.

Church Considers New Skyscraper

A proposal is under consideration by the Collegiate Reformed Church of St. Nicholas, Forty-eighth Street and Fifth Avenue, New York City, for the erection on part of its site of a skyscraper to be used as the administrative center of all the Protestant Reformed church in New York City.

This is the church that would not sell its property when John D. Rockefeller, Jr., was assembling the large tract which has now been given over to the development of a radio capital. The Rev. Malcolm J. McLeod, pastor, said the church skyscraper would be in architectural conformity with the amusement project.

PEACE PACT IN BUFFALO WAR

Washington.

A plan for the settlement of the broadcasting controversy in Buffalo, N. Y., has been submitted to the Federal Radio Commission by both sides. The Buffalo "Evening News," which charged that the Buffalo Broadcasting Company maintained a monopoly by ownership of three of the stations and a 99-year lease on the other, would acquire WMAK by purchase and operate on 900 kc, the channel it had been awarded by the Commission for a new station. Also, the two other stations will each revert to separate ownership.

The Commission announced it would take the plan under advisement, but warned that formal applications for ownership transfer would have to be made in the usual course, and that only then would any action be taken.

The three stations owned by the Buffalo Broadcasting Company are: WGR, 550 kc, 1,000 watts; WKEN, 1,040 kc, 1,000 watts; WMAK, 900 kc, 750 watts. The leased station is WKBW, owned by the Churchill Evangelistic Association, Inc., 1,480 kc, 5,000 watts.

WMAK, which appealed to the court from the Commission's decision awarding 900 kc to the proposed "News" station, would consent to the dismissal of the appeal, should the dissolution plan be ratified by the Commission.

Lafount Commends Cultural Center

Commenting on the projected cultural center in the heart of New York City which is to be devoted to radio broadcasting and related entertainment, Harold A. Lafount, member of the Federal Radio Commission, said:

"It will afford the people the benefits of the finer things of which our great radio and entertainment arts are capable." He asserted he was "delighted" to learn of the project and that it deserved the highest commendation.

W2XCR ON 107 METERS

W2XCR, the radiovision broadcasting station of the Jenkins Television Corporation at Jersey City, N. J., has been operating on 2800 kilocycles (107 meters) instead of on 2150 kilocycles (139 meters) as formerly, to clear up interference between W2XCR and W2XR in New York.

BOARD TAKES NEW TACK FOR EQUILIZATION

Washington.

As a means of more nearly approximating equality of distribution of radio facilities, as required under the Davis amendment to the radio law, the Federal Radio Commission has developed a system of rating stations by units.

The object is to establish an equality of units in each of the five zones. No specified number of units need constitute the total for each zone, the only requirement being that the number of units be the same in each zone.

Table Gives Unit Ratings

The definition of "units" is included in the following table, which represents the main basis of rating:

Units	Circumstances
5	A station of 5,000 watts or more, operating on an exclusive channel at night.
4	A station of 5,000 watts or more, sharing the same frequency with one other station for simultaneous operation at night and separated by 2,000 miles or more.
2	A station of 5,000 watts or more, sharing the same frequency with one other station for simultaneous operation at night, but separated by less than 2,000 miles.
1	A station of 1,000 watts sharing the same frequency with any number of stations for simultaneous operation.
0.6	A station of 500 watts, sharing the same frequency with two or more stations for simultaneous operation.
0.4	A station of 250 watts, sharing the same frequency with two or more stations for simultaneous operation.
0.2	A station of 100 watts or less, sharing the same frequency with two or more stations in the same zone.

Excess Day Power Counted

Besides the above, there are small fractional unit values for stations assigned to day-time operation only. Also there is provision where excess power is authorized for day use.

The final paragraph of the order reads: "It is further ordered that each of the five zones created by Section 2 of the Radio Act of 1927 shall be equal, and shall be fairly and equitably distributed among and allocated to the States within each of said zones in proportion to the population of the zone, and that the quota of broadcasting facilities to which each State is entitled shall be determined and fixed as herein provided and in accordance with values in units for various classes of stations above set out."

N. Y. POLICE SEEK RENEWAL

Washington.

The Police Department of the City of New York has applied to the Federal Radio Commission for renewal of the license of its limited service station, which is about to expire. The station communicates with the Macom, the city's reception boat, regarding police arrangements when distinguished visitors are taken off liners for the trip to the Battery.

3 SUITS BEGUN AGAINST STATE TAX ON RADIOS

Columbia, South Carolina.

The State law imposing a tax on the privilege of owning and operating a radio receiver, is attacked as unconstitutional in three suits in Federal Court. One of the suits was brought by WBT, of Charlotte, another by a listener and the third by a radio dealer. The suits are against the Tax Commission and the Sheriff of Charleston County.

The unconstitutionality is alleged as existing under the Constitutions of Nation and State. State radio is interstate commerce and a State tax on the privilege of engaging in such commerce violates the Federal Constitution, it is charged.

The unconstitutionality under the State's organic law is alleged on the ground the act relates to two subjects, one the tax, the other the appropriation of the proceeds to a tuberculosis sanitarium.

So far \$20,000 has been collected and the suits do not stop the continuation of collections.

Praise from Board of Trade

The Charleston Board of Trade, "oldest Board of Trade in America," through T. Gilmore Smith, president, wired WBT:

"By resolution of Board of Directors all the forces and facilities of the Charleston Board of Trade are placed at your command in your splendid fight against the iniquitous tax imposed by the State of South Carolina on each and every radio set in use in this State.

"Our legal department concurs in your opinion that the South Carolina Radio Tax Act conflicts with the Federal Radio Act enacted under authority conferred upon the Congress of the United States by the Federal Constitution, granting to the United States the regulation of interstate commerce, under which radio stations are licensed.

"We contend that the State should not tax the radio sets of thousands, especially of poor families in South Carolina, for radio, besides creating a whole new world of communication is a social medium which means clean entertainment and real education.

Whole a Vital Factor

"Radio is a vital factor in American life. It is swaying and educating the world. To some families it is the only form of amusement and entertainment that they have, and it offers something which does not take people out of their homes. This has immense value, especially for young people.

"Radio is the greatest possible channel for good. It transmits to thousands in this State educational discourses, such as scientific and generally cultural lectures, and to innumerable little ones bedtime stories which are doing so much to lighten the burdens of mothers in a multitude of households. It must be obvious that Radio is a public service of the highest importance to the Nation."

I. R. E. CONVENTION NEXT MONTH

The fifth annual national and first international convention of the Institute of Radio Engineers will be held in Toronto, Canada, August 18th to 21st.

The engineering division of the Radio Manufacturers' Association are holding joint technical meetings with the I. R. E. during this convention.

Ousted Station Gets Injunction

Washington.

An appeal was filed by KFKB, Milford, Kans., from the order of the Federal Radio Commission refusing to renew the station's license because Dr. John R. Brinkley gave prescriptions in talks from the station. The petition, asking the Court of Appeals of the District of Columbia to compel the Commission to issue a license pending the appeal, was granted.

The specific charge against the station was that the broadcast talks by Dr. Brinkley, who owns a hospital in Milford and formerly owned the station, invited sufferers to write letters revealing their ills, whereupon, without examination or diagnosis, the physician would read a number over the air. This number was to be revealed by the "patient" to a drug store, which would give the medicine called for by the number, it is alleged. A further charge was that only drug stores that were members of the Brinkley Pharmaceutical Association knew what medicines the numbers designated.

KFKB was the first station licensed in Kansas, in 1923, and the license was issued to Dr. Brinkley, states the petition. The frequency used recently was 1,050 kc. and the power was 5,000 watts.

SLOAN DEFENDS COST OF 'JUICE'

Matthew S. Sloan, president of the National Electric Light Association, said Frederic M. Sackett, United States Ambassador to Germany, who attacked the high cost to consumers of electric power, in an address before the World Power Conference in Berlin, disclosed a lack of understanding of fundamental economics. The Ambassador had said that distribution costs were too high, as the 6 cents per kilowatt hour average was between fifteen and twenty times the cost at the power house.

"Ambassador Sackett is mistaken," said President Sloan. "Electricity does not cost the great mass of consumers fifteen times what it costs to produce, as he said. On the average, the country over, the sales price is not over four times the cost of energy at the power houses.

"The Ambassador discloses a lack of understanding of the fundamental economics of business generally, and particularly of electric service."

The interest of radioists lies in the fact that such a large number of them use AC receivers in homes that also obtain light and heat and run motors from the same source.

Washington.

Senator Norris, of Nebraska, attacked Samuel Insull, Chicago utilities magnate attending the World Power Conference, for having attempted to induce Ambassador Sackett not to utter that part of his speech referring to the consumer cost being from fifteen to twenty times the cost at the power house.

Ambassador Sackett was a United States Senator from Kentucky prior to his recent appointment, and was formerly president of an electric power company and of a gas company in Louisville, Ky.

WENR, Chicago, is owned by the Great Lakes Broadcasting Company, a subsidiary of the Insull interests.

WEST SIGNALS TO BE STRONG IN EAST SOON

BY HAROLD A. LAFOUNT
Federal Radio Commissioner

A study of West-East night radio transmission by scientists proves such transmission to be inversely correlated with solar activity.

Nine years ago when radio broadcasting was just starting, we were in a minimum of solar activity, a sunspot minimum, and reception here in the East from Western stations was at its maximum.

Field Strength Increasing

For the past several years, we have been passing through a maximum of sunspots. Measurements made by Dr. Greenleaf Whittier Pickard at Newton Center, Mass., have shown low field values from Western stations, in consequence of which but slight heterodyne interference has existed between East and West Coast stations.

Scientists tell us we are now rapidly passing through the sunspot maximum or period, with the result that field strength of West coast stations is increasing in the East and an extrapolation of the curve indicates that within a year we shall again have high field strength from Western stations.

Check-Up Is Close

The work of Dr. Pickard in correlation of radio reception with solar activities checks closely with the conclusions of other workers in the field, and is extremely helpful in the allocation of broadcasting stations.

Plan is Offered for Rural Listeners

Correlation of radio broadcasting for farmers with Federal and State agriculture extension programs is necessary, according to a statement appearing in the current issue of "The Extension Service Review," the official publication of the Extension Service of the Department of Agriculture.

The statement says that two things must be done in the interests of the rural listener: first, coordinate effectively the extension radio work of the Department of Agriculture and land-grant institutions; second, build radio teaching into the very fabric of extension teaching, to add radio's strength as an attention getter and an inspirer of action to the present extension teaching program and to reinforce radio's weakness in detailed instruction with the resources of print and demonstration and personal contact now available in the extension organization.

Three Nations Linked As Notables Speak

Berlin, Germany.

The Second World Power Conference was marked by an international radio hookup. Five persons in foreign countries addressed the 4,000 at a dinner, by radio, while two persons present made remarks.

Ambassador Sackett and H. Foster Bain were visible to the audience they addressed, but not so of Owen D. Young and Matthew S. Sloan, speaking from San Francisco; Lord Derby and Guglielmo Marconi, from London, and Thomas A. Edison, from East Orange, N. J.

A THOUGHT FOR THE WEEK

NOW that the Rockefeller millions are to be used for the glorification of radio as an art, an amusement and a science, it may be said truthfully that radio has taken its place with the biggest of the tremendous financial and business interests of the country. Standard Oil would do well to look to its laurels in the Big Business division. Perhaps air waves are more potent than gasoline!

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Ninth Year

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The Talker's Right

STATIONS send representatives to Washington to demand their rights. Listeners send complaints to the Federal Radio Commission about stations, and also demand their rights. But how about talkers at stations, particularly those talkers who pay the station in advance for the time on the air? May not they, too, demand their rights? They may, in the opinion Ben Fishback, of Orlando, Fla.

He was a candidate for State's attorney at Orlando and bought time on the air at the only local station, only to be informed later that he would have to submit a copy of his intended speech to the station's attorney before the speech could be delivered over the station.

The candidate sued the Orlando Broadcasting Company, owner of the station, asking the court to issue an injunction compelling the station to permit him to make the speech without submitting a copy.

Two stations in other parts of the country were ousted from the air by the Commission a few weeks previously for permitting broadcasts in which there had been much use of strong language.

Much of what is said over the air, even from large stations, including whole chains, is said without any one knowing the text in advance, indeed not even the speaker, sometimes! It is a matter of faith. Where there is any doubt the station will demand a copy of the speech. And when any one says anything that strikes the instructed radio operator as not being permissible, the microphone will be dead from then on.

Hurrah for Husing!

THE speed, accuracy and fairness of Ted Husing's blow-by-blow narrative of the Carnera-Godfrey heavyweight fight were a comfort to a fight-listening public that is not used to such expertness at ringside microphones. When blows are being exchanged at the fastest pace within the power of the fighters it is not possible for any one to record in simultaneous words each and every blow. The eye is willing, but the tongue is weak!

It was marvelous the way he almost kept abreast of the blows so much of the time. He had to talk so fast that, it must be admitted, only fight fans could catch the full significance. How well he succeeded all who heard him know.

THIS SUMMER'S RECEPTION FAR AHEAD AND WHY

A multitude of factors is responsible for year-round radio, says a statement from WFAA, Dallas, Tex., 50,000-watt station. Broadly they may be summed up as improvement of transmitters and receivers.

Ten years ago, 500 watts were regarded as high power for a broadcaster. Today 50,000 watts are considered as high power. There are eight stations in the United States whose aerials are actuated by this much or more electrical energy.

This multiplication of transmitting power has the same effect upon the old-style sets as upon the new. It increases the signal level over the noise level. The result is that, with any type of receiver, programs should be easily audible at all times this Summer at least fifty miles from a broadcaster. The majority of receiving sets are believed to be within this distance.

Higher Per Cent Modulation

Another improvement in reception brought about at the transmitting station is that of modulation. A greater proportion of the energy radiated is now modulated, which means that under modern radio engineering practice a greater proportion of the electrical energy that is used in broadcasting actually comes out of the loudspeaker in the form of voice or music.

The radio engineer can not claim a complete victory, because an electrical storm directly overhead can still mangle even a strong program; but the day is past when almost any electrical disturbance can turn a program into what sounds like a major artillery engagement.

Tube and Tuning

Greater efficiency at the receiving end centers in two fields of development, sharper tuning and better tubes. The sharper the tuning, the narrower the wave length band upon which static can effect a receiver, and the lower the volume of static. Improved tubes, notably the screen grid, have helped to achieve finer tuning.

These are by no means the only improvements. Others, such as visual tuning devices and a sensitivity control which automatically cut down the volume of excessively loud signals, have come to the assistance of the radio listener. And now, with the increasing use of a radio-phonograph combination, even the most violent thunderstorm can not rob listeners of Summer musical entertainment.

Tube Manufacturers to fix Replacement Plan

A standard replacement policy is being considered by radio tube manufacturers of the Radio Manufacturers' Association.

A questionnaire to manufacturers is being circulated to ascertain fully the present policies and opinions as to future policies of the tube makers. About forty representatives of tube manufacturers discussed the replacement policy and measures to overcome the practices of some dealers and jobbers in returning tubes.

Another meeting of the tube manufacturers will be held following completion of the questionnaire which has been circulated.

They Say

A. ATWATER KENT—"While my direct interest has been in manufacturing and musical broadcasting, I have felt for some time that the use of radio in other fields, education for example, has marvelous practical potentials. I feel that we should not permit the attractiveness and pleasure of entertainment broadcasting to absorb us to the point of exclusion or neglect of education, information and cultural development through the use of radio. Broadcasting stations are finding a growing interest in educational and business programs. The universities and other institutions of learning are broadcasting instruction to supplement the work of the class room. The Departments of Agriculture and Commerce are presenting information in an interesting way which means dollars and cents to farmers and business men. This practical use of radio has, I think, grown in the same ratio as its cultural use."

* * *

RALPH H. LANGLEY, director of engineering, Crosley Radio Corporation: "Perhaps the most outstanding advance will be an increased simplicity in the controls. With the signals from the broadcasting stations varying in strength over an enormous range it has been a matter of great difficulty, even for an experienced user to adjust the receiver to the more distant stations without creating an almost intolerable volume of sound as the set was tuned through the local stations. It was necessary to tune the set with one hand and try to maintain the volume within reasonable limits with the other hand. Now comes a perfected automatic volume control by which the set adjusts itself to the strength of the incoming signal and the user has only to tune to the station he desires having previously set the controls for the amount of volume he wants. As a result of this improvement listeners will again become interested in the more distant stations for they can now receive them without any manipulative skill and without the fear of an unbearable roar from stations nearby."

* * *

WILLIAM ALLEY, merchandising manager, Radio Manufacturers' Association: "Practically every one of the new 1930 set models includes, for instance, an automatic volume control. While this may not mean much to the average set owner, it does mark a definite step forward in the design of receivers. Invisible to the layman and hidden inside the cabinet, nevertheless this little gadget performs its work almost miraculously. It insures that every broadcast station received, no matter how weak, is automatically brought up to loud speaker volume. No longer will the listener have to strain ears to hear a distant program. While automatic volume control has already been adopted by a few manufacturers, next season it will be almost universal on every model."

Complete Newspapers by Radio Prophesied

Milwaukee, Wis.

Frank Parker Stockbridge, fifty years a newspaper man, and now editor of The American Press, predicted to the National Editorial Association, at its convention here, that complete newspapers will be sent by radio facsimile methods.

"The reproduction will be on sensitized paper," he said. "All that the subscriber will see will be paper rolling out of the radio printer, ready for him to take it out and read it."

MAJESTIC FIRM TOLD TO RESIGN, SAY RMA MEN

The announcement made by the Grigsby-Grunow Company, of Chicago, makers of Majestic sets and tubes, and first among set manufacturers of the world in business done, that it resigned from the Radio Manufacturers Association because the association did nothing to fight the "Radio Corporation monopoly," has been disputed.

Morris Metcalf, of Springfield, Mass., new president of the RMA, said that the Grigsby-Grunow Company was asked to resign. The reason for the request had nothing to do with the RCA or the patent situation, he said, but he refused to reveal what the reason was.

Accompanying his prepared statement was a letter citing a resolution of the board of directors of the RMA, ascribing the request for resignation to "various acts of the Grigsby-Grunow Company during the week of the convention and trade show." This letter was signed by Bond Geddes, executive vice-president of the RMA.

Letter from Geddes

Mr. Geddes' letter follows:
"In connection with the enclosed statement regarding the resignation of the Grigsby-Grunow Company of Chicago from the Radio Manufacturers' Association of Chicago, for your information only and not with the expectation or desire for publication, I am transmitting herewith a copy of the resolution adopted unanimously by those present of the RMA Board of Directors at Atlantic City on June 6th. The resolution, which you may publish or not as you desire, follows:

"RESOLVED, that various acts of the Grigsby-Grunow Company during Trade Show at Atlantic City, June 2-6, 1930, having been reported to this Board of Directors, and the Board having duly considered the same and having determined that such acts are detrimental to the best interests of the Association and the conduct of its affairs, and that the membership of the Grigsby-Grunow Company in the Association ought not to continue and this Board having determined that the resignation of such offending member should be requested, this Board of Directors do hereby instruct and direct its (sic) Executive Secretary to send or deliver a copy of this Resolution to an officer of the Grigsby-Grunow Company immediately and that such member be and hereby is requested to resign from membership in this Association."

Metcalf's Statement

President Metcalf's remarks on behalf of the RMA, referred to in Mr. Geddes' letter, follow:

"A statement by the chairman of the board of the Grigsby-Grunow Company has appeared in today's newspapers, assigning as his company's reasons for its resignation from the RMA the failure of the RMA to take an active stand on issues of vital interest to members of the industry.

"I wish to state emphatically that the actions of the RMA are not determined by any member or group of members, but by a majority vote of the membership or of its board of directors, and that the

Driverless Auto Mystifies Police

East Chicago, Indiana.

An automobile was making its way through traffic, stopping at red lights and starting at green ones, and turning corners properly, but there was no driver, so far as the eye could see. Therefore a policeman jumped aboard, stopped the car at a curbstone and looked underneath in search of the hidden driver. But there was nobody hidden under the chassis, behind the cowl, over or under the motor, or in any cylinder. The policeman was at a loss what to do, so he "arrested" the car.

At the police station an investigation of the law disclosed that a machine can not commit an offense and hence can not be arrested for committing one. The next best thing, thought the police, was to hold the driver responsible, but then it was recalled there was no driver. There must be an owner, however, and he was found to be Rimes Lee, president of an automobile company. He explained the automobile had been driven by remote radio control, using photo electric cells to transmit the actuating impulses on a high frequency. He showed auto and radio licenses, and the police gave him a handshake instead of a summons.

resignation of Grigsby-Grunow Company was requested by the unanimous vote of those directors present at the regular meeting of the board held at Atlantic City, New Jersey, on June 6th.

"The reason for such request has nothing to do with the patent situation or, in fact, any phase of the radio business situation as it now exists.

"The reasons leading up to the request for the resignation of the Grigsby-Grunow Company are generally known in the trade, and it is a matter of surprise to me that that Company should wish to refer to the matter in any way."

After sending the letter and enclosure Mr. Geddes left on his vacation.

Members of the RMA, asked if they knew the reasons actuating the board of directors, said they did not know.

What Grigsby Said

B. J. Grigsby, chairman of the board of the Grigsby-Grunow Company, had charged that RCA and its associates are maintaining a monopoly in every phase of radio and now are dominating the policies of the association.

"The Radio Manufacturers' Association in this public crisis takes the position that it cannot do anything which would interfere with those members," said Mr. Grigsby. "It cannot do anything to prevent a monopoly which would destroy or seriously cripple all of its members except the Radio Corporation of America and its associates, even though they are engaged in a criminal conspiracy to monopolize the radio industry.

"The radio industry, as organized in the Radio Manufacturers' Association, cannot and does not express its true sentiments nor stand, as an industry, for the things in which it believes."

Spain Considering Government Monopoly

Madrid, Spain.

The Radio Commission reported to the Council of Ministers on the radio status in Spain. It is believed that Spain will establish a Government monopoly.

Messages in particular are the concern, as the business has not proven popular for two of the three private operators now in the field.

REED IS HIRED TO AID A LEGAL FIGHT ON RCA

Chicago, Ill.

The Grigsby-Grunow Company, of this city, manufacturers of Majestic radio receivers and tubes, and whose chairman, before a Senate committee in Washington, recently attacked the Radio Corporation of America's licenses as not as protective as the patent pool maintains, has hired former Senator James A. Reed, of Missouri, as counsel. The company intends to carry on its fight against the RCA patents, as promising to hold the licensees harmless from patent suits, but failing of this avowed purpose.

Also, the Grigsby-Grunow Company asserts that RCA is free from any patent payment obligation itself, and, being a competing set manufacturer, is able to get an edge on those it licensed.

Reed made a speech at a Democratic rally at Sedalia, Mo., during which a supposedly fake SOS was sent out that put off the air some stations that were carrying his speech. He was beginning an attack on what he termed the radio trust.

Company Sponsored Talk

Sixty-five stations of the Columbia Broadcasting System carried the first part of the speech. It was learned that Grigsby-Grunow sponsored Reed's speech and paid the claim.

It is said that Senator Reed also will be asked to give assistance, on behalf of his new client, to the Federal Government in its patent pool suit against RCA, Westinghouse, General Electric and others. What form this assistance would take was not stated, but it was reported it would be in the nature of furnishing information, as Reed's long service in the United States Senate helped to make him highly informed on the radio situation.

Grigsby-Grunow Company, like all other licensees of the RCA for set-manufacturing, pays a royalty of 7½ per cent., of which the minimum guarantee per year is \$100,000.

Makes Ice Boxes, Too

The company first gained radio prominence by making and selling more B eliminators than any other company in the world. Then it went into the set field and won first place in its first year. Next it added tubes to its line, and now it also has electric refrigerators, in an effort to sustain a high degree of business during summer months when radio sales usually decline.

Three Countries Join Radio Police System

The enlistment of radio in fighting crime is under way by three countries, says the Department of Commerce. Scotland Yard, London's famous police headquarters, will have a radio station of its own, which is to be connected with other British cities for transmitting information and following the movements of criminals. Two other police radio stations will be constructed at the same time, one probably in Birmingham and the other either in Glasgow or Edinburgh.

Canada and France are also planning similar police stations. The French police will use the short-wave station in the Eiffel Tower.

OUSTER LOOMS AS 30 STATIONS DEFY THE LAW

Washington.

The campaign for the vigilant policing of the air and elimination of abuses, that got under way soon after Maj-Gen. Charles McK. Saltzman became chairman of the Federal Radio Commission, is being waged in several new directions.

Twenty instances have been cited by the Commission to the Department of Justice of various types of stations operating without a license, which is punishable by fine and imprisonment. The information was dug up by operatives of the radio division of the Department of Commerce, which division had been asked to keep a sharp lookout for non-licensed operation.

Television Licenses Under Fire

Another phase of the ever-widening campaign against air abuses is the investigation of complaints that stations licensed for television on an experimental basis only are violating the terms of their license by selling time on the air.

One station, on the advice of its publicity agent, sent out a notice to the press, praising the progress of television, and stating that already it had reached the stage of sponsored programs, giving the name of the sponsor, or advertiser, and of the station. This publicity release was the cause of the investigation, which corroborates the fact that trade announcements were shown in television and even verbal transmission made along the same lines.

Then the investigation grew still more important when other television "experimental" stations were found to be conducting an "experiment" as to whether it was possible to make much money selling time on the air for television broadcasts.

Fortune Tellers Next

The other part of the campaign has to do with refusing license renewals to, or revoking licenses of, broadcasting stations that tolerate the sending from the station of talks of undoubted impropriety. Two stations recently were refused license renewal for this reason, although the objectionable talks were made by persons who bought time on the air, and the stations felt they had no censorship right.

These were the first two examples, in the history of the commission, of license renewals refused because of the nature of broadcast talks, and this was cited as "Army discipline."

Other matters which are under investigation are in divining by Rajahs, gypsies and the like, who invite listeners to mail their questions to the "prophet" at the station, and "as many as possible will be answered over the air." The Rajah then will read questions, giving only the initials of the writers, and tell what "the crystal shows very clearly" as to the inquirer's problems, including success in love and business.

How the Racket Sounds

A Rajah's discourse runs like this: "Here is a letter from J. C. M.—but I can't answer this one. The rule is that the writer must sign his or her full name and address, although only initials will be used over the air. As it is impossible to answer all the questions by radio, writers should enclose a self-addressed, stamped

Seeks Sets for All Florida Schools

Gainesville, Fla.

A movement, backed by civic organizations, has been started to install radio receiving equipment in all the schools of the State, under the supervision of the State Department of Education, due to the impending opening of the School of the Air, by WRVF, University of Florida station.

Recently a series of lectures on musical appreciation was broadcast. The text will be published in book form. All teachers in Florida schools will receive a copy.

SUES WDBO ON EDITING SPEECH

Orlando, Fla.

In a suit filed against the Orlando Broadcasting Company, Inc., Ben Fishback, candidate for State's attorney at Orlando, asks for an injunction to compel the corporation to permit him to make a speech over WDBO (1,120 kc, 500 watts), in his campaign, without having to submit a copy of the speech to the company's attorney for approval.

Fishback asserts that, as attacks against his candidacy had been made by an opponent over the station, and that as WDBO is the only station in Orlando, he felt constrained to use the station to answer the attacks. So, he asserts, he bought time on the air for two nights and paid for it. Then, the day before the first scheduled talk, he asserts, he was informed he would have to submit to the station's attorney a transcript of the proposed remarks before he could go on the air. He refused.

The suit is brought on two major legal grounds: first, that a contract was made between himself and the broadcasting station, through its incorporated owner, and that this contract embodied all the terms, there being nothing said of submitting the speech for approval; second, that one who buys time on the air has the right to make a speech without submitting to censorship by the station.

envelope with their inquiries, so that it will be possible to answer them by mail, if not by radio. Now, here is a letter from a careless writer, who put a one-dollar bill in her letter of inquiry, and didn't pin the bill to the letter."

Persons who sent in letters, as required, but no dollar bill or other money, only the stamped, addressed enclosed envelope, got no reply by air or by mail.

Marriage brokers, heard on other stations than the one guilty of the above, also have caused the stations to be under investigation. No kind of a program is offered by the marriage broker, but in English, usually broken, he will offer to obtain life partners, and will boast that he has many satisfied customers. "No fee unless successful" is his fair-enough temptation.

The Commission is gradually acquiring a large portfolio of complaints and information concerning the many stations that permit their facilities to be used by adventurers, such as fortune tellers and marriage brokers. The record shows that many stations, small ones, for the most part, are ready to accept "clients" that newspapers virtually unanimously reject from their advertising columns.

All told, about thirty stations are in danger of losing their licenses.

HUSING TELLS BLOWS FAST IN CARNERA FIGHT

The heavyweight fight between Primo Carnera, the Venetian giant, and George Godfrey, veteran colored pugilist, of Leiper ville, Pa., was described from Philadelphia in rapid blow-by-blow fashion by Ted Husing, announcer, over the Columbia Broadcasting System's network.

The peak of excitement was reached in the fifth round, when the crowd went through its prerogative of going wild, but the line was cut off or accidentally went dead until the scene quieted down a little. Then Husing explained that a doctor was examining the fallen man, who was writhing as if in intense pain. For several minutes listeners, if one judged by the reception over WABC, the key station, were in the dark as to who had fallen, and why.

"It was a clear foul, from what I saw," said Husing, "but I am only giving my own personal opinion and am making no announcements except official announcements."

Foul Called "Deliberate"

Then Husing said that Godfrey was standing in his corner, looking toward the spot where Carnera lay, and that was the first that the listening audience knew that Carnera was down and the question was being decided whether he had been fouled.

When the referee advanced to make his report, Husing stopped so the referee's words could be heard by the radio listeners. The referee announced Carnera the victor on a foul in the fifth round and declared the foul deliberate.

Just prior to the beginning of the fight, and during the periods between rounds, Husing's voice could be heard competing with that of another announcer. It seemed that a Philadelphia station had a microphone at the ringside for direct receipt of Husing's description, but that in the preliminary moments and during the rest periods in the ring, another announcer spoke into the independent microphone, and Husing worked for the benefit of the rest of the chain. The result was that virtually nothing of what either said at these times could be understood, unless one had a developed faculty for listening to two persons talking fast at the same time.

Husing Does Fine Job

Husing's quick command of words enabled the radio listeners to keep almost abreast of the ring action. Where there was clinching Husing would so announce, and would utilize the time by giving interesting, unbiased comparisons of the action thus far. One point he stressed was that Carnera was putting up a good showing, and was faster than had been expected, these remarks, however, by no means inferring that Carnera was winning.

Husing's account of the fight was highly interesting and was executed in the manner of one thoroughly familiar with boxing.

Husing also was on the job in getting persons before the microphone. He succeeded in bringing Godfrey there, also Leon See, Carnera's handler, and Dr. Vaughn Deever, who made the official medical report on the foul. See said Carnera had been fouled five times, the fifth rendering him helpless.

SLIGHTING OF 3 STATIONS HELD IN PUBLIC GOOD

Washington.

A proposed reallocation, which would have shifted twenty-six stations, to establish better conditions on clear channels, was planned on an engineering basis, and for the general good, although a slight disadvantage would result to three stations, the Federal Radio Commission explained in a statement.

This reallocation was halted, at least temporarily, by injunctions obtained by three of the stations affected: WHAM, Rochester, N. Y. (Stromberg-Carlson); WHAS, Louisville, Ky., and KYW, Chicago. If the courts sustain the Commission, the intention is to carry out the changes immediately.

Disadvantages Called Overshadowed

The Commission has a method of computing interference, in which the mileage enters, and on this basis it was estimated that under this reallocation, which was mainly for reducing interference, six clear channels would have 3,676 fewer "interference miles," while three channels would have 143 more "interference miles," making a net improvement over the present situation of 3,533 "interference miles."

The statement then went on:

"Therefore it is evident that the slight disadvantage to the three channels is greatly overshadowed by the tremendous relative gain by sixteen channels and the listening public."

"The elimination of stations or any change in the power or geographical location of existing broadcasting stations is a serious matter.

Complicated Problem

"Therefore, in cases of interference, every possible effort is made to make the necessary adjustment by a change in frequency or wavelength. This is a very complicated problem, as each individual change must be considered in relation to all other stations within interference range as to all the factors."

At another point the statement set forth:

"Certain stations now operating on clear channel assignments are suffering from and causing crosstalk interference to other stations on other channels, in some cases due to improvements which increased the efficiency of transmitters since the present allocation was put into effect."

Television to be Separate Long Time, Says Replogle

Television equipment for the home must remain separate from the usual broadcast receiver for many years, said D. E. Replogle, of the Jenkins Television Corporation, Jersey City, N. J. Sound broadcasting is considerably ahead of sight broadcasting in point of relative perfection, so that it would be decidedly unfair to each art to be coupled together in an inflexible combination, he remarked.

According to Mr. Replogle, sight and sound broadcasting proper may be combined in an experimental manner, as is being done in several instances.

To attempt to combine both sight and sound functions into a single receiver, he continued, would be folly at present, therefore, the radio industry and the radio buyer need not wait for the combination sight and sound broadcast receiver, which is still far away in the dim future.

Table Compares Interference

Washington.

The following table gives a list of the 22 clear channels involved in or affected by the proposed shift up to and including 50 kilowatts and 30 kilocycles, arranged according to the amount of gain or loss, and showing the number of "interference miles" gained or lost by each station within the recommended separation.

- 1.—WTAM, Cleveland, Ohio; +600.
- 2.—WCAU, Philadelphia, Pa.; +410.
- 3.—WVVA, Wheeling, W. Va.; +375.
- 4.—WTIC, Hartford, Conn.; WBAL, Baltimore, Md.; +370.
- 5.—WRVA, Richmond, Va.; +363.
- 6.—WBT, Charlotte, N. C.; +360.
- 7.—WOAI, San Antonio, Tex.; +270.
- 8.—WLWL, New York, N. Y.; WPG, Atlantic City, N. J.; +250.
- 9.—KOB, State College, N. Mex.; KEX, Portland, Ore.; +220.
- 10.—WHAM, Rochester, N. Y.; +203.
- 11.—WVHO, Des Moines, Iowa; WOC, Davenport, Iowa; +140.
- 12.—WDZ (D), Tuscola, Ill.; +55.
- 13.—YV, Chicago, Ill.; +15.
- 14.—WOWO, Fort Wayne, Ind.; +15.
- 15.—WKAR, (D.), East Lansing, Mich.; +15.
- 16.—WKEN (L. T.), Buffalo, N. Y.; +15.
15. Total +3676.
- 17.—KRLD, Dallas, Tex.; KTHS, Hot Springs, Ark.; 0.
- 18.—KSL, Salt Lake City, Utah; 0.
- 19.—WAPI, Birmingham, Ala.; KVOO, Tulsa, Okla.; 0.
- 20.—WHAS, Louisville, Ky.; -25.
- 21.—WGY, Schenectady, N. Y.; -50.
- 22.—KMOX, St. Louis, Mo.; -68.
- Total -143.

WAY TO STRETCH CHANNEL CITED

Modulation by phase shifting of two carriers on the same frequency, permitting "200 broadcast channels in the space now occupied by one," has been successful, said Dr. Sydney N. Baruch, inventor, who owns WBNY, New York City. This method has been used on short waves, he explained, especially for relaying, but is applicable as well to the broadcast spectrum.

Dr. Baruch explained the technique of the operation as follows:

"Two carriers of the same frequency are utilized. Nothing is placed on the wave, as in ordinary broadcasting, to change its shape or form; intelligence is carried by the shifting of one wave with respect to the other, such as electrical engineers call 'lagging or leading.'"

"This determines the amount of energy intercepted at the receiving device. Normal modulation is produced by a 45-degree phase shift in the two carrier waves of the same frequency. To obtain secret transmission the phase shift is made to take place to the extent of 90 degrees.

"This, however, necessitates the use of an independent oscillator device at the receiver.

"The speed of transmission of this system is tremendous, being limited only by the speed at which it can be modulated."

Washington.

A method of modulating by phase-shifting has been called to the attention of engineers of the Federal Radio Commission by Dr. Sydney Baruch, who operates WBNY from 400 East 139th Street, New York City.

SEVEN TO LOSE IN FIGHT FOR 50,000 WATTS

Washington.

Having decided to limit to twenty, the number of cleared channels on which 50,000-watt transmission of broadcasts would be authorized, or four for each for the five zones into which the United States is divided for radio administration, the Federal Radio Commission has to apply the rule to present applicants for higher power. Hearings will be held in the Fall, except in one possible instance, when a Commissioner who is to make a trip to the Pacific Coast may hold a hearing there on one application, within a few weeks.

If the existing 50,000 watt stations were added to five given construction permits, and thirteen other applications, the total, assuming all were put in operation, would be twenty-seven stations, or seven in excess of the maximum.

There are forty cleared channels, eight to a zone. Although twenty channels are permitted for 50,000-watt transmission, only nine channels are used at that power at present, thus presenting eleven possibilities for the applicants.

Nine Licensed at 50,000 Watts

Nine stations are licensed to use 50,000 watts, although two of these stations use the same transmitter. The maximum permanent authorization is 25,000 watts for all nine, while the extra 25,000 watts are allowed "experimentally."

Those now licensed at 50,000 watts total are:

- WBAP, Forth Worth, Tex.
- WEAF, New York City.
- WENR, Chicago, Ill.
- WFAA, Dallas, Tex.
- WGY, Schenectady, N. Y.
- WLW, Cincinnati, O.
- WTAM, Cleveland, O.
- WTIC, Hartford, Conn.
- KDKA, Pittsburgh, Pa.

The two stations that use the same transmitter are WBAP and WFAA.

Five Hold Permits, Thirteen More Apply

Five stations already hold construction permits for 50,000 watts, although not yet having been given a license at this power. The five are:

- WABC, New York City.
- WLS, Chicago, Ill.
- WOAI, San Antonio, Tex.
- KMOX, St. Louis, Mo.
- KNX, Los Angeles, Calif.

Besides, applications for permission to use 50,000 watts, where no construction permit has yet been issued for that power, have been filed by the following thirteen stations:

- WAPI, Birmingham, Ala.
- WCFL, Chicago, Ill.
- WFBM, Indianapolis, Ind.
- WHAM, Rochester, N. Y.
- WHO-WOC, Des Moines and Davenport, Iowa.
- WOWO, Fort Wayne, Ind.
- WRVA, Richmond, Va.
- WSB, Atlanta, Ga.
- WSM, Nashville, Tenn.
- WWJ, Detroit, Mich.
- KGO, Oakland, Calif.
- KTNT, Muscatine, Ia.
- KWKH, Shreveport, La.

Vice-Chairman Eugene O. Sykes is going to the Pacific Coast to conduct hearings on other matters and may take up the KGO application at that time.

Set of SOCKET WRENCHES FREE!



FOR turning nuts down or up there is nothing as efficient and handy as a socket wrench. Here is a set of three wrenches for hexagonal nuts, enabling use with 5/32, 6/32, 8/32 and 10/32 nuts. Fit the nut into the proper socket and turn down or up. The three different size sockets, one size on each wrench, enables use of three different outside diameters of nuts, but at least ten different sizes of threads. Send 50 cents for four weeks subscription for RADIO WORLD and get this set of three wrenches FREE!

RADIO WORLD, 145 W. 45th St., New York, N.Y.
50 cents enclosed for 4 weeks' subscription for RADIO WORLD. Send socket wrenches free!

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GUARANTEED Neontron Tubes!
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224 @ \$1.20	UX199 @ \$1.20
250 @ \$2.20	UV199 @ \$1.20
210 @ \$2.20	199, Navy base, @ \$1.20
245 @ \$1.20	120 @ \$1.20
240 @ \$1.20	200A @ \$1.20

30-day free replacement guarantee!
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"Seconds" But Serviceable Tubes Nevertheless at Prices That Seem Incredible

A tube factory that maintains the highest possible standards for a large laboratory customer has tubes for sale that fall just a trifle below the most exacting specifications, but which are excellent tubes nevertheless. They are called "seconds" and they are "seconds," but they are not "thirds." You can get 500 hours excellent use out of them. Note the prices. Remit with order. Generous replacement policy.

112A	50c	227	50c
UV or UX-199	50c	245	50c
201A	45c	250	75c
210	60c	171A	50c
224	65c	280	50c
226	50c	281	60c

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 If renewing Radio World subscription, put cross in square at beginning of this sentence.
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1,680 Alphabetical Headings from A-battery to Zero Beat; 1,025 Illustrations, 920 Pages, 240 Combinations for Receiver Layouts. Price, \$6.00. Radio World, 145 W. 45th St., N. Y. C

RADIO AND OTHER TECHNICAL BOOKS At a Glance

"Audio Power Amplifiers," by Anderson and Bernard	\$3.50
"Drake's Radio Cyclopaedia," by Manly	6.00
"The Electric Word," by Shubert	2.50
"Elements of Radio Communication," by Morecroft	3.00
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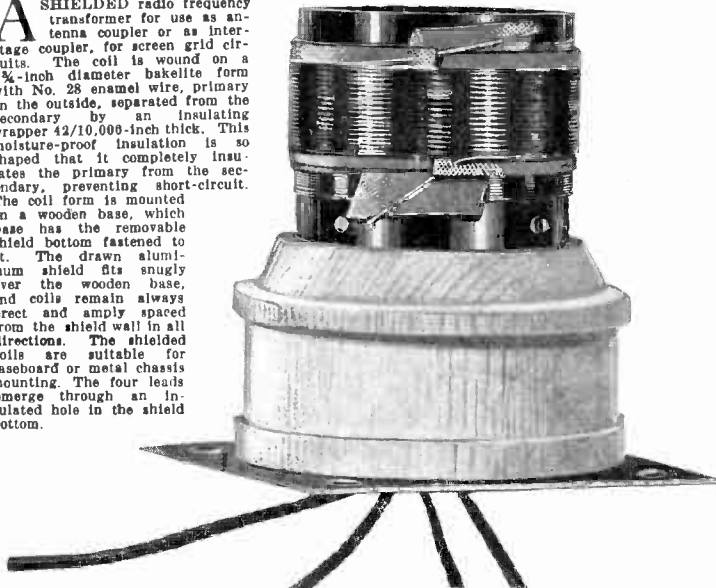
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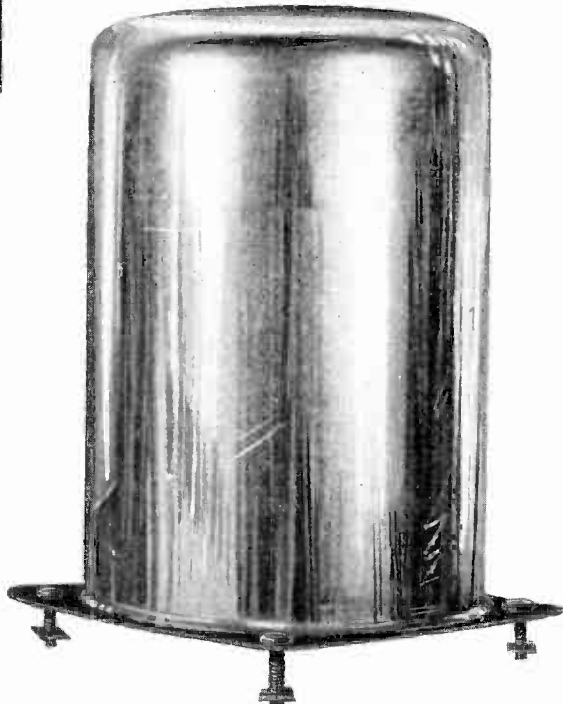
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High-Gain Shielded Coils

A SHIELDED radio frequency transformer for use as antenna coupler or as interstage coupler, for screen grid circuits. The coil is wound on a 1 3/4-inch diameter bakelite form with No. 28 enamel wire, primary on the outside, separated from the secondary by an insulating wrapper 42/10,000-inch thick. This moisture-proof insulation is so shaped that it completely insulates the primary from the secondary, preventing short-circuit. The coil form is mounted on a wooden base, which base has the removable shield bottom fastened to it. The drawn aluminum shield fits snugly over the wooden base, and coils remain always erect and amply spaced from the shield wall in all directions. The shielded coils are suitable for baseboard or metal chassis mounting. The four leads emerge through an insulated hole in the shield bottom.



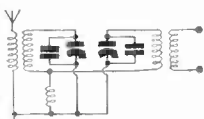
The coil comes already mounted on a shellacked wooden base, which is fastened at the factory to the shield bottom. Series A coil is illustrated.



The external appearance of the shield, with four 6/32 machine screws and nuts, which are supplied with each coil assembly.

Precisely Matched for Gang Tuning

O NE primary lead-out wire from the coil, for antenna or plate connection, has a braided tinned alloy covering over the insulation. This alloy braid shields the lead against stray pick-up when the braid alone is soldered to a ground connection. The outleads are 6 inches long and are color identified. The wire terminals of the windings themselves, and the outleads, are soldered to copper rivets. Each coil comes completely assembled inside the shield, which is 2 3/4 inches square at bottom (size of shield bottom) and 3 3/4 inches high. High impedance primaries of 40 turns are used. Secondaries have 80 turns for .00035 mfd. and 70 turns for .0005 mfd.



BP-6 is the coil at bottom.

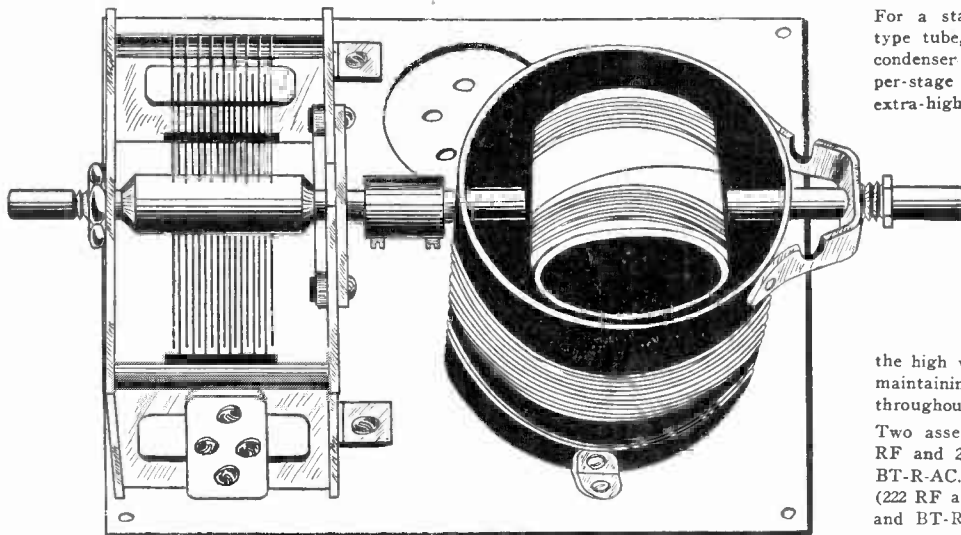
EXTREME accuracy in winding and spacing is essential for coils used in gang tuning. These coils are specially suited for gang condensers, because the inductances of all are identical for the stated size condenser. The coils are matched by a radio frequency oscillator. The color scheme is as follows: shielded wire outlead is for antenna or plate; red is for ground or B plus. (These options are due to use of the same coil for antenna coupling or interstage coupling.) Blue is for grid and yellow is for grid return. For .00035 mfd. the Cat. No. is A-40-80-S. For .0005 mfd. the Cat. No. is A-40-70-S. Where a band pass filter circuit is used the small coupling coil to unite circuits is Cat. BP-6. The connection is illustrated herewith.

Junior Model Inductances

The Series B coils have the same inductance and the same shields as the series A coils, but the primary, instead of being wound over the secondary, with special insulation between, is wound adjoining the secondary, on the form, with 1/4-inch separation, resulting in looser coupling. No wooden base is provided, as the bakelite coil form is longer, and is fastened to the shield bottom piece by means of two brackets. No outleads. Wire terminals are not soldered. Order Cat. B-SH-3 for .00035 mfd. and Cat. B-SH-5 for .0005 mfd.

Coils for Six-Circuit Tuner

Series C coils for use with six tuned circuits, as in Herman Bernard's six-circuit tuner, are wound the same as type A shielded coils, but the shields are a little larger (3 1/16-inch diameter, 3 3/4 inches high), and there are no shield bottoms, as a metal chassis must be used with such highly sensitive circuits. Fasten the brackets to the shield and then, from underneath the chassis, fasten the other arm of the two brackets to the chassis. Order Cat. C-6-CT-5 for .0005 mfd. and Cat. C-6-CT-5 for .00035 mfd. Five needed for Bernard's circuit. If band pass filter coupling coil is desired order Cat. BP-6 extra.



For a stage of screen grid RF, either for battery type tube, 222, or AC, 224, followed by a grid-leak-condenser detector, no shielding is needed, and higher per-stage amplification is attainable and useful. This extra-high per-stage gain, not practical where more than one RF stage is used, is easily obtained by using dynamic tuners. Two assemblies are needed. These are furnished with condensers erected on a socketed aluminum base. Each coil has its tuned winding divided into a fixed and a moving segment. The moving coil, actuated by the condenser shaft itself, acts as a variometer, which bucks the fixed winding at the low wavelengths and aids it at the high wavelengths, thus being self-neutralizing and maintaining an even degree of extra-high amplification throughout the broadcast scale.

Two assemblies are needed. For AC operation (224 RF and 224 or 227 detector), use Cat. BT-L-AC and BT-R-AC. For battery or A eliminator operation (222 RF and any tube as detector), use Cat. BT-L-DC and BT-R-DC.

Screen Grid Coil Co., 143 West 45th Street, New York (Just East of Broadway):

- Enclosed please find \$..... (Canadian must be express or P. O. Money Order), for which send me prepaid the following:
- | | |
|--|---|
| <input type="checkbox"/> A-40-80-S, each..... \$2.25 | <input type="checkbox"/> B-SH-3, each..... \$1.00 |
| <input type="checkbox"/> Matched set of four A-40-80-S..... 10.00 | <input type="checkbox"/> Matched set of four B-SH-3..... 4.00 |
| <input type="checkbox"/> A-40-70-S, each..... 2.25 | <input type="checkbox"/> B-SH-5, each..... 1.00 |
| <input type="checkbox"/> Matched set of four A-40-70-S..... 10.00 | <input type="checkbox"/> Matched set of four B-SH-5..... 4.00 |
| <input type="checkbox"/> BT-L-AC and BT-R-AC, assembled, with condenser, link, socket and base, per pair..... 6.00 | |
| <input type="checkbox"/> BT-L-DC and BT-R-DC, assembled, with condenser, link, socket and base, per pair..... 6.00 | |
| <input type="checkbox"/> C-6-CT-5, .0005 mfd. shielded coil for six-circuit tuner..... each \$2.25 | |
| <input type="checkbox"/> C-6-CT-3, .00035 mfd. shielded coil for six-circuit tuner..... each \$2.25 | |
| <input type="checkbox"/> BP-6..... .25 | |
| <input type="checkbox"/> EQ-100, equalizer of 20-100 mfd. capacity, made by Hammarlund..... .35 | |
- (Note: All coils come with shields, except BP-6 and BT-L.)

NAME..... ADDRESS.....

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

If ordering C.O.D. put cross here. Post office fee will be added to prices quoted.

BT-L for the antenna stage and BT-R for the detector input. BT-L consists of a small primary, with suitable secondary for the .00035 mfd. condenser supplied. BT-R has two effective coils: the tuned combination windings in the RF plate circuit, the inside fixed winding in the detector grid circuit. The moving coils must be "matched." This is done as follows: Turn the condensers until plates are fully smashed, and have the moving coils parallel with the fixed winding. Tune in the highest wavelength station receivable—above 450 meters surely. Now turn the moving coils half way round and return to bring in the station. The setting that represents the use of lesser capacity of the condenser to bring in that station is the correct one. If gang tuning is used, put a 20-100 mmfd equalizing condenser across the secondary in the antenna circuit and adjust the equalizer for a low wavelength (300 meters or less).