RF AUTOMATIC VOLUME CONTROL

JULY 12th
1930

RADIO WORLD

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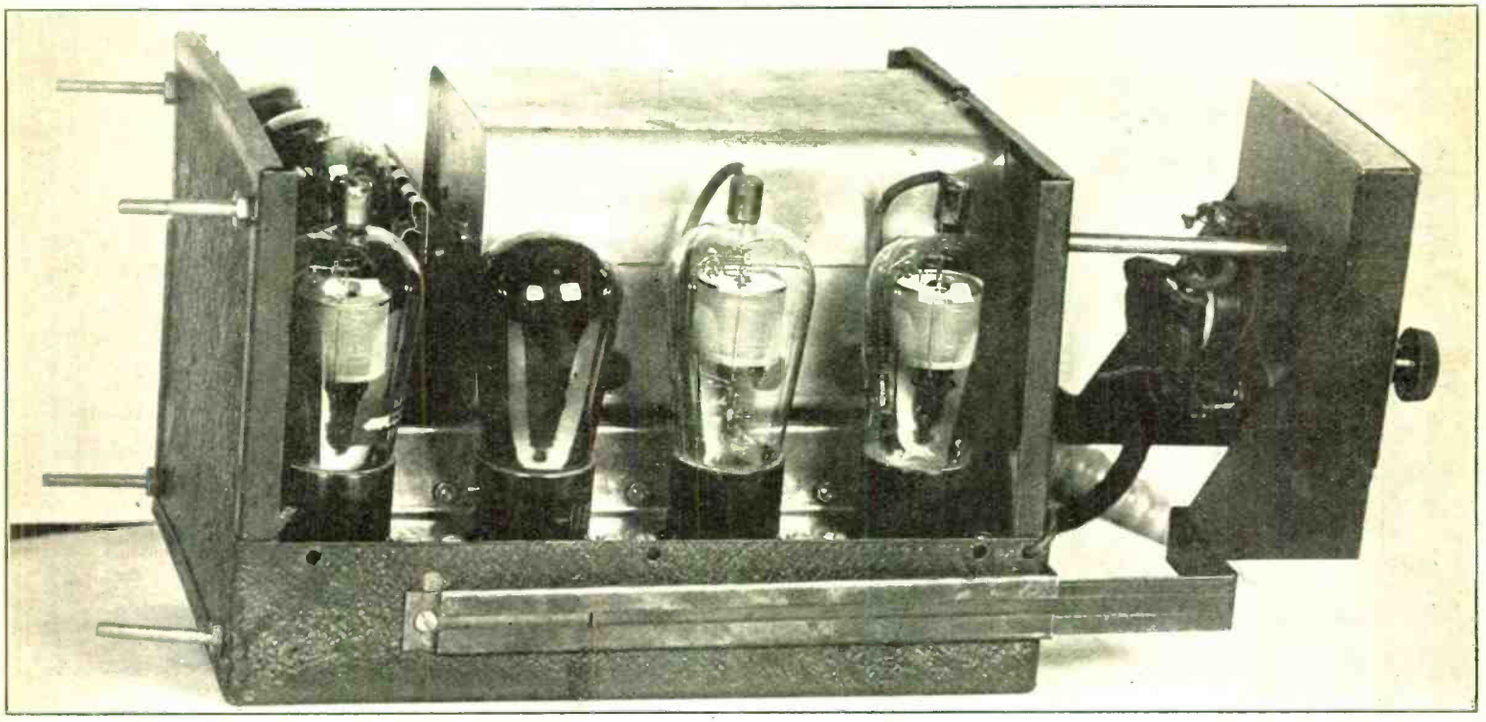
The First and Only National Radio Weekly

433rd Consecutive Issue—NINTH YEAR

6-TUBE AUTO RECEIVER



A shielded receiver for auto installation, using screen grid RF amplification.
See article on pages 5 and 6.

TONE CONTROL

MB-30 SENSITIVITY

Need of Thorough By-passing Circuits

Amateurs Form Part of New 'SOS Reserve'

THIRD BIG CHAIN LOOMS

SUES RCA FOR $30,000,000

KEY TUBES

Quality First

The following constitute the thirteen most popular tubes used in radio today. Despite the severely low prices the Key tubes are firsts of the very first quality. The tubes are manufactured under licenses granted by the RCA and its affiliated companies.

All prices are net and represent extreme discount already deducted.

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☐	224 AC screen grid	$1.43
☐	245 AC power tube	$1.28
☐	226 AC amplifier	.68
☐	227 AC det.-amp.	.90
☐	222 battery SG	$1.88
☐	112A power tube	.78
☐	171A power tube	.78
☐	201A battery tube	.53
☐	240 hi mu tube	$1.60
☐	250 power tube	$4.95
☐	210 power tube	$3.25
☐	280 AC rectifier	$1.13
☐	281 AC rectifier	$2.95

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☐ Put cross here if C. O. D. shipment is desired. Canadian remittance must be by postal or express money order.

MB-30 Price

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World's most intriguing places. Where famous stage, screen, radio stars live their lives. Intimate stories of their stage and personal doings in

NEW YORK **STAR** National Illustrated Amusement Weekly

Edited by Roland Burke Hennessy. Clever writers cover comedy, tragedy, fascination of professional life. Portraits and unusual pictures of favorites. 10c copy, $5 year (52 issues). SPECIAL: 12 issues $1. STAR, 1562 Broadway, New York.

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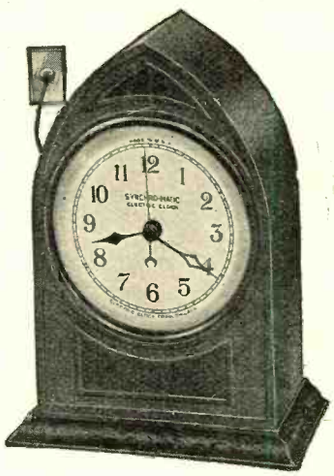
Electric Clock, $7.15



This clock for use on alternating current only, has a synchronous motor built in, so when the plug is connected to 110 v. 60 cycles the clock keeps accurate time. Case is moulded bakelite, beautiful walnut finish with moulded design on front; 7" high by 5⅛" wide at base; bevel glass in front of aluminum dial with black lettering. Has three hands. Order Cat. EC-60 at $7.15.

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Works on 110-120 volts, AC or DC; power, 50 watts. A serviceable iron, with copper tip, 5 ft. cable and male plug. Send $1.50 for 13 weeks' subscription for Radio World and get these free! Please state if you are renewing existing subscription.

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Fidelity Unit, Cat., FDU, price $2.25

The Fidelity unit is pre eminent for horn-type speakers such as exponential horns. The faintest word from a "whispering tenor" or the tumultuous shout of the crowd or highest crescendo of the band is brought out clearly, distinctly. Stands up to 450 volts without filtering. Works right out of your set's power tube, or tubes, requiring no extra voltage source. Standard size nozzle and thread. Works great from AC set, battery set or any other set, push-pull or otherwise. The casing is full nickel finish, highest polish.

This unit can be used in a portable without any horn attached and will give loud reproduction.

Order Cat. FDU, with 50-inch tipped cord; weight, 2½ lbs.; size, 2¾-inch diameter, 2⅝-inch height. (This is the large size). Price..... $2.25

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"AUDIO POWER AMPLIFIERS"

by J. E. Anderson and Herman Bernard, begins with an elementary exposition of the historical development and circuit constitution of audio amplifiers and sources of powering them and proceeds to an exposition of circuit laws, including Ohm's laws and Kirchhoff's laws. The determination of resistance values to produce required voltages is carefully expounded. All types of power amplifiers are used as examples: AC, DC, battery operated and composite. But the book treats of AC power amplifiers most generously, due to the superior importance of such power amplifiers commercially. Full technical data on tubes. 193 pages. **(APAM)**

"FOOTHOLD ON RADIO"

In English that any one can understand, the technical side of radio is presented by Anderson and Bernard. It is intended for the sheer novice. The treatment is non-mathematical. The origin of the broadcast wave, its radiation, reception, amplification and rectification are set forth in clear language. Published June, 1930; 59 pages..... **(FOR)**

"THE SUPERHETERODYNE"

This is a volume by Anderson and Bernard, published July, 1930, dealing with the principles and practice of the Superheterodyne method of receiving. It explains the function of the oscillator, the modulator, the pre-modulator selector, and the intermediate frequency amplifier. It explains the cause of repeat points and gives methods for avoiding them or minmizing their effect. It expounds the relative advantages and disadvantages of high and low intermediate frequencies, and shows the effect of selectivity on the quality. Constructional circuits included. 112 pages ..... **(ABSH)**

115 LATEST COMMERCIAL SET DIAGRAMS

Compiled by John F. Rider. Contains, each on separate 9 x 12" sheet, schematics of Audiolas 30B and 330; Balkite F; Crosley 41A, 42 A.C., 609, 600 A.C., 20, 21, 22, 31S, 30S, 33S, 804 A.C., 40S, 41S, 42S, 82S, 60S, 61S, 62S; Sonora 7P, A30, A32, B31, A30, A40, A44; Kennedy 80, 10, 20; Stewart-Warner 900 A.C., 950 battery, 950 A.C., 950 D.C., Model B; Radiola 44, 47, 66; Majestic 90, 9P6 power unit, 9P3 power unit; Stromberg-Carlson 641, 642, 846; Edison R1, R2, C2 (50 and 25 cycles), R5 and C4, C1; American Bosch 54 D.C.; Victor R32 and RE45; Grebe SK4 A.C. (early model), SK4 A.C. (late model), SK4 D.C., 428; Traveler A.C. power pack; Eria 224 A.C. screen grid; Silver-Marshall 30B, 30C, 30D, 30E; Eveready 1, 2 and 3, Series 30, Series 40, Series 50; Steinite 40, 50 and 102, 50 power unit; All American Mohawk 96 (60 cycle), 90 (25 cycle), 90 (60 cycle), 70, 73 and 75; Gulbranson Model C (early model), Model C (late model); Bremer-Tully 7-70 and 7-71, 81, 82; Earl 21, 22, 31, 32, 41, 42; Philco 65, 76, 87, 95 screen grid; Peerless Electrostatic series, screen grid; Fada 20, 20Z, 22 battery, 25, 252, 25, 25Z, M250, M250Z, Electric units, 35, 35Z, 75, 77; Brunswick 5 NC8 Radio Chassis Schematic, NC8 Audio Chassis Schematic, NC8 and 3 NC8, Audio Chassis Schematic, 5 NC8 cabinet wiring, 3 NC8 Radio Chassis Schematic, 3 NC8 cabinet wiring, S14, S21, S31, S81, S82 screen grid Radio Chassis Schematic, S14, S21, S31, S81, S82 screen grid Radio Chassis Actual, S14, S21, S81, S82 Audio Chassis Schematic (25 cycle), S14, S21, S81, S82 Audio Chassis Schematic (60 cycle), S14, S21, S81, S82 Audio Chassis Actual (25 cycle), S14, S21, S81, S82 Audio Chassis Actual (60 cycle), S31, Audio Chassis Schematic (60 cycle) S31, Audio Chassis Actual (60 cycle), 3 KRS cabinet wiring, 3 KR8 Radio Chassis, 3 KR8 Audio Chassis Schematic, 3 KR8 Audio Chassis Actual, 5 NO Radio Chassis Schematic, 5 NO Socket Power Schematic, 5 NO Socket Power Actual, 3 KRO and 3 KR6 Radio Chassis, 3 KRO and 3KR6 Socket Power, 5KR, 5KRO, 2KRO Socket Power, 5KR, 5KRO, 3KRO, 2KRO, 5KR6 Socket Power, 5KR, 5KRO, 2KRO, 5KR6 Radio Chassis; Amrad Bel-Canto series; Spartan 89, 89A, 49, ensemble, 931, 301 D.C., 931 A.C., 110 A.C., 301 A.C..... **(SUPP. NO. 1)**

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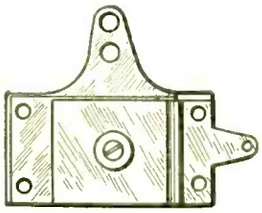
Accurate Tuning Condensers and Accessories

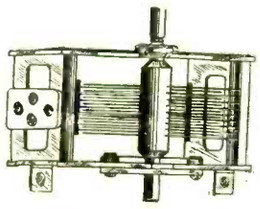
EQUALIZER



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

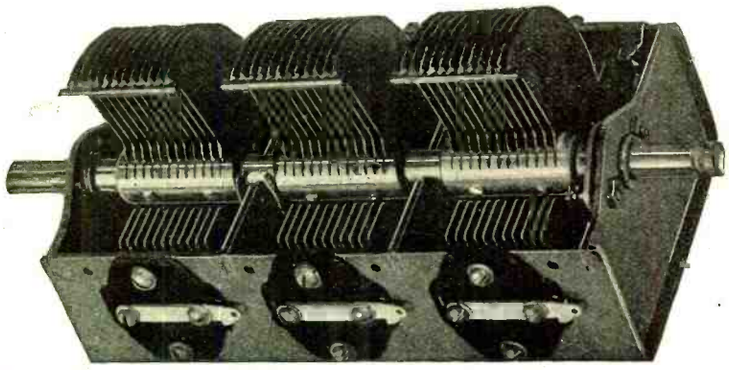
SINGLE .00035



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 ¼ inch diameter, and its length may be extended ⅜ inch by use of Cat. XS-4. Brackets built in enable direct subpanel mounting, or may be plied off easily. Front panel mounting is practical by removing two small screws and replacing with two 3/34 screws ⅝ 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 3¾ 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 99¾ 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 ⅜ 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 ¼" 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 ⅜ 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 sidewise 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

For coupling two ¼ inch diameter shafts, either coil shaft and condenser shaft, or two condenser shafts, a coupling link is used. This may be of the rigid type, all metal, where the linked units are not to be insulated. 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 ¼ 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 ¼" diameter shafts not long enough for your purpose. Fits on ¼" shaft and provides ⅜" extension, still at ¼". Hence both the extension shaft and the bore or opening are ¼" diameter. Order Cat. XS-4.

For condensers with ⅜" diameter shaft, to accommodate to dials that take ¼" shaft, order Cat. XS-8 at 15c.

.00035 TWO-GANG

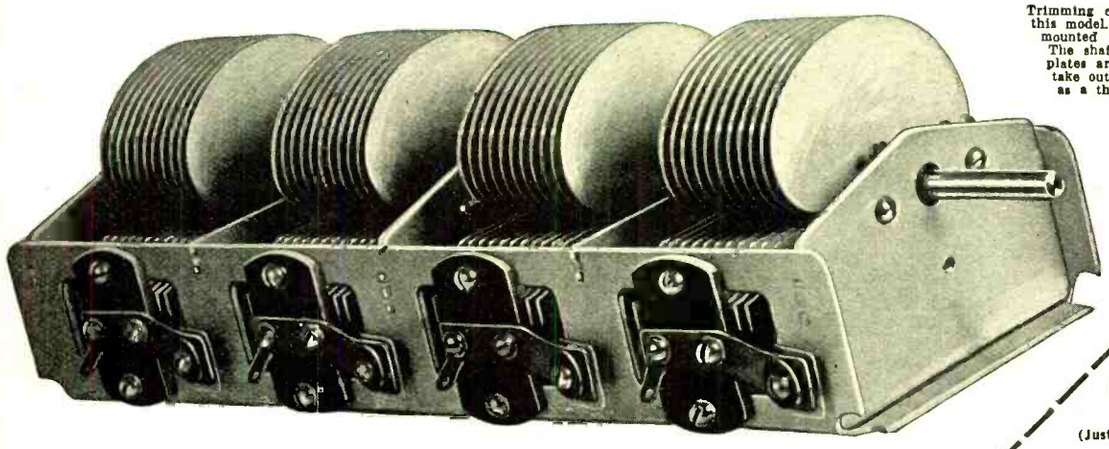
A two-gang condenser, like the single type, KHS-3, but consisting of two sections on one frame, is Cat. KHD-3, also made by Scovill. The same mounting facilities are provided. There is a shield between the respective sections. The tuning characteristic is modified straight frequency line. Order Cat.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

DRUM DIAL

CAT DD-0-100 @ $1.50

A suitable drum dial of direct drive type is obtainable for ¼" shafts or ⅜" 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, 3½ 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 99¼%.

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

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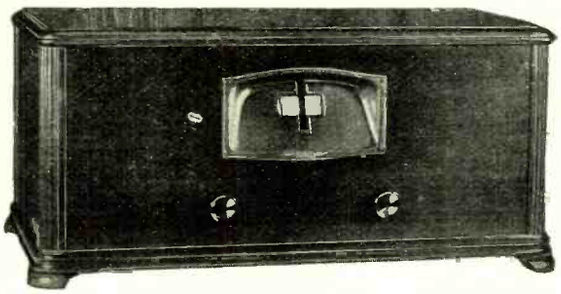
☐ Cat. XS-4 @ 10c
☐ Cat. KH-3 @ 85c
☐ Cat. XS-8 @ 15c
☐ Cat. KHD-3 @ $1.70
☐ Cat. RL-3 @ 12c
☐ Cat. DD-0-100 @ $1.50
☐ Cat. EQ-100 @ 35c
☐ Cat. SC-3 G-5 @ $4.80
☐ Cat. SPL-4 G-3 @ $3.95
☐ Cat. FL-4 @ 30c
☐ Cat. SW-S-150
☐ Cat. SW-S-250

ALL PRICES ARE NET

Balkite Push-Pull Receiver



The Balkite A-5 Neutrodyne, one of the most sensitive commercial receivers ever developed; 8 tubes, including 280 rectifier. Wholly AC operated, 105-120 v. 50-60 cycles; in a table model cabinet, genuine walnut, made by Berkey & Gay.

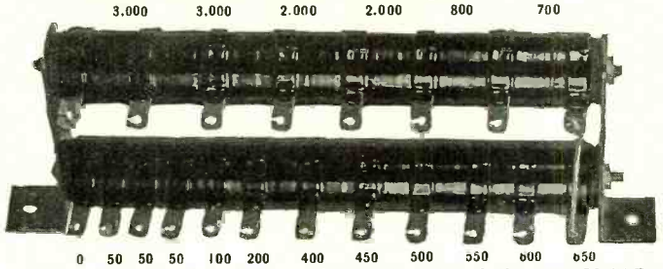
Three stages of tuned RF, neutralized, so there's no squealing; easy tuning; operation on short piece of wire indoors perfectly satisfactory; no repeat tuning points; no hum; phonograph pickup jack built in; excellent tone quality; good selectivity. Two posts are accessible for connecting the field coil 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 Gilfillan. 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 undercover, so there is no stray pickup. Cat. BAL-A5, list price $135; net price.....

$44.00

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-sided 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.

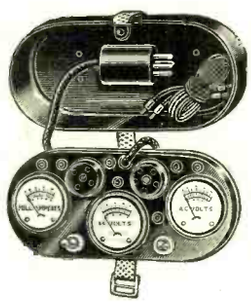
When the R-245 is plugged into the vacated socket of a set and the removed tube is placed in the proper socket of the Tester, the receiver's power supplies all the voltages and currents. You see the vital tests made right before your eyes, all three meters registering immediately, all three reading at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

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**

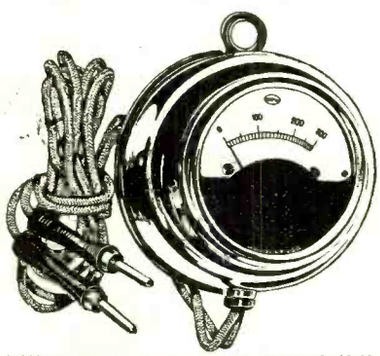
Fixed Condensers

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.	

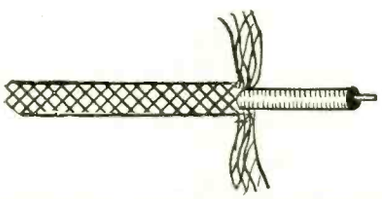
Order Cat. MICON .0001 etc. at prices stated.

High-Voltage Meters



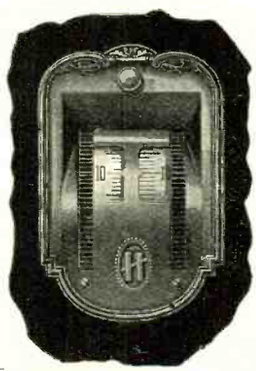
0-300 v., 200 ohms per volt. Cat. F-300 @ $2.59
0-500 v., 233 o.p.v. Cat. F-500 @..... 3.73
0-600 v., AC and DC (same meter reads both); 100 ohms p.v. Order Cat. M-600 @ 4.95

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**

Double Drum Dial

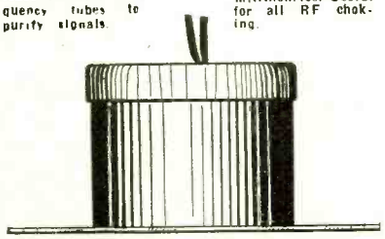


Hammarlund double drum dial, each section individually tunable. Order Cat. H-DDD. List price $6.00; net price **$3.00**

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 choking.



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**

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- ☐ H-DDD @... $3.00
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A 6-Tube Car Set

By John C. Carver

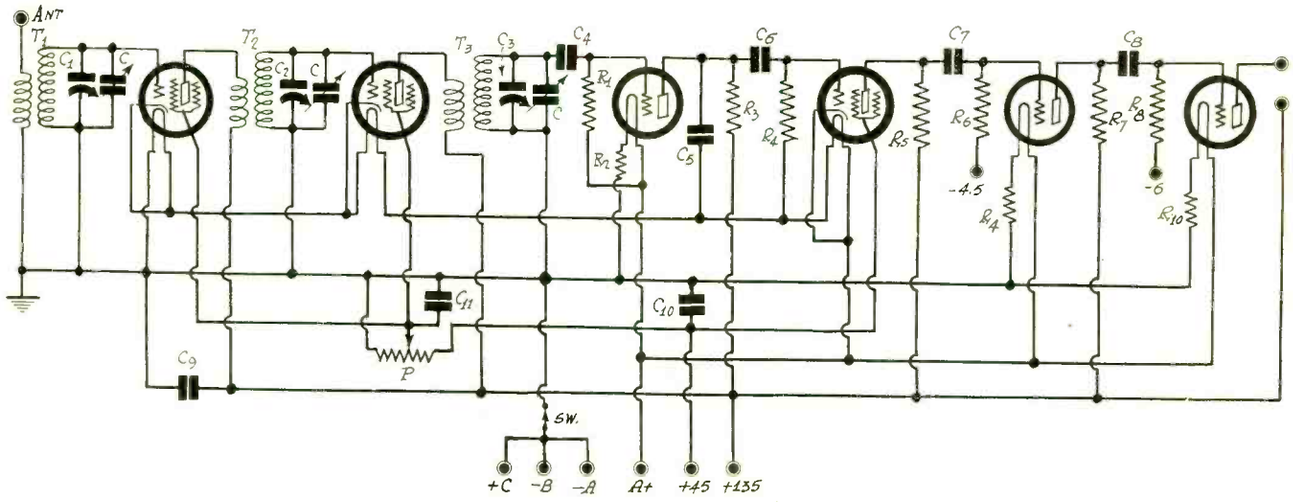


FIG. 1
THE CIRCUIT DIAGRAM OF A SIX TUBE SCREEN GRID RECEIVER UTILIZED IN A COMPACT AUTOMOBILE RECEIVER.

ONE of the important requirements of an automobile radio receiver is complete shielding of the set proper as well as the leads to the batteries. Another is high sensitivity so that signals may be picked up with loudspeaker volume at long distances from broadcast stations with the rather poor antenna and ground circuit that can be provided in a car.

The sensitivity requirement practically imposes the choice of screen grid tubes for the circuit wherever such tubes can be used advantageously. In a six tube circuit comprising two stages of radio frequency amplification and two stages of resistance coupled audio amplification, such as is shown in Fig. 1, at least three screen grid tubes can be used to advantage, two in the radio frequency stages and one in the first audio stage.

When three screen grid tubes of the 224 type are used on direct current it is possible to connect the heaters in series. While this does not give full 2.5 volts across each heater it gives slightly over 2 volts, since the battery is always fully charged and therefore has a voltage little in excess of 6 volts.

Provision of Grid Bias

The use of heater tubes with series-connected heaters gives opportunity for obtaining bias for the grids and still permit grounding all the tuning condensers. Note how it has been done in the drawing. All the condensers are connected to ground and to A minus. The cathode of the first tube is connected to the positive end of the heater of that tube. Thus a bias of about 2 volts is given the grid. It is quite permissible to connect the cathode to the positive end for a positive voltage on the cathode is often recommended

The cathode of the next tube is connected to the negative end of the heater for that tube. That is, it is connected to the same point on the heater circuit as the cathode of the previous tube. Thus the second also gets a bias of about 2 volts. But the cathode is slightly negative with respect to the average potential of the heater. This, too, is all right for a negative bias is often recommended. Indeed, it makes little difference whether the cathode voltage with respect to the heater is negative or positive, especially is this true when the heater current is direct.

The director tube is of the three-element type that takes a filament voltage of 5 volts. Hence a 4 ohm resistance R2 is put in the negative leg and the grid leak R1 is returned to the positive. This connection of the grid leak is necessary in order to give the grid a positive bias and at the same time permit grounding the condensers.

The cathode of the first audio tube goes to the positive end of the heater, which is also the positive of the A battery. Hence the grid leak is returned to the negative end of the heater in order to give the grid a bias of two volts negative. The remaining tubes are of the three-element type and require bias voltages of 4.5 and 6 volts in addition to the drop in the resistances R9 and R10. Consequently leads are brought out for connection to a grid battery.

Suitable for Automobile Set

The circuit shown in Fig. 1 is suitable for an automobile receiver because it is capable of high sensitivity and can be put into a compact unit that may be shielded well. Ordinarily one would expect a six tube receiver to be bulky, but the receiver represented by Fig. 1 is not bulky for it is encased in a steel box 6.5x6.6x9.5 inches. This casing does not include the filament switch, the volume control, or the dial, for these are mounted in front of the box on a device to be mounted on the instrument panel. The main casing and the control panel are connected electrically by a flexible cable and mechanically by a

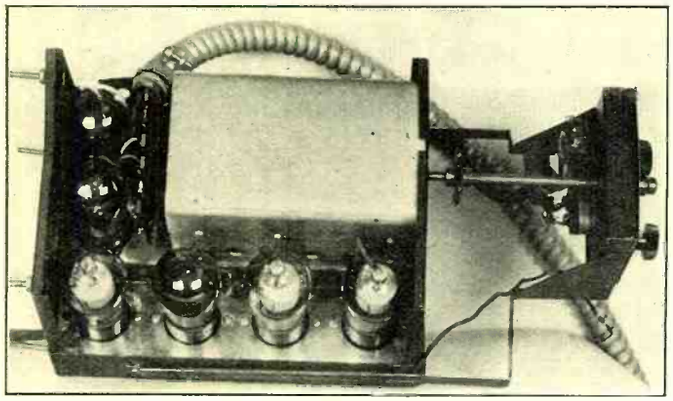


FIG. 2
AN INSIDE VIEW OF THE COMPACT AUTOMOBILE RECEIVER THE CIRCUIT DIAGRAM OF WHICH IS GIVEN IN FIG. 1.

rod and flexible coupler. The distance between the casing and the control panel is variable through a distance of about 7 inches to allow for indifferences in cars.

Shielding Is Well Done

The shielding is exceptionally well done, as it must be in a compact receiver. The condensers are shielded from the rest of the circuit and are also separated from each other by metal partitions. Likewise the coils are separated from each other in the same manner. The radio frequency tubes are also separated, the partitions being attached to the metal cover.

The cable which runs from the receiver on the dash-board to the batteries under the body of the car pass through a heavy, flexible metal tube, which is grounded to the chassis of the car. This shielding eliminates practically all of the undesired pick-up.

Selectivity Secured

The selectivity of the receiver is secured by three tuned circuits controlled by a single knob on the panel. A trimmer condenser, C, is connected across each tuning section, and each of the three trimmers is accessible from the outside after the cover has been put in place. Thus the final trimming is effected after all other changes in distributed capacity have been made. The holes through which the trimmer condensers are accessible are so small that no impairment of the shielding results from them.

The receiver is provided with tip jacks for the loudspeaker but the loudspeaker itself must be placed elsewhere in the car. Small speakers suitable for car operation and fitting this receiver are available. Indeed, they are made especially for it.

Controlling the Volume

The volume control is in the form of a high resistance potentiometer controlling the screen grid voltage of the two radio frequency amplifier tubes. This control is at the right on the control panel and the tuning control is at the left.

No knob is provided for the filament switch. A key is required to turn on the set. This, of course, is to prevent unauthorized persons from tampering with the receiver.

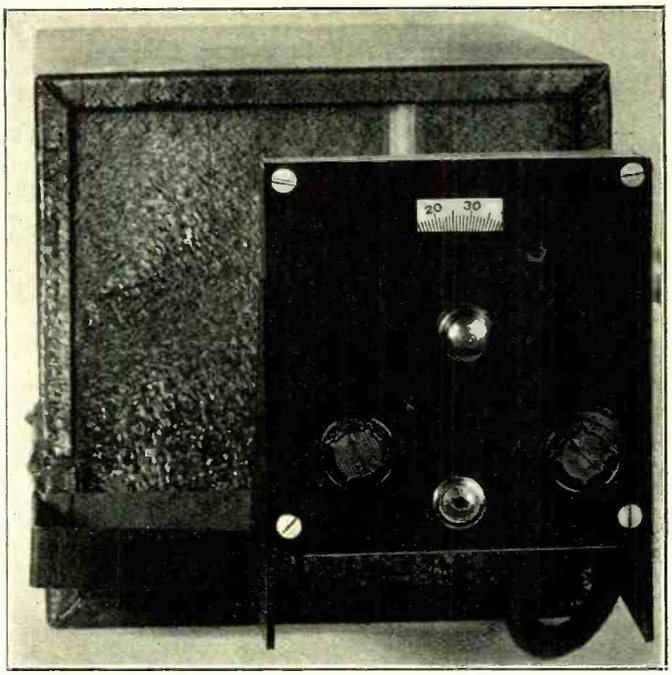


FIG. 3
ANOTHER VIEW OF THE INTERIOR OF THE AUTOMOBILE RECEIVER.

The dial is so constructed that the condensers stay in the position they are set regardless of the jars incident to traveling over bumpy roads. This is an obvious advantage in that it is not necessary to retune the circuit every time the car has hit a bump. While the same effect could be secured by using a thumb set screw this would add another control to the receiver and thus complicate the tuning. Any lock of this nature would be undesirable because in the process of locking the tuning would be thrown out of adjustment. The sluggish turning works out satisfactorily because the knob is geared to the dial at such a ratio that it does not require much braking on the knob to hold the condensers in the positions set.

Antenna and Ground Equipment

The chassis of the car supplies the only ground that is needed. Since minus A of the car battery is grounded the ground connection is taken care of automatically. An antenna, however, must be provided, and for this purpose a flexible lead, suitably marked. To provide a reasonably good antenna on a car is probably the most difficult problem met with in car installations. If a wire is strung under the chassis the effective height of the antenna is extremely small. But in the case of an open car this is about the only way an antenna can be rigged up. Of course, poles could be erected at the rear and front and the antenna strung between them, but this is hardly a practical way. Fortunately, the set is sensitive enough not to require an elaborate pick-up.

KFI IS HEARD ON 50 KW PLEA

Washington.

When he tunes in WLW, Cincinnati, and KDKA, Pittsburgh, from his home in West Virginia, he finds that these two 50,000-watt stations take up ten divisions apiece on his receiver, said Federal Radio Commissioner Ira E. Robinson, at a hearing on the application of KFI, Los Angeles, for permission to use 50,000 watts.

"Is there any assurance," inquired the Commissioner, who was chairman of the Commission and strongly opposed superpower, "that KFI, if using 50,000 watts, would not blanket other stations on adjacent channels?"

For KFI, Arthur F. Kale, manager, said in the California area the nearest station to KFI, in point of frequency, is 40 kc removed.

KFI, two years ago, was authorized to use 50,000 watts, but did not use it, hence had to make an explanation of why it should not be considered to have forfeited the right. Mr. Kale explained that when the authority was granted it was impossible to get any assurances of delivery of equipment within a year after the giving of the order for it, and, besides, two years ago 50,000-watt transmitters "were still in the experimental stage."

The station now feels the need of 50,000 watts, instead of the 5,000 watts used, because it would be better able to serve the listeners in Los Angeles and environs, explained Mr. Kale. The station has a clear channel assignment on 640 kc, and he felt it was thus entitled to 50,000 watts.

The manager spoke freely of the financial results of operation of the station, which is owned by Earle C. Anthony, Inc., and of which station he has been manager since the very beginning, April, 1922.

In the early years losses were heavy, and in one particular year, he remembered with remorse, the deficit was $80,000. Finally the tide turned. Last year, for instance, the station made a profit of $19,000, he reported, while the expected profit for 1930 is put at $30,000. Contrasted to this situation was the general average of losses prior to 1929 of $50,000 a year.

Mr. Kale mentioned with pride the type of programs put on by the station, and said that listeners within the service area are highly gratified.

BOARD ACCEPTS BUFFALO PEACE

Washington.

Approval was voted by the Federal Radio Commission of the plan submitted by the Buffalo Broadcasting Company for the solution of the controversy in that city, arising from the charge of broadcasting monopoly, made by the Buffalo "Evening News."

The plan, as submitted by the company's counsel, William J. Donovan, friend and political co-worker of President Hoover, calls for the dissolution of the monopoly of the four stations in Buffalo under the one company, and resortation of individual ownership in three instances, and relinquishment of a lease in the fourth instance.

The "Evening News" had intended to erect its own station, and had been given a construction permit on 900 kc, but will now buy WMAK.

The appeal of WMAK for a clear channel, denied by the Board, was withdrawn as part of the pact.

Sensitivity of the MB-30

By Neal Fitzalan

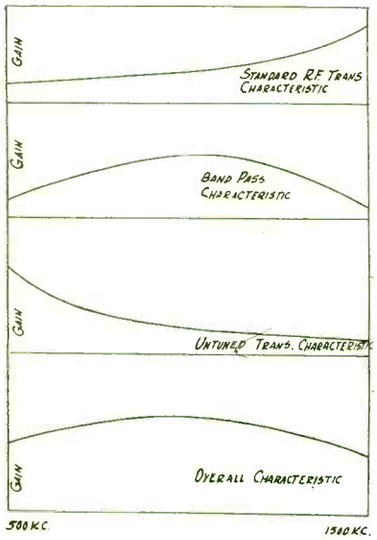


FIG. 1

Gain curves of the MB-30 tuner and amplifier. The top curve is the characteristic of the standard R. F. transformer.

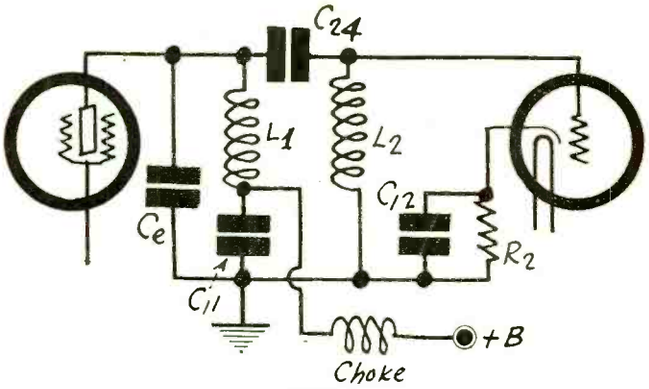


FIG. 2

A simplified drawing of the untuned radio frequency transformer showing the tube capacity Ce which tunes the primary.

WE mentioned in a previous installment on the MB-30 that the overall sensitivity of the amplifier was essentially uniform over the entire tuning range, and that this uniformity was attained by properly combining the characteristics of tuned radio frequency transformers, untuned transformers, and band-pass filters. We shall discuss this more in detail.

In the figure herewith are four different characteristics. At the top is shown the characteristic of a standard tuned radio frequency transformer and below this that of a band-pass filter. The third characteristic is that of an untuned transformer and at the bottom the characteristic of all the couplers, or the overall sensitivity characteristic. These curves show transmission, whereas the sensitivity curve previously given showed the reverse, or the sensitivity in microvolts that would give standard output.

The sensitivity curve for the standard RF transformer rises as frequency increases from 500 kc to 1,500 kc, and the rate of rise also increases. Consequently the curve, instead of being a straight line sloping upward, bends upward. The reason for the increase in the sensitivity is that for a fixed mutual inductance between the secondary and the primary the voltage induced in the secondary by a given signal current in the primary is directional proportional to frequency. This variation alone should give a straight line with a constant slope. However, as the circuit is tuned to higher frequencies the tuning capacity is continually made smaller and the ratio of inductance to capacity is continually made larger. Since the voltage induced is greater the greater this ratio the curve rises more rapidly than it would if only the frequency increases were involved.

Hump In Band-pass Curve

The sensitivity curve for the band-pass filter rises first as the frequency increases, then reaches a maximum in the middle of the band and finally falls as the frequency is increased still further. To find the reason for this rise and the fall we have to analyze the construction of the band-pass filter. We note that there is a radio frequency transformer between the tube preceding the filter and the first tuned circuit. This has the same characteristic as a standard tuned radio frequency transformer, and therefore this contributes a rising characteristic. This, then, accounts for the initial rise in the curve.

The drop in the curve must be looked for in the coupling between the two tuned circuits constituting the filter. We note that the essential part of the coupler is a condenser of comparatively large value. As is well known, the value of a condenser as a coupling medium is inversely proportional to frequency. Thus for a given value of coupling condenser the higher the frequency the looser is the coupling between the two tuned circuits. That is to say, the higher the frequency the lower is the signal voltage transferred from the first tuned circuit to the second. Thus we have accounted for the downward slope of the band-pass sensitivity characteristic from the middle of the tuning band to the 1,500 kc.

Characteristic of Untuned Transformer

Why the sensitivity characteristic of the untuned radio frequency transformer should have a falling slope, the reverse of that of a standard tuned transformer, is not evident at first. The rapid rise in the curve as the frequency decreases toward 500 kc indicates that there is a resonance peak somewhere below this frequency, and that is just the reason why the curve rises. The resonance is between the inductance of the primary winding of the transformer and the plate-to-ground capacity of the screen grid tube. This capacity is of the order of 25 mmfd., and it may be considerably higher. Thus the untuned transformer primary is designed so that the inductance resonates with this capacity at a frequency somewhere below 500 kc.

It is clear that the tuned circuit thus formed cannot be very selective, for if it were there would be practically no transmission in the broadcast band. It has to be just selective enough to give the necessary rise at the low frequency end of the tuning range without cutting out the frequencies between 500 and 1,500 kc. This condition is not difficult to satisfy because the capacity entering into the tuned circuit is small and the untuned transformer must have a rather large primary inductance. However, to aid in transmitting the higher frequencies, a condenser is connected between the plate of one tube and the grid of the next. This condenser is labeled C24 in the circuit diagram. The capacity that resonates with the primary inductance is not shown, since it is a part of the screen grid tube.

Getting Overall Characteristic

Now there are three types of couplers having three different types of characteristics, any one of which is unsatisfactory if we are striving for uniform sensitivity over the entire broadcast band. The characteristic of the band-pass filters comes nearest being what is desired, but it falls too much at both ends. If we now use one untuned stage having a characteristic like that in the third graph, the sensitivity is brought up at the low frequencies, and if we use a standard transformer with a characteristic like that in the first graph, the sensitivity is brought up on the high frequencies. To get a satisfactory overall characteristic it is only necessary to use a suitable number of each of the three different couplers. The overall characteristic shown in the fourth graph is the result of using two band-pass filters, one untuned transformer, and two standard tuned radio frequency transformers, and this curve is considered satisfactory because the slight deviation from uniformity is entirely negligible.

Comes In Kit Form

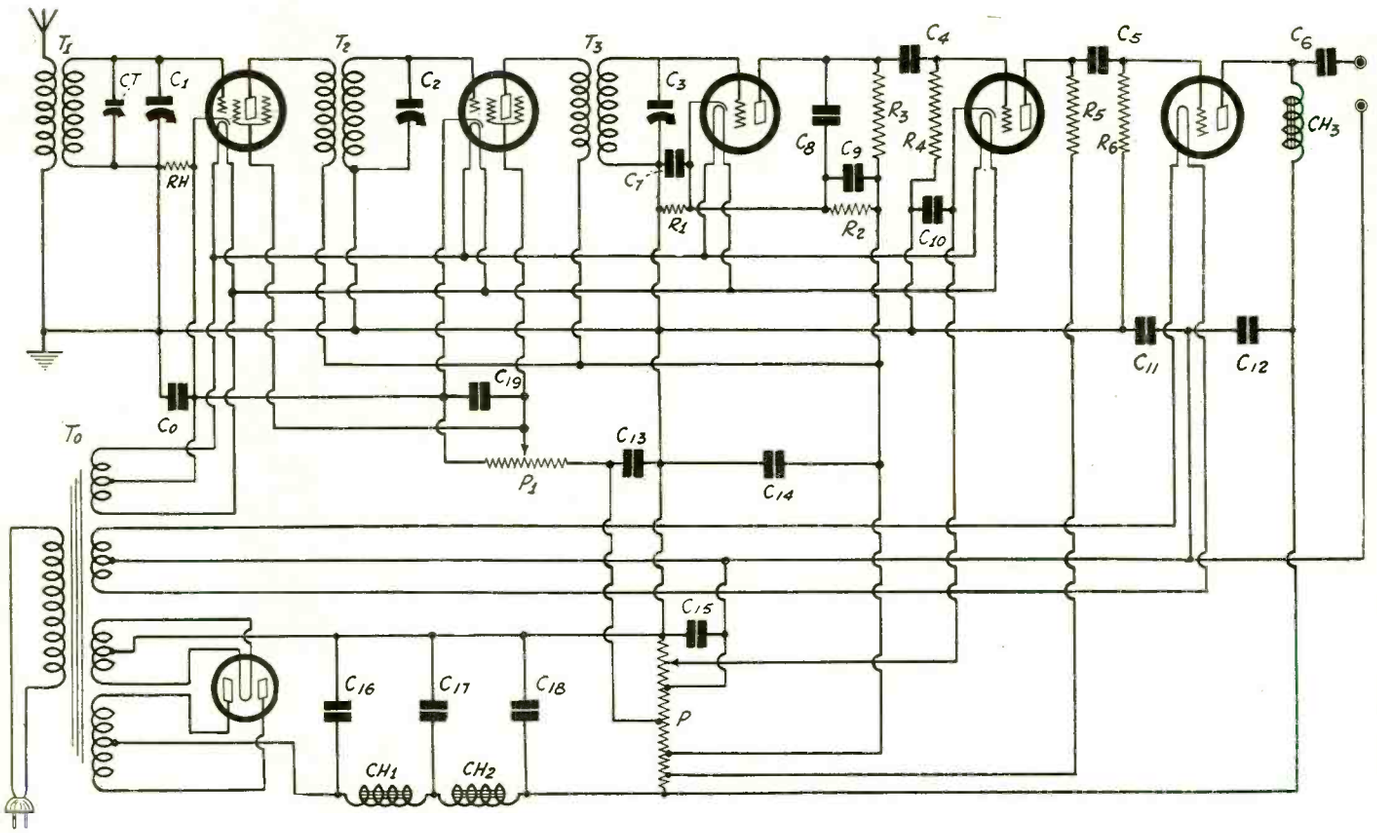
The MB-30, just as the MB-29, comes in kit form to be assembled and wired by the purchaser. However, the couplers come assembled, wired, and shielded so that the work of assembly is a simple matter. No difficulties at all should be experienced. It is possible, though, that certain defects have developed in the parts since they left the inspection department of the factory, especially if they have been shipped long distances. To guard against trouble from this source every part should be tested before it is put into the receiver, or before it is wired. Tests should be made for continuity of windings and for shorts, particularly shorts to ground or to any part which is to be grounded in the final wiring. It only takes a few minutes to make the tests, and a few minutes thus spent may save hours of testing afterward. While there is little chance that defects have developed, it is reassuring to know before any part is wired that none has developed.

In Fig. 2 we have a simplified circuit of the untuned radio frequency coupler. Ce is the plate-to-ground capacity of the tube as it is related to the primary L1 of the transformer.

(*Continued on page* 8)

The Need for Ade

By Roger



THIS AC OPERATED RECEIVER IS COMPLETE IN EVERY RESPECT EXCEPT THE LOUDSPEAKER IS MISSING. THE THREE TUNED CIRCUITS INSURE SELECTIVITY, THE TWO SCREEN GRID TUBES, SENSITIVITY, AND THE RESISTANCE COUPLED AUDIO AMPLIFIER, GOOD TONE QUALITY.

IN building an AC operated receiver like the one here illustrated success is assured if good parts are chosen throughout and that no skimping on chokes and by-pass condensers is practiced. A husky power transformer is also a necessity if consistently good results are to be obtained.

For some reason many fans hold the opinion that by-pass condensers are specified for no better reason than to sell parts. They often ask if it is not possible to get equally good results if many of the by-pass condensers are omitted or reduced in capacity. The answer to such questions must be no, for there is a general rule that the larger a by-pass condenser is the better will be the results. Of course, it is possible to use so large condensers that the advantage gained by increasing their capacities does not improve the performance sufficiently to justify the increase. But it is always safer to use large capacities rather than small.

There is one condenser in the filter that should be limited, and that is the first by-pass condenser in the B supply, the one following the rectifier tube. While using a large value condenser here results in a higher output voltage and better regulation, it does not always improve the filtering. Moreover, a large condenser at this point endangers the rectifier tube, and it is mainly for this reason that its capacity should be limited to about 2 microfarads.

Other Limitations

There is also one by-pass condenser in the amplifier that should be limited, and that is C8, the one across the plate coupling resistor in the plate circuit of the detector. When the coupling is by transformer this condenser might be as large as .0005 mfd. but when the coupling is by resistance it should be no larger than .00025 mfd. The reason for this is that a condenser is much more effective as a by-pass when it is connected across a high impedance or resistance than when connected across a low impedance or resistance. The object of limiting this condenser, of course, is to prevent high audio note suppression, and the main object for using it is to make the detector more efficient.

It is also well to limit the capacities of isolating condensers C4 and C5. While the low note reproduction will be better the larger these condensers are, leakage through the condensers enters to mar the performance. The larger the capacity of a condenser the greater is the leakage through it, and the more leakage the more difficult it is to maintain the grids at the proper negative potential. A large value stopping condenser often leads to a drift in the plate current of the tube following,

---

Sensitivity of

(*Continued from preceding page*)

It is really connected across L1 and C11 in series but C11 is so large in comparison with Ce that its effect on the position of the resonance may be neglected. In effect, therefore, Ce is directly across L1.

In Fig. 3 we have a simplified diagram of one of the band-pass filters, drawn so as to show clearly how condenser C8 couples the two tuned circuits. The resistance R7 across the

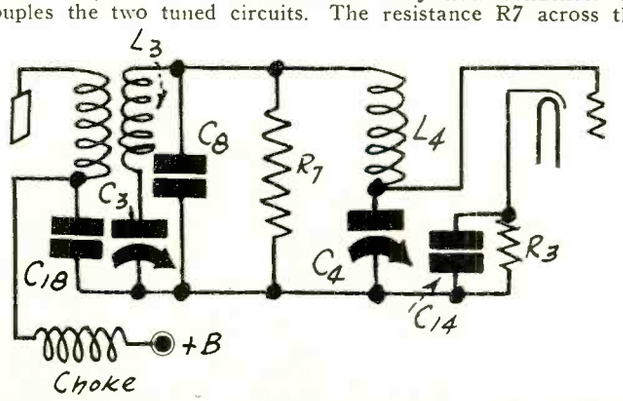
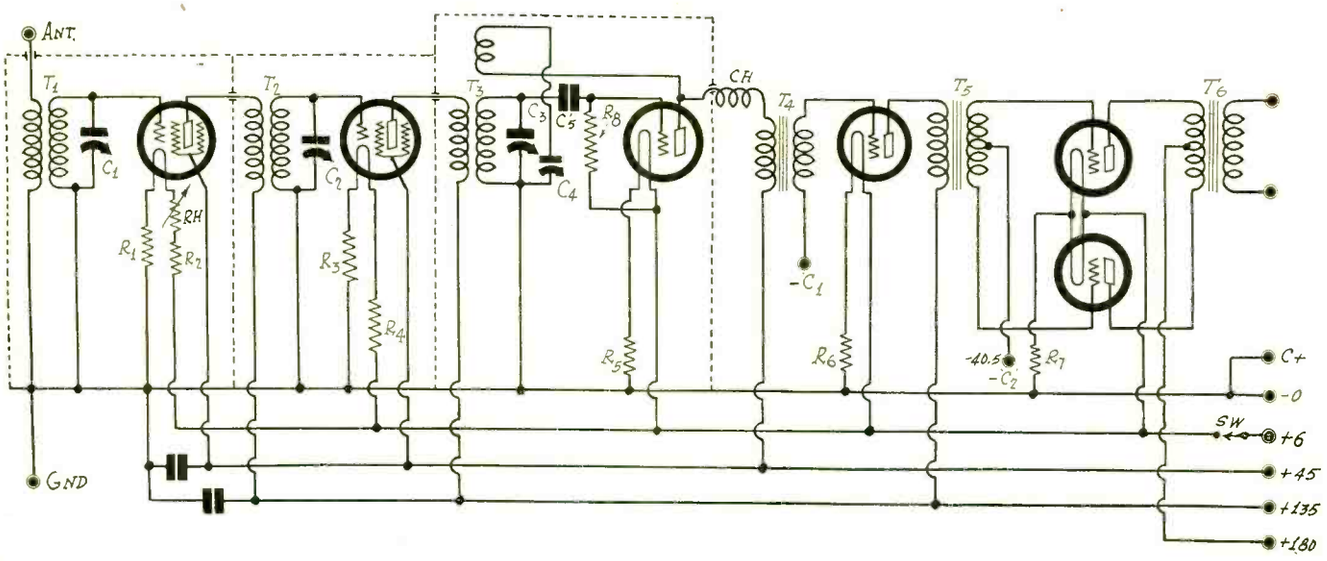


FIG. 3
A SIMPLIFIED DIAGRAM OF THE BAND-PASS FILTER.

quate By-passing

Redmond



FOR A DC OPERATED RECEIVER THIS IS A GOOD CHOICE. THE TWO SCREEN GRID TUBES AND THE REGENERATIVE DETECTOR INSURE SENSITIVITY, THE THREE TUNERS AND THE REGENERATION, HIGH SELECTIVITY, AND THE PUSH-PULL AMPLIFIER PLENTY OF UNDISTORTED OUTPUT.

indicating that the grid is gradually going positive. The set may function for about one minute after the tubes have heated up. After that time the grids are so positive as to prevent operation. If such trouble is encountered the immediate remedy is to reduce the value of the grid leak resistance. A more permanent and more satisfactory remedy is to substitute a stopping condenser with mica dielectric and smaller capacity.

No Drift in Transformer Circuit

When the amplifier is transformer coupled like the DC operated circuit above there is little danger of such drift of the plate current because there is no stopping condenser and the grid leak resistance is comparatively low. Whenever a drift is encountered one immediately suspects that one of the grid circuits is open on the low potential side.

In the DC circuit only two by-pass condensers are shown, those across the screen and plate voltages. If these condensers are large and the batteries used are fresh, stable operation will result. But when the batteries are old—and they get old in a surprisingly short time—it is absolutely necessary to use much larger capacities in order to get stable and distortionless operation. The batteries may last six months to a year, but as far as the need of large by-pass condensers is concerned, they get old in a month.

No condensers are shown across the grid batteries, but they too should be by-passed because they develop high internal resistances which may change the tone quality considerably. Moreover, the grid bias resistors in the radio frequency amplifier should be by-passed even when one is used for each tube, for when they are not by-passed there is a reverse feed-back which reduces the sensitivity. While this reverse feed-back is small it is enough to justify the use of a by-pass condenser across each resistor.

Husky Equipment Needed

When the battery circuit is operated by a B supply unit it is especially important to use large by-pass condensers for in many such supply units the by-passing is entirely inadequate for good quality.

The need of a husky power transformer for the AC receiver on page eight cannot be overemphasized because many receivers otherwise well designed are unsatisfactory because the regulation of the power supply is poor. The plate voltage particularly varies over wide limits as the load on the device is altered, and this variation shows up in the form of hum in many instances.

The choke coils Ch1 and Ch2 should also be of substantial construction because if they are not they will not be very effective in reducing hum. Small-core chokes will saturate quickly, when they are of little use as chokes.

Preferred Volume Controls

The two circuits on pages 8 and 9 exemplify the preferred types of volume controls for AC and DC receivers. In the AC circuit the volume is controlled by controlling the screen voltage on the two radio frequency amplifier tubes by means of a high resistance potentiometer P1. This is connected across a potential difference of about 67 volts on the voltage divider and the slider run to the screen returns. The voltage variation attainable by this means is from zero, or less, to 67 volts positive. The most sensitive setting is when the screen voltage is near the upper limit, and of course the set is dead before the minimum voltage is reached.

In the battery circuit the volume is controlled by means of a rheostat Rh in the filament circuit of the first tube. No more satisfactory volume control has been found for this type of tube. It is effective and quick acting.

the MB-30

coupling condenser is used primarily as a grid leak and does not affect greatly the degree of coupling between the circuits.

When L3C3 and L4C4 are tuned to the frequency desired the coupling condenser does not have much effect, acting as a rather high impedance. When the two circuits are detuned C8 begins to have a low impedance, relatively, and then it acts as a loose coupler between the circuits. These two circuits are both completed through C8. There are two resonance peaks at which the voltage across C4, that impressed on the grid of the second tube, is maximum. The first occurs when the two circuits L3C3 and L4C4 are in tune. If L3 equals L4 and C3 equals C4, the second maximum occurs when the frequency is $f = f_r (1 + 2C/C8)^{\frac{1}{2}}$, where f_r is the first resonant frequency. If C is small compared with C8, as it is in practice, the square root of the right hand member of the equation can be written $(1 + C/C8)$. Thus the second maximum occurs at a frequency higher than the first by the amount $f_rC/C8$. Therefore this expresses the width of the band admitted by the band-pass filter. This may also be expressed $1/f_rLC8$, which shows that for this type of band-pass filter the width of the band is inversely proportional to the frequency, since the inductance L of either circuit is a constant, and C8 is also of fixed value.

When the coupling impedance between the two circuits is an inductance, the width of the band passed by the filter is directly proportional to the frequency and may be expressed approximately $f = f_rLm/L$, in which Lm is the common inductance between the two tuned circuits and L is the inductance either tuned circuit.

An Automatic Volu

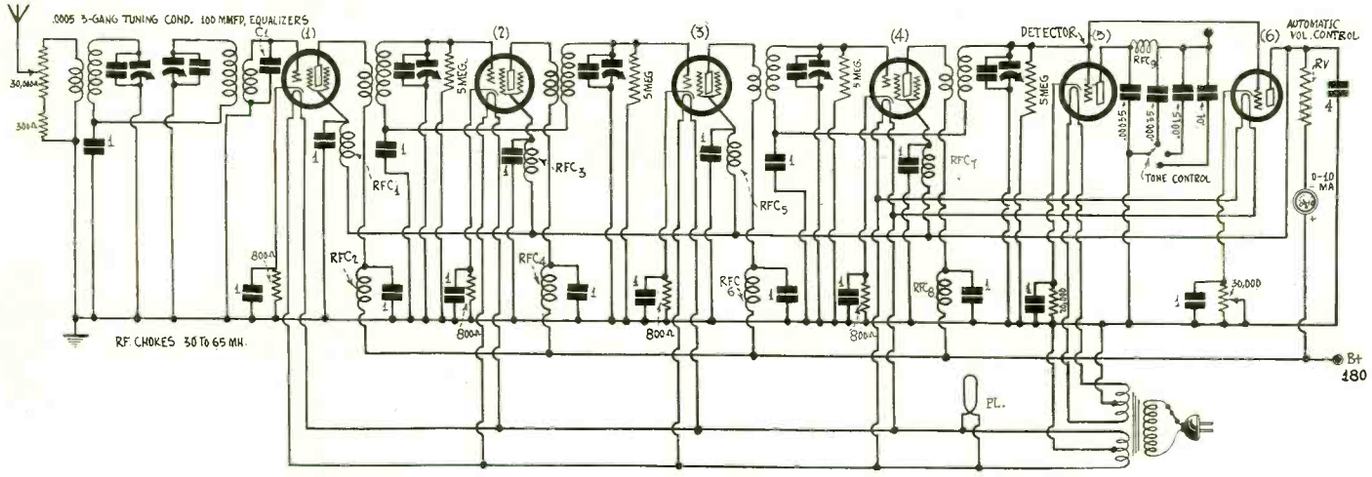


FIG. 1
A 6-CIRCUIT TUNER, WITH AUTOMATIC VOLUME CONTROL AND MANUAL TONE CONTROL. C1 IS FOR FAVORING THE LIGHTER WAVES

A QUICK glance at the diagram, Fig. 1, might give the impression that some manufacturer of fixed condensers, overstocked with 1 mfd. capacities, had got his engineer busy on the design of a circuit intended to sweep the stock off the shelves, at a price. A closer view might augment these suspicions and suggest even a conspiracy among coil, variable condenser, fixed condenser and resistor manufacturers, with constructive sales suggestions by the licensed tube group, for there are plenty of these parts and accessories required if the circuit is to be built.

In a nutshell, this is a six-circuit tuner, with each pair of tuned circuits comprising a band-pass filter, the first without any tube between the two filter sections, the second and third with a tube coupling the circuits. The common radio frequency return through a 1 mfd. condenser for each pair of circuits constitutes the simple band-pass filter. There are automatic volume control and tone control.

The object of this article is not primarily the discussion of the total circuit, but particularly the automatic volume control. An incidental consideration is the simple tone control used in a few circuits already.

Relative Levelling

It has been customary to use as a volume control an adjustable resistor in the screen grid circuit. A potentiometer connected from ground (B minus) to a suitable positive voltage, with moving arm to the screen grids, has been shown time and again. Hence variation of the screen grid voltage to alter the volume is standard practice.

This season, with automatic volume controls coming into high favor, the general scheme is to use a tube so that its biasing resistor serves as the grid biasing resistor in the radio frequency stages. The volume is relativly levelled, because any increase in volume will increase the plate current in the control tube, hence increase the voltage drop in the biasing resistor in that tube's cathode-to-ground circuit, hence increase the bias on the RF tubes and decrease the volume.

This system works, but it does require a common resistor, whereas it appears to be more desirable to isolate these grid biasing circuits, especially as the tendency toward oscillation at radio frequencies, due to interstage coupling intentionally introduced for biasing objects only, is more easily avoided.

Principle of Operation

So a plan was worked out whereby the screen grid voltages would be altered, instead of the biasing voltages, as this permitted isolation of the biasing circuits of the RF amplifiiers, and also the screen grid circuits could be filtered, by RF chokes with condensers across them, and the automatic volume control adjunct would be like any resistor in a voltage divider, that reduces a high voltage to the desired screen grid voltage, and in addition reduces the screen grid voltage further, as the signal intensity increases.

At the right-hand side of Fig. 1 is shown the volume control tube, so marked. The principle of operation is based on rectification. The automatic volume control tube takes the same input as the detector, that is, these two grid circuits are in parallel, and both are biased for power detection, so that any increase in the signal intensity will produce an increase in the plate current. As the plate current increases in the control tube. the voltage drop in resistor RV increases, and the effective voltage on the plate to which RV is connected decreases, so that, to state the paradox, increased volume produces decreased volume. In other words there is a relative levelling effect.

The only requirements for the operation of the automatic volume control, therefore, are that the screen grid circuits be returned to the plate of the automatic volume control tube, and that proper voltages be applied to correct constants.

Difference in Current Behavior

It will be noted that by former methods of manual control of volume by adjustment of the applied screen voltage through a potentiometer, the resistance was adjusted to produce changes in volume. Here the resistance is fixed, but the current through the resistor is changed, by the signal, due to the signal's effect in increasing the plate current. This increase of current with increase of signal voltage is true of bias detection.

Right or

QUESTIONS

(1)—The first photo-electric cell was made by Heinrich Hertz, the German physicist who first demonstrated the existence of radio waves.

(2)—Edison was the first to make practical use of the electron emission from heated filaments.

(3)—It is impossible to compensate in the audio frequency amplifier for the high note suppression resulting from high selectivity in the audio amplifier.

(4)—By putting a sharply tuned radio frequency amplifier ahead of the modulator tube in a Superheterodyne all repeat points are eliminated.

(5)—Repeat points in a Superheterodyne are due entirely to simultaneous reception of two or more carrier waves.

(6)—Metallic conductors never introduce any noises into the signal of a receiver because the current flows uniformly on conformance with the voltage.

(7)—When a wire is wound into a loose helix and a current is sent through the coil thus formed, the turns separate, lengthening the coil.

(8)—The heater circuit in a multi-tube receiver using 224 and 227 type tubes cannot cause any feedback because this circuit is independent of the signal carrying circuits.

(9)—Regeneration in a receiver may increase the sensitivity more than several stages of screen grid amplification.

(10)—The increased modulation of the carrier frequencies of many stations has improved reception and decreased the interference.

ANSWERS

(1)—Wrong. While Hertz discovered the photo-electric effect he did not do much with it for he was busy with radio waves. The German experimenters Elster and Geitel made the first photo-electric cell.

(2)—Wrong. Edison discovered the effect but he did nothing with it. Sir John A. Fleming of England was the first to apply the "Edison Effect." He made use of it when he built the two-electrode vacuum tube for detecting radio waves.

(3)—Wrong. There is no special difficulty in arranging an audio amplifier so that its characteristic is complementary to that of the tuner. The audio amplifier might be arranged so that there is regeneration at 10,000 cycles, for example, and the

me Control for SG Sets

but the opposite is true of leak-condenser detectors, and of RF and AF stages.

The inclusion of an automatic volume control suggests the necessity for a meter as a resonance indicator. If only the ear is relied on to disclose resonance by maximum volume you will be fooled. It implies greatest volume at resonance, and automatic volume control tends to level the volume. A little off resonance the volume is as great as at resonance.

The meter used has a range of 0-10 milliamperes, because through the resistor RV flow the plate current of the automatic volume control tube and also the screen grid currents of the four radio frequency amplifying tubes. The total will read about 5 milliamperes. Resonance is determined by the needle being as far to the right as it can go by tuning.

Establishes Fixed Maximum

The function of the automatic volume control is to establish a fixed maximum volume, which will not be exceeded in the tuning process, so that one may tune throughout the frequency scale without having the most powerful locals blast on one's ears. Incidentally, any relative levelling of volume will have the effect of minimizing fading to the same degree, provided the action of the control is fast enough. In the present instance the action is fast indeed.

But we have not finished when we have installed an automatic volume control. We still desire control that will enable us to change the volume independently, on the basis of signal input. Such a manual control really ought to be one that leaves the rest of the circuit voltages intact, but governs the signal voltage. Hence if the input to the antenna coil is altered by manual operation, as when we want to listen in with moderated volume, we gain our result simply. There is still the question of what shall be the standard of volume.

Different Roads to Same Goal

The automatic volume control will tend to keep the volume from exceeding this standard. But you may desire a certain value of volume as standard and I another value, so it is necessary to provide some ready means of making the adjustment. This is not a control in the strict sense, but merely a standardizer. Once this standardizer, which is not on the front panel, is set, it is not disturbed. The control is shown as a 30,000-ohm potentiometer used as a rheostat in the biasing circuit of the volume control tube. Another possible method would be by making the biasing resistor fixed, at 20,000 ohms, and making RV adjustable, 0-30,000 ohms, or the standard of volume may be established by using greater or lesser values of fixed resistance for RV, with the biasing resistor 20,000 ohms. These directions apply to tube 6.

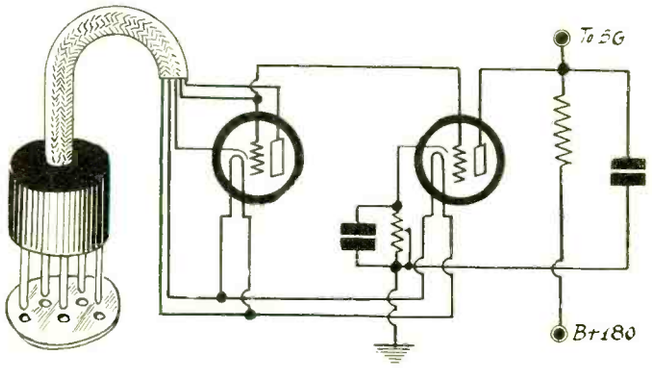


FIG. 2

A PLUG-IN ARRANGEMENT, THE INDICATING DEVICE WOULD BE SUPPLEMENTAL

One care which must be exercised is to keep the voltage through RV free from the radio frequency itself, otherwise satisfactory operation would not ensue. However, a bypass condenser of 4 mfd. sidetracks the RF, because of extremely low impedence to RF. So, if 20,000 ohms for RV and 1 mfd. are used, the time constant is .08 second, equivalent to 12½ cycles, hence there is no cut-off of any of the low frequencies of moderation. Nothing below 24 cycles is transmitted by stations.

What It Does Not Do

Sometimes one loses sight of just what an automatic volume control is supposed to do, or what it is not supposed to do. Tune in a weak local with automatic volume control in circuit. Turn the dial to bring in a strong local. *The automatic volume control is not supposed to reduce the volume of the strong local to that of the weak one.* It does not do it, it will not do it and can not do it. And it would be mischevious if it did or could do it. The object of the automatic volume control is to prevent any station coming in louder than a predetermined level, but without reducing the volume of weaker stations.

Therefore, tune in the strongest local, set the standardizer so that volume is as desired, and from then on you will not be troubled by any station being tuned in with deafening and painful volume, but a nice, smooth level will be established, while weak stations will come in just as loud as before, but no louder.

The object of the additional manual volume control is to enable you to reduce the volume on loud stations even below the standard of volume, particularly useful when you don't want to annoy anybody, as when you are listening in late at night. The operation of the manual control does not upset the automatic volume control.

Tone Control

As for the tone control in Fig. 1, it consists of three fixed condensers of increasing capacity. The detector plate circuit is filtered, and on one side of the RF choke is a permanent fixed condenser, this being needed to bypass radio frequencies as an auxiliary to the choke that tends to keep them from the output circuit.

Another condenser should be at the other side of the choke. Hence by choice of value of the second condenser the audio frequency component of the signal may be affected.

Assuming an audio amplifier used in conjunction with the tuner, which amplifier has a good high audio frequency response, the tone is controlled by reducing the strength of the highs. Therefore speech is most intelligible when the control is set at upper dot (brilliant) middle notes more intelligible at right dot (mellow), and low notes are most pronounced at lower dot (deep).

—HERMAN BERNARD

Wrong?

amount of this regeneration could be adjusted so that it increased the signal in about the same proportion as the tuner suppressed it.

(4)—Wrong. Much of the interference due to repeat tuning might be cut out this way, but not the repeat points themselves. Moreover, some of the repeat points may be much stronger because the signal delivered to the modulator tube may be so great as to overload the modulator and thus create strong harmonics. If a radio frequency amplifier and tuner are used ahead of the modulator for the purpose of reducing interference and increasing sensitivity, the volume control should be put in the antenna so that the signal delivered to the modulator may be kept down to a value that does not overload it.

(5)—Wrong. This is not the cause of repeat tuning at all. If there were only one carrier "on the air" a Superheterodyne could receive that carrier at many points on the tuning control. Interference due to repeats can only occur when there are two or more stations operating within the range of the receiver.

(6)—Wrong. There are many causes for non-uniformity of current flow in a wire or any metal. The greatest cause of noise is due to the fact that the electrons do not move at a uniform rate. This effect is a recent discovery.

(7)—Wrong. The loose turns pull together, shortening the coil. The reason for this is that unlike poles attract, and the opposite sides of any two adjacent turns have opposite magnetic polarity. Hence there is attraction and the coil as a whole shortens.

(8)—Wrong. While it is true that the heater circuit is independent from the rest of the circuit the heater leads are coupled electrically and magnetically to the other leads and thus the heater leads act as coupling media between the other circuits.

(9)—Right. The increase in the sensitivity that may be effected by means of regeneration depends on the resistance in the circuit and on the coupling arrangement. When all the factors are favorably adjusted the amplification may be several times greater than that obtained by two or three stages of screen grid amplification.

(10)—Right. It has improved reception because for a given distance away from the station the useful component of the signal is stronger. For the same reason interference from noises has decreased.

increase of signal level is true of negative biased detectors,

Types of Tone C

By J. E.

Techni

TONE controls are featured in the receivers for 1930-31. Just what is the purpose of such controls?

Different persons have different tone tastes. Some prefer crispness and brilliancy of tone, obtained when the high audio frequencies are present in abundant strength. Other people prefer mellowness and fullness of tone, obtained when the low tones predominate and when the highs are relatively absent. Still other people prefer realistic quality, obtained when the high and low are reproduced in their true relative proportions.

The object of tone controls is to give each listener an opportunity to select his own tone proportion in the output of the loudspeaker, to suit his own permanent or temporary preferences.

There are many methods and devices whereby the tone proportion can be changed, but all are based on the properties of condensers and inductance coils, and sometimes on resistances.

In discussion suppression we often refer to the "line" and it is well to define what is meant by this expression. There can be no misunderstanding what is meant by the line when this consists of two parallel wires connecting two electrical apparatus. It simply is those two parallel wires. When one of these wires is omitted and the ground is used as the return, the meaning may not be quite so clear, but becomes so when it is realized that the ground is one of the conductors and that the direct wire runs parallel to it.

Specialized Lines

Every line terminates at either end in some kind of apparatus, such as a relay, a loudspeaker, a microphone, a tube, a transformer, and others. All these devices are really a part of the line, specialized sections of the line. so to speak.

We also speak of various devices across the line and in series with it. How can one distinguish whether a device is in shunt, that is, across the line or in series with it? If the current on its way to the sink, that is, to the place where it is ultimately used, must pass through the device, that device is in series with the line. It may be in either side of the line, except when one side of the line is the ground. A series-connected device is always an obstruction.

If the device is placed like a bridge from one side of the line to the other so that part of the current is diverted through the device and prevented from reaching the sink, it is in shunt with the line, or simply across it. A shunt-connected device is always a diverter.

Borderline Connections

In some instances it is not easy to say off-hand whether a device is shunt or series connected. Take, for example, a grid leak connected between the grid and the filament. Is this in shunt with the line or in series? It is connected from the high potential side of the line, the grid, to the grounded side of the line. Therefore it seems to be a bridge across the line and should be shunt-connected. Actually it is in series, for it is the termination of the line. It is the sink. The useful signal current flows through the grid leak. The tube following the grid leak is a relay which starts the line all over again. The grid to filament capacity, and even the grid to filament resistance inside the tube, are shunts.

There is also a question as to whether the coupling resistor in the plate circuit is in series or in shunt. It is more of a shunt than the grid leak because it diverts current. The current that flows through the plate coupling resistor never reaches the grid leak. But if the plate coupling resistor were not in the circuit, there would be no signal current in the grid leak. The fact is that the coupling resistor and the grid leak are parallel, so that both are in series with the line. It is assumed that the isolating condenser is so large that it does not present any appreciable impedance to the signal current.

The case of the standard resistance coupler is illustrated in Fig. 1 in which R1 is the plate coupling resistor, R2 the grid leak and C2 the isolating condenser. If we remember that R1 returns to ground through the B supply, which is supposed to have negligible impedance, it is easy to see that R2 and R1 are in parallel, neglecting C2.

The by-pass condenser C1 is in shunt because this diverts current from R1 and R2.

In Fig. 2 we have a radio frequency choke Ch1 in series with the line, because the signal plate current must flow through this choke. The primary impedance of the transformer is also in series, as is the impedance of the secondary. The distributed capacity across either winding is in shunt.

Tone controls are made up of devices connected either in shunt or in series with the line, or combinations of both.

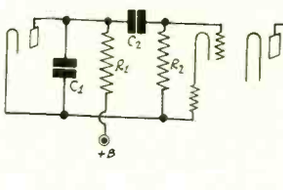


FIG. 1
A STAGE OF STANDARD RESISTANCE COUPLED AMPLIFIER. THE HIGH NOTES MAY BE SUPPRESSED BY INCREASING C1 BECAUSE THIS IS IN SHUNT WITH THE LINE.

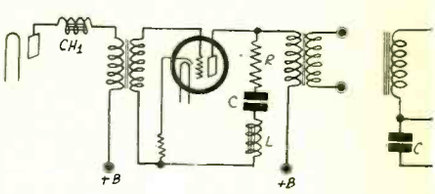


FIG. 2
A CHOKE CH1 IN SERIES WITH THE LINE MAY BE USED TO SUPPRESS THE HIGH NOTES. A RESONANT SHUNT LCR MAY BE USED TO SUPPRESS ANY FREQUENCY.

When a choke coil is connected in series with the line it suppresses the high frequencies more than the low, and when it is connected in shunt it suppresses the low more than the high.

When a condenser is connected in series with the line it suppresses the low frequencies more than the high, and when it is connected in shunt it suppresses the high more than the low.

Condensers and coils, therefore, act in opposite directions. A coil in series with the line and a condenser in shunt suppress the high frequencies. A coil in shunt and a condenser in series suppress the low frequencies.

Fig. 1 illustrates one of the simplest methods of varying the suppression on the high and the low frequencies. Suppose we make C1 variable. The larger it is made the more will the high audio frequencies be suppressed. The effectiveness of this condenser depends also on the resistance R1, and to some extent on R2, and the larger R1 is the more will the high frequencies be suppressed for a given value of C1.

Now suppose we make C2 variable. The smaller we make this condenser the more will the low notes be suppressed. But its effectiveness depends on the value of R2. The smaller R2 is the more effective will any given value of C2 be in suppressing the low notes.

Since the suppression by C1 depends on the value of R1, it is clear that the high note suppression can also be varied by varying R1. Also, since the suppression by C2 varies with the value of R2, it is clear that the low note suppression can be varied by varying R2. One of the most effective methods of stopping motorboating in a resistance coupled amplifier is based on this effect. Troublesome motorboating occurs, as a rule, on very low frequencies. Hence if the amplification of these frequencies is cut down the oscillation may be stopped, and this reduction in the amplification can be effected by reducing the value of either.

Effect of RF Choke

In Fig. 2 the radio frequency choke Ch1 is used for preventing the radio frequencies from entering the amplifier, but it also suppresses the high audio frequencies by an amount depending on the value of the choke and the impedance connected in series with it. If it were convenient to provide a choke of variable inductance, this could be used as a tone control for cutting out more or less of the high frequencies.

In Fig. 3 we have a practical method of controlling the low frequency output of an amplifier. In many circuits it is customary to connect the loudspeaker in series with a condenser and supplying the plate current through a high inductance choke coil. In this figure the choke is Ch and the condenser is any one of the six condensers of different values that may be picked up with the switch Sw. When the switch is set so that the 5 mfd. condenser is in series with the speaker, the low notes come through with practically no attenuation. When the next condenser is picked up there is some suppression of the low notes but still the quality seems to be rich in bass. Then as smaller and smaller condensers are picked up the suppression of the low notes increases so that when the smallest, the .01 mfd., condenser is in series with the speaker, the tone is quite tinny.

The same effect could be brought about by varying the choke coil Ch in steps, but this is not practical.

Another method of varying the proportion of low note response is to vary the condenser C across the grid bias

Control Circuits

Anderson

al Editor

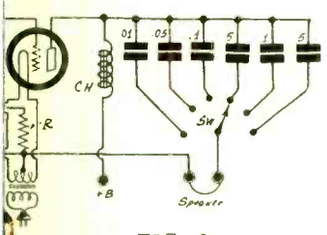


FIG. 3
BY SELECTING CONDENSERS OF VARIOUS CAPACITIES IN SERIES WITH THE LOUDSPEAKER VARIOUS DEGREES OF LOW NOTE SUPPRESSION MAY BE OBTAINED. THE SWITCH CONTROLS THE TONE.

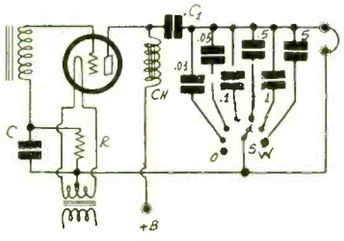


FIG. 4
BY SELECTING CONDENSERS OF VARIOUS CAPACITIES IN SHUNT WITH THE SPEAKER VARIOUS DEGREES OF HIGH NOTE SUPPRESSION MAY BE OBTAINED.

resistor R. The larger C is the better in the reproduction of the low notes. It is advisable not to use a smaller value than 4 mfd. for C and to control the low note response by varying the capacity in series with the speaker.

Shunts Across Speaker

If it is desired to cut out the high frequencies, this may be done by a set of condensers, any one of which may be connected in shunt with the speaker. This method is illustrated in Fig. 4. In this figure C1 represents any one of the series condensers in Fig. 3. By means of the switch Sw in Fig. 4 any one of the six condensers ranging in values from .01 to 5 mfd. can be connected across the speaker, thus permitting almost any degree of high note suppression. When the 5 mfd. condenser is shunted across, practically nothing but the lowest bass notes get through.

Since even the smallest shunt condenser will induce a considerable suppression of the high notes, a blank point has been provided on the switch so that when desired all shunts may be removed.

The values of shunts in Fig. 4 are merely illustrative. In practice it may be well to start with a value no higher than .5 mfd. and then go down to values considerably smaller than .01 mfd. The choices of values is a matter for each individual to decide on, since the whole object of tone control is to enable each one to select the tone values he desires.

It would be possible to combine the two controls illustrated in both Figs. 3 and 4 in one switch, so that when low notes are wanted both the high shunt and high series condensers are cut in, and conversely, when high notes are wanted, to cut in low shunt and series condensers. However, this eliminates the flexibility afforded by two separate controls.

Peak Suppression

In some receivers there is a sharp amplification peak at one frequency, usually due to some resonance effect either in the amplifier or in the speaker. In the amplifier the peak may be due to resonance between the leakage flux of an audio transformer and the capacity of one of the windings. This peak usually falls at a high frequency. It may also be due to regeneration because of a common impedance. This peak may fall at any frequency value from below the audible limit to above it. It is a case of incipient motorboating.

When there is an amplification peak at any frequency there is almost certain to be overloading distortion at that frequency, and this will give unpleasant effects. Even when the amplifier is able to handle the peak without "cracking," the effect is unpleasant, because whenever the signal contains the frequency at which the resonance peak occurs there will be a sharp blast, which is always unpleasant.

A method of cutting down the effect of this distortion has been worked out and is illustrated in Fig. 2. It consists of a resonant shunt circuit, composed of an inductance L, a condenser C, and a resistance R. This circuit can be tuned to any desired frequency, and when it is tuned to the peak it cuts this down. The sharpness of the "absorption" peak can be varied by varying R. Thus by adjusting L and C the absorption peak can be placed so as to coincide with the amplification peak of the circuit, and by varying R the depth of the absorption peak can be made to equal the height of the amplification peak. The result is that in the loudspeaker there will be no peak at all.

Position of Resonant Shunt

If this resonant shunt is placed immediately before the loudspeaker it will not prevent overloading at the peak in all instances. It will only prevent the blasting of the speaker at the frequency in question. If the peak is due to a resonance in the speaker it is all right from this point of view to place the shunt directly before the speaker, but if the peak is due to regeneration or resonance in the amplifier it is well to place the shunt as far forward in the audio amplifier as practicable. Possibly the best place is directly after the detector.

If the resonance peak is due to regeneration in the amplifier the shunt may completely stop the regeneration. Consequently, when regeneration is the cause, more resistance would be used in series with the condenser and the inductance. Otherwise the resonant shunt might be so effective as to create a "hollow" in the characteristic of the amplifier.

It is difficult to install a resonant shunt without having some means for measuring the output characteristic of the amplifier and the speaker. Without this equipment it is impossible to know when the absorption peak coincides with the amplification peak and when the compensation has been adjusted properly.

If it is only a question of stopping oscillation at an audio frequency by means of a resonant shunt, no measuring equipment is needed. The shunt is simply installed and the capacity or the inductance varied until the squeal disappears. This should be done with little resistance in series. When the resonance point has been found in this manner the resistance can be cut in as required.

Cutting Out Two or More Peaks

It may be that the receiver has more peaks than one. In that case it is possible to use one resonant shunt for each peak, each shunt being tuned to one resonance peak.

Another method of controlling the tone of a radio receiver is to have two loudspeakers, one designed so that it favors the high notes and the other so that it favors the low. Then by means of a control the output of the receiver may be divided between the two in various proportions. One simple method of doing this is that of the following: An output transformer is connected between the power tube, or tubes, and the speakers, which are connected in series. A potentiometer P, the resistance of which should be equal to the effective resistance of the two speakers in series. The slider of the potentiometer is connected to the junction of the two speakers. When the slider is moved all the way up the low note speaker is shorted and all the output is delivered to the lower, high note speaker. When the slider is moved all the way down, the high note speaker is shorted and all the output is delivered to the low note speaker. When the slider is set in the middle the output is divided between the two speakers in proportion to their impedances.

If the speakers have been designed, or subsequently treated, so that one strongly favors the low notes and the other the high notes, this method provides a very simple and effective method of controlling the tone.

Two Parallel Amplifiers

This arrangement suggests the possibility of accomplishing the same thing with two different amplifiers and one speaker. One amplifier could be designed so that the low notes were amplified strong and the other so that the high notes would be amplified most. A suggested arrangement is shown in Fig. 6. The transformer T might be the first audio transformer in the circuit directly after the detector. The potentiometer P should have a very high resistance, say of the order of one megohm.

Since the upper amplifier is to be effective on the low note, Ch1 should have a very high inductance and C1 should have a high capacity. And since the lower amplifier is to be effective on the high notes, Ch2 and C2 should both have small values.

The signal voltages are impressed on the two amplifiers in opposite phase. It is not desired that the two amplifiers deliver the signals to the speaker in the same manner. Therefore the amplifiers should be arranged so that the phase is reversed. This is easily effected if the amplifiers are transformer coupled throughout. It would only be necessary to reverse a pair of transformer leads. If the two are resistance or impedance coupled, one of the amplifiers would have to have one more stage than the other.

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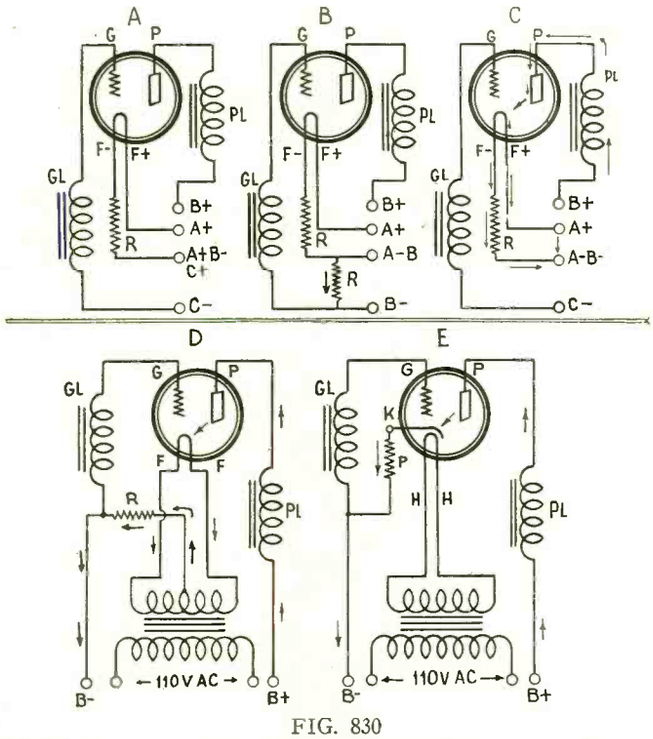

FIG. 830

THIS ILLUSTRATES DIFFERENT METHODS OF OBTAINING GRID BIAS. THE TWO DIAGRAMS BELOW SHOW HOW BIAS MAY BE OBTAINED FOR AC TUBES BY A DROP IN A RESISTOR THROUGH WHICH THE PLATE CURRENT FLOWS.

PLEASE PUBLISH a diagram showing how the plate current of AC tubes flows and how a grid bias can be established by means of a resistance.—A. G. W

See Fig. 830. This contains a diagram for a filament type tube on the left (D) and for a heater type tube on the right (E). The arrows show the direction of the plate current. For the directly heated tube the mid-point on the heating transformer is regarded as the zero point with respect to the grid and plate voltages. For the cathode type tube the cathode K is the zero point. In each case the plate current flows through the grid bias resistor, R or P, from the zero point to the grid return. Therefore the grid return is connected to a point the potential of which is lower than the potential of the zero point. That is, the grid return is connected to a negative point with respect to the filament or the cathode. The amount by which the grid return is lower is determined by the voltage drop in the resistance, which is the product of the resistance in ohms by the plate current in amperes.

* * *

Where Earth's Magnetism is in Reverse

I HAVE NOTED that all transatlantic aviators have had trouble over the Grand Banks off Newfoundland. Their magnetic and inductor compasses fail in that region, and they also seem to have difficulty with radio transmission and reception. There must be something that accounts for this difficulty. Have you any explanation?—B. J. G.

That they should have trouble with the magnetic and the inductor compasses is no wonder. The reason is plainly shown on any magnetic map of the region. The earth's magnetic lines of force go through some queer gyrations in that region. The lines do not run uniformly north and south but in some places they run east and west and in other places they run almost south and north. That is to say, the magnetic needle points in reverse. It may be that radio waves are affected as to direction when they pass through this region, which would account for the erratic behavior of the radio equipment.

* * *

Short-Wave Receiver Exceeds Converter

IN YOUR opinion, which is better, a short-wave converter operating with a good radio receiver, or a complete short-wave receiver?—F. R. C.

There is no doubt that a specially built, complete short-wave receiver is better than any adapter or converter. But a special short-wave receiver may not be worth while in many instances, particularly when the listening is done mostly on the broadcast band with the family receiver, and when short-wave listening is only done as a curiosity or diversion. In such cases a Superheterodyne type converter of good design fills the needs very well.

* * *

Antenna Directionality

DOES AN ANTENNA receive signals equally from all directions or is there any directional effects that favor stations from certain directions more than those from other directions—H. R. R.

An antenna consisting of a straight vertical wire receives signals from all directions alike, but an antenna consisting of a vertical wire and a horizontal portion is slightly directional, receiving signals better from the direction opposite that to which the horizontal portion of the antenna points. Thus if the horizontal portion runs east from the vertical the pick-up is better from the west than from the east. This directional effect is greater the longer the horizontal portion compared with the vertical.

* * *

Variation of Inductance

WHAT IS the reason the inductance of a coil increases with frequency? It cannot be due to a change in the dimensions of the coil, since they remain constant.—J. B. K.

If the pure inductance of the coil increases with frequency it must be because the effective dimensions of the coil increase and this increase must be looked for in the skin effect. This effect forces more of the current to flow in the outer half of the wire than in the inner. That is, the skin effect would increase the effective diameter of the coil. The apparent inductance of a coil also increases as a result of distributed capacity up to the frequency where the pure inductance resonates with the distributed capacity. For higher frequencies the apparent inductance decreases with frequency.

* * *

Non-Uniformity of Selectivity Change

IN YOUR article on sideband suppression you said that the selectivity changed with the change in the apparent inductance as well as with the change in the radio frequency resistance. Is this change always an increase as it was in the cited example?—A. L. W.

The change is not necessarily always an increase. It depends on which increases more rapidly, the resistance or the inductance, or rather which increases the more rapidly, the inductive reactance or the resistance.

* * *

Test to Make a Super Work

I HAVE constructed a Superheterodyne which I have not yet been able make function. I suspect that it is the oscillator which does not work, but I don't know any simple way of testing it for oscillation. Can you suggest a way?—J. C. D.

If you construct an oscillator which you know oscillates by a heterodyne test against a broadcast station, you can couple the coil of this oscillator to the pick-up coil of the Superheterodyne. This should make the Super function if the only trouble is that the regular oscillator does not work. If the auxiliary oscillator coil is large enough and provided with long leads, you can slip the coil over the regular oscillator coil, or you may provide the pick-up coil with long leads and put this coil inside the auxiliary oscillator coil.

* * *

Reflection of Waves Analogued

CAN YOU GIVE an analogy illustrating "skip distance" of radio waves? It is very difficult to understand why waves should skip over certain regions and why this should depend on wavelength.—I. C. K.

Take a glass vessel nearly full of water. Arrange a beam of light so that it strikes the surface of the water from underneath, and so that the angle between the beam and the water surface can be varied. Observe the reflected beam. In certain positions the beam will be reflected back into the water. In other positions the beam will not be reflected downward but will come through the surface. The Heaviside layer is supposed to be such a reflecting layer as that water surface. Some waves will strike the layer and come down at some other place, thus skipping a certain distance on the surface of the earth. The angle at which the light beam ceases to be reflected and emerges on the upper side depends on the color of the light, that is, on the wavelength. Likewise the angle at which radio waves cease to be reflected by the Heaviside layer and begin to emerge on the upper side depends on the wavelength. Those waves that get through can-

not again come back to earth, just as the light beam that gets through the water surface cannot get back into the water. The radio case is much more complex than the optical case because the Heaviside layer is not so clearly defined as the water surface. Moreover, the light waves cover only one octave whereas the radio waves cover many octaves.

* * *

Speaker's "Tuning" Characteristic

I SIMPLY can't see how a loudspeaker can change the pitch of the tones delivered to it by an amplifier. If you can explain it to me I shall appreciate it very much.—W. C. J.

The fact is that the speaker simply can't do it. What is meant by change of pitch in this connection is that the speaker reproduces certain frequency bands better than others so that either the high pitch or the low pitch notes seem to predominate. The actual pitch of any note delivered to the speaker remains the same but only the volume changes.

* * *

Electrical versus Motional Values

WHAT IS MEANT by the motional impedance and motional resistance of loudspeaker? Are these different from the electrical impedance and resistance of the speaker?—E. C. B.

By motional impedance is meant the impedance due to the motion of the diaphragm of the speaker and by motional resistance is meant the resistance due to motion, and these are different from the impedance and resistance of the speaker itself. The motional quantities are measured by first measuring the quantities when the diaphragm is vibrating and then when it is clamped. The differences between the quantities give the motional values. The motional resistance is directly due to the radiation of sound from the speaker and corresponds with the radiation resistance of an antenna. It is the useful portion of the total resistance.

* * *

Condenser for Audio Oscillator

IS IT POSSIBLE to construct a condenser so that when it is used in a heterodyne type audio frequency oscillator the frequency is directly proportional to the dial settings of the condenser?—C. H. D.

It is possible. It is a matter of cutting the plates of the condenser to the proper shape. If the two beating frequencies are high compared with the highest audio frequency to be generated and if the variable portion of the total capacity is small compared with the fixed value when the two oscillators are in unison, the variable condenser is an ordinary straight line capacity condenser. That is, the plates of the condenser are semicircular. This type of condenser was used almost exclusively in the early days of broadcasting.

* * *

Range of Hearing

WHAT IS THE highest and the lowest frequencies that a human being can hear?—S. U. E.

There are no fixed limits because they vary with the individual, with his health, and with his age. Children, as a rule can hear up to 20,000 cycles or a little above. Few adults can also reach this frequency. In middle age a normal person can hear as high as 15,000 cycles. The lower limit for all persons lies between 16 and 30 cycles per second. Persons may be deaf to either the high or the low, or partially deaf, the abnormality being due to disease rather than to age.

* * *

Measurement of Reverberation

WHAT IS MEANT by the reverberation period of an auditorium? I know that is has something to do with echoes but I should like to know how it is defined and what its value should be when an auditorium is considered to be good. I should also like to know what factors in the room alters it.—P. W. A.

The reverberation period might be defined in several ways, but one definition is the time it takes for the intensity of a sound to die down to .367 of its original intensity. The higher the period the worse is the auditorium because echoes will last longer. All hard reflecting surfaces increase the period. All absorbing surfaces and open doors and windows reduce it. Carpets, clothing, upholstery and porous walls also shorten the period.

* * *

Alternating Sound Pressure

HOW CAN a sound wave be alternating when the sound pressure is only an extremely small fraction of the total air pressure? Is it not the same with sound in air as with alternating current in the plate circuit of a tube—that is, the air is pulsating but always in the same direction?—A. P. R.

It is slightly different. We might illustrate the alternating character in terms of slow movements of air, that is, wind. One day the air may be flowing south, the next day it may be flowing north. If this movement of air recurs regularly we have an alternating flow of air. The air pressure rises and falls as the wind blows. A sound wave is just the same thing except that the changes in direction occur rapidly. The "wind" accompanying a sound wave may be very intense, much greater than any hurricane. This is especially true when the sound is intense and of high pitch.

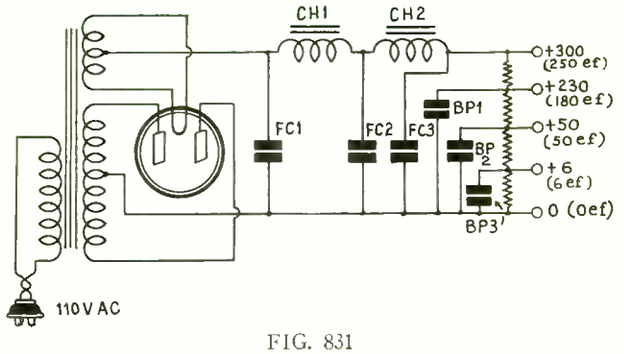

FIG. 831

THE DIAGRAM OF A SIMPLE B-SUPPLY CIRCUIT THAT WILL DELIVER 300 VOLTS

I HAVE a Polo power transformer and two Polo chokes with which I wish to construct a simple B supply. Will you kindly show a hook-up using these parts and a 280 type rectifier tube?—C. W. N.

See Fig. 831. The condensers in the circuit may have the following values: FC1, 2 mfd.; FC2, 4 mfd.; FC3, 8 mfd.; BP1, BP2, and BP3, 2 mfd. each. The voltage divider should be one having many taps so that many voltage combinations may be obtained.

* * *

HOW MANY turns should I use on a 1.5 inch bakelite tube to make a 5 millihenry choke, using No. 36 enameled wire?—A. C. P.

Use 1,200 turns in a single layer. This will make the coil nearly 7 inches long, which is not very convenient.

KDKA Short-Wave Schedule

The following is the present schedule of short-wave transmission by KDKA on relay band, using the call W8XK:

Kc.	*M.*	*Mon.*	*Tues.*	*Weds.*	*Thurs.*	*Fri.*	*Sat.*	*Sun.*
6,140	48	5 p.m. to close		5 p.m. to close		5 p.m. to close		
15,210	19.7		8 a.m. to noon		8 a.m. to noon		8 a.m. to noon	8 a.m. to noon
11,880	25.4		Noon to 7 p.m.		Noon to 7 p.m.		Noon to 7 p.m.	Noon to 7 p.m.

"SOS RESERVE" FORMED, WITH AMATEURS' AID

Washington.

The American Radio Relay League, consisting of the amateur radio operators and station owners, has united with the Red Cross and the Navy Department in the co-operative establishment of an SOS Reserve, whereby in times of disaster messages will be forwarded to relief stations and headquarters, for speedy succor.

The organization and its scope are country-wide, and the SOS signal is not to be that of only ships in distress, but all the territory of Continental United States is involved. Hence, in the event of a flood, earthquake or a blizzard, the assistance of the League members as reporters and as message purveyors will be given. There are now 2,300 members of the League.

Rule for Messages

The Navy Department announced that the League members will render assistance principally as individuals, and will have a standard method of reporting. The League members will be part of the SOS Reserve, and as such reservists will flash messages from the local area of disaster to Red Cross branch headquarters or to the Red Cross local chapter. There are 3,400 such chapters in the United States.

The standard message will be in two parts. The first part will report the type of disaster, the location and preliminary detail of the catastrophe. It is assumed there will be a lapse of time between this and the second part of the message, so the desired information can be obtained. This information will deal, said the Navy Department, with the number of injured, homeless and dead, houses destroyed or damaged and families affected.

Additional Messages

After the two-part message has been cleared, additional messages, giving more details of topics previously discussed, making corrections of previous figures given, and embodying miscellaneous incidental information, are to be flashed, but no personal messages are to go through until after the official messages have been cleared.

The Navy has twenty-two radio control stations throughout the eleven reserve districts, and these stations are to co-operate.

Disasters Grouped

Disasters are grouped into two classes, predictable and unpredictable. Under predictable disasters come floods and hurricanes. The Navy has different rules for its own co-operation under the two classes, as to manning the reserve stations.

The value of the League in the past, in times of emergencies, has been amply proved. Great assistance was rendered by amateurs during the Mississipi floods, as the most recent notable examples. The amateurs got messages through when the commercial lines of communication had been destroyed. In consequence, many lives were saved that might have been lost, and much loss of property was averted.

Sets On Half of Farms in Iowa

Des Moines, Iowa.

Of the 208,506 farms in the State, 97,287 are equipped with radios, said M. G. Thornburg, State Secretary of Agriculture. Hence almost half the number of farms have radio receivers.

The tabulation was made following a survey which was independent of the radio question in the Federal census.

There are still quite a few crystal sets used on the farms, but their number is decreasing rapidly. This is further attested by the fact that the percentage of sets in the more thickly populated areas has not increased as fast as the percentage of sets on more remote farms, where only tube receivers would bring in signals.

The increase in the number of sets in use throughout the State, on a year's basis, was 11,158.

SLOW PAYMENT MARKS TRADE

While looking forward to a good season for 1930-31, radio manufacturers, including parts makers, are experiencing more than usual difficulty in making collections for this time of the year. This is ascribed to the depressed economic situation.

The same factor that makes for delay in debtors meeting bills compels the creditor-manufacturer to refrain from doing much selling, because of a desire not to extend further credit. Therefore some manufacturers have had to do more than their usual share of internal financing, dumping generous thousands of dollars into their own business, to maintain their own credit intact, while, indirectly, this money represents the equivalent of a loan to the debtors.

If the debtors had paid promptly, the manufacturers would have been able to carry along without putting up any more reluctant Summer money than was the case in previous years.

While collections are poor, the accounts are rated as good, and the certainty of payment is regarded as unimpaired, which is the main consideration, once a creditor-seller becomes aware of debtors running past the due dates. There has been some issuing of notes by purchasers to cover quantities of merchandise, and to take up bills due, these notes being mainly of the non-renewable kind, called trade acceptances.

One manufacturer of parts, who does a very large business, summed up the situation as follows:

"We make radio parts and some other instruments. The radio parts are sold to set manufacturers and to jobbers for final outlet to custom-set builders and home experimenters. The non-radio parts are made for very large concerns, none of which has a capitalization of less than $50,000,000.

"All classes of customers are failing to discount and most are taking sixty days net, which is a 30-day overdue. The very large concerns mentioned are paying their bills in about 60 days, after much talking on our part. These big companies never say they haven't the money, but always offer some reason associated with auditing the books, or disturbance by inventory, or other dignified excuse."

OVAL BUILDING OF 12 STORIES FOR RADIO CITY

The skyscraper that will rise in New York City as part of the radio capital which the Rockefeller interests are backing, is to be 60 stories high, and the oval building, that will face Fifth Avenue, will be twelve stories high, with the other structure nearer the Sixth Avenue side, but aside from these facts, no definite structural scope has been decided on, said Hugh S. Robertson, who represents John D. Rockefeller, Jr., in the undertaking.

Room for Separate Theatres

The property is between Forty-eighth and Fifty-first Streets, north and south, and between Fifth and Sixth Avenues, East and West. Thus it is three square blocks. However, the two buildings will occupy space between Forty-ninth and Fiftieth Streets.

The beautifying adjuncts, including a gorgeous garden with architectural fountains and cultural statuary, would be mainly to the south, in that event, although it is planned to have it extend also between the two buildings.

Space for Separate Theatres

The remaining ground space could be devoted to the independent construction of the three theatres—one a variety house, another a sound picture house and the other a "legitimate" theatre—although the purpose as originally announced seemed to indicate the intention of including the theatres inside the skyscraper.

On the ground floor of the twelve-story structure will be shops, while on the roof will be a restaurant with a terraced promenade and outdoor auxiliary tables.

Work for 10,000 Persons

A model of the radio capital has been constructed, and shows the beauty of the layout, but the purpose of the model is to facilitate visualization during discussion, rather than to represent anything like a finished pattern. So great is the undertaking, which runs into a few hundred million dollars, that all possible pains are being taken preparatory to the formulation of an accepted plan.

Work on the actual construction of buildings and garden is to begin in the Fall, if possible, while the entire radio capital is supposed to be finished by the Fall of 1933. It is expected to relieve the unemployment situation in and around New York, because at peak operations as many as 10,000 persons will be on the job at one time.

ANOTHER AVOWAL OF VOWELS

OH yeah—while you're at the job of restoring the lost R to New Yawk—see what you can do about the sissification which causes those announcer birds to sniff linguistic refinement in aping the English affected by Piccadilly's fops. To many of us the announcement that there will be a rendition of Filmore's brass band is welcome news. The information that the 'numbah" will be played by Filmore's brawss bawnd at Cincinnaughty, and similar vowel slurring of our so-called cousins across the "wawtah" causes "regust" rather than the hoped-for admiration.

SILENCING FOUL TALK IS CALLED NO CENSORSHIP

Washington.

Violation of the public trust imposed upon it as a station, the same trust that every station must bear, was the reason for ruling KVEP, Portland, Ore., off the air, and the expulsion order was not due to the exercise of what might be termed "censorship," says the Federal Radio Commission in a brief filed with the Court of Appeals of the District of Columbia. The brief is an answer to the appeal taken by the station, which asked the court to order the license issued because the Commission exercised prohibited censorship.

The conduct of a station is to be judged by the standard of "public service, convenience and necessity," says the Commission's brief, and even though the radio law specifically prohibits the exercise of censorship, this does not authorize the use of indecent and obnoxious language, any more than the right of free speech under the First Amendment to the Federal Constitution ever was construed to authorize such language.

Wildcat Starts Fracas

KVEP was ruled off the air following nightly talks by Robert G. Duncan, self-styled Oregon Wildcat, who denounced banks, newspapers and individuals, until civic and business organizations, as well as individuals, organized to petition the Commission to silence the station. Duncan, a defeated candidate for Congress, according to the Commission, carried on a "program of villification."

The brief states also that the station and its owner, William B. Schaeffer, had been guilty of other offenses which themselves would have been sufficient to warrant refusal of license renewal. The revocation, the brief continues, was based on "the nature of the broadcasts which have been emanating from this station."

Why It is Not Censorship

By applying the test of "public interest, convenience and necessity" the Commission is not resorting to the prohibited censorship, the brief sets forth, continuing:

"This test is set up as the essential criterion for all programs and the right of freedom from the censorship thereby becomes a qualified right subject to such reasonable control by the Commission as would be consistent with the primary consideration of the public welfare.

"In any event the restriction on censorship is no more beneficent in its scope than the First Amendment to the Federal Constitution, which confers the right of free speech, and this constitutional provision has never been construed to protect obnoxious and indecent language," it is stated.

Innuendo Not Public Service

"The dissemination of such langauge or its by-products in the form of innuendo is certainly not in the public interest and to prevent its broadcast by declaring it to be inconsistent with the legislative standard is, obviously, not such an exercise of censorship as was contemplated by Congress in the radio act."

STATIC PRECEDES STORM

When static is present it is usually an indication of a storm coming or present. Scientists are making tests in an effort to standardize forecasts.

Damrosch Gives Culture Advice

A decline in interest in the study of music, due to our "restless and speedened age," and ascribed in part to radio, was voiced by Walter Damrosch, in a letter discussed at a meeting of the Associated Music Teachers League, held in New York City.

"All cultured people should know how to sing and how to play one instrument," he wrote. "Radio and the phonograph can not replace the piano in the home."

Music teachers find that many pupils who begin earnestly enough to take lessons, become discouraged and stop.

FULTOGRAPH'S SCOPE WIDENED

Preparations are being completed to broadcast photographs over a New York radio station by the Fultograph system of transmitting and receiving pictures by radio or wire, according to an announcement by Captain Otho Fulton, the inventor, from his New York City laboratory at 38 West Fifty-ninth Street, and also to receive the photographs and project them on the screen of a local theatre.

The Fultograph will be thrown on the screen by means of a special optical system not unlike a stereopticon. The photographs will be in the nature of news pictures, Capt. Fulton said, which will be accompanied by special music from the station sending the pictures.

The Fultograph is widely used in Great Britain and on the European continent and has also been adopted by the British Navy and Army. Other European countries having adopted the system are Germany, France, Italy, and Spain.

An English news bureau serving 600 publications in the British Isles has also agreed to use the system. American municipalities are also interested in the system as a means of sending finger prints, pictures, and facsimile matter.

The system operates at such a speed that it takes about three minutes to transmit a picture 3½x5 inches. In announcing his progress in the transmission of colored pictures, Capt. Fulton said:

"I have recently perfected a system using three recording cylinders which will intercept photographs in their original colors. One cylinder will reproduce the red parts of the picture, another the yellow tints, and the third the blues. These will be reproduced in an accurate, homogeneous surface rivaling in smoothness and texture the tints of the original."

Capt. Fulton's system is not one of television but rather one of the transmission of facsimile. It requires 3 minutes to send a complete picture by this method, whereas in television the same picture would have to be transmitted in one-sixteenth of a second. That is to say, television is at least 2,880 times as fast. It follows that, for the same transmission circuit, the detail of a Fultograph picture would be 2,880 times as great as that for the same size television picture.

New Corporations

Radio Science Corp., Brooklyn, N. Y., printing, publishing—Corp. Trust Co.

Gould-Brody Radio Corp.—Atty. A. Brody, 302 Broadway, New York, N. Y.

Lincoln Radio Corp.—Atty. C. Brecher, 2 Lafayette St., New York, N. Y.

FREQUENCY AS "PROPERTY" UP IN COURT AGAIN

Washington.

A second case on an agreed state of facts, certifying questions to the United States Supreme Court relating to whether the licensed operation of a station on a certain frequency vests it with a property right to that frequency is that of the American Bond and Mortgage Company versus United States, and concerns WMBB-WOK, Chicago.

The frequency was used after it had been allotted as a clear channel in another zone. Thereupon, with the threatened continued use of this frequency by the station, the Commission obtained an injunction. This was appealed and the appellate court has certified the legal questions to the Supreme Court which, if it answers the questions, will decide the problem of property right to a wavelength.

First Raised by Hughes

The question of the existence of a property right, something akin to a trademark, was raised first by Charles Evans Hughes, as counsel for WGY, Schenectady, N. Y., which was contesting its fate in the reallocation of November 11th, 1928, whereby it was assigned to only part time on its previous frequency. The main point was that the station, by reason of its huge investment, its developmental and its experimental work, was fairly entitled to a full-time assignment, and on that ground the station won in the Circuit Court of Appeals. The Supreme Court refused to review the case.

No determination was made by the court as to the "property right" claim. Now that Mr. Hughes is Chief Justice of the Supreme court, he will not sit in either of the "property-right" cases when they come before the court for consideration. The second case is that of White versus Johnson.

Reason for Unconstitutionality

In the WMBB case the question of the constitutionality of the radio law and of the Davis amendment thereof is raised on the ground of authorization of the Commission to confiscate private property without due process of law, contrary to the Fifth Amendment to the Federal Constitution.

In obtaining its license in 1927 WMBB signed a waiver of "any right or any claim of right as against the United States, to any wavelength, or to the use of the ether in radio transmission, because of previous license to use the same or because of the use thereof."

The effect of this waiver is to be construed.

Literature Wanted

Chas. B. Galloway, 304 N. Congress St., Jackson, Miss.

Theodore R. Reiley, 103 Bonner St., Hartford, Conn.

W. E. Gibson, 21 Wallace St., Greenville, S. C.

Jas. Walker, 2061-10th Ave., Columbus, Ga.

E. R. Clark, 1468 Girard St., N.W., Washington, D. C.

H. P. Bezanson, 314 Commercial St., E. Braintree, Mass.

Charles E. Dornbush, Pollock, S. D.

M. F. Nowak, 3034 Gresham Ave., Chicago, Ill.

Stephan R. Wagner, 337 Riverside Dr., New York City.

John E. Bradley, 2590 Assiniboine Ave., Winnipeg, Man., Canada.

E. L. Tabor, Box 87, Big Arm, Mont.

Arthur R. Amo, 6413 23rd Ave., Kenosha, Wis.

Perlie F. Craft, R.R. 2, Box 84, Mt. Pulaski, Ill.

RADIO WORLD

The First and Only National Radio Weekly
Ninth Year

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Roland Burke Hennessy, editor; Herman Bernard, business manager and managing editor; J. E. Anderson, technical editor.

The Legal Dilemma

RADIO is offering its own example of law working through the processes of enactment, enforcement, and interpretation. When a Federal law is passed that affects an important right or industry, the process of its final determination surely stretches over an ample period of years. Meanwhile amendments may be passed, and must go through their own lingering period of adolescence, to reach their standardized majority.

In regard to the Federal Radio Commission itself, the powers it possesses are by no means settled. Just now one question to the fore concerns the right to rule a station off the air that permits the repeated broadcasting of obscene and indecent language.

In favor of sustaining such power, one starts with the assumption that foul language poured into the homes is utterly indefensible and intolerable. The only sure way to stop it, and to deter others, is to silence the station. But a station so silenced will point to the radio law itself, saying that censorship is prohibited in express terms.

The Commission must have legal authority for its every act. So it decides that, since the law requires stations to be operated for the "public interest, convenience and necessity," foul language over the air violates this part of the law. Censorship, says the Commission, is not exercised when mere decency is upheld.

A station ruled off the air obtains an injunction, pending decision on which it is permitted to continue broadcasting. Meanwhile the Commission does not really know where it is at, since the laws are only what the courts say they are.

It might be assumed that where a law vests a Commission with authority to assign frequencies, power and hours on the air, that such an investiture is clear enough, and that the actions of the Commission in this respect may be regarded as binding. Here is an example of the exercise of an administrative function. And yet we find the courts frequently overriding the Commission, even though the Commission prevails in most of the appeals from its administrative decisions. Every station is a link in a chain under such an apportionment of the facilities of the air, and a court that overrules one assignment is not called upon to rectify the country-wide structure of stations that the court's executive act upsets. Again, does the Commission find itself hemmed in.

Under the anti-monopoly laws and the patent laws, radio companies do not fully know where they are at. What safeguard is a patent? It is only a voidable certificate from the Patent Office granting the applicant a monopoly on the use of his device for seventeen years for his revelation to the public of the details of his creative success. The patent begins to become certain as one court after another affirms its validity, but the assurances are never complete until the United States Supreme Court has given its approval, or has refused to review the case, so that the decision of the court below stands as made.

On the score of monopoly, companies that group their patents do not know for sure whether they are acting within the Sherman or Clayton law, or against both, with the uneasy threat of dissolution if their opinion of the legality of their actions is held erroneous. In such a predicament are the corporations that are being sued by the Federal Government for violation of the Sherman and Clayton acts. They are charged with monopoly and conspiracy, but even the Government is not sure these offenses have been committed. The purpose of the suit is to resolve the doubt. The formal severity of the charges does not change this fact at all.

A patent itself is a legal monopoly. Does pooling of many patents heighten the degree of monopoly? Can monopoly be graded at all? Is the patent law that grants a monopoly contradicted by an anti-monopoly law that prohibits patent pooling?

The Radio Corporation of America, Westinghouse, General Electric and the other large companies defendants in the Government suit, as alleged conspirators and monopolists, are amply financed, nevertheless stand to expend several million dollars to defend the suit, and if they win, can feel, perhaps, that the adjudication was worth it.

Licensees under the patents of the pool are less fortunate. Not all of them can withstand serious disturbance of their business, particularly in these days, and yet their fate is partly wrapped up with that of the patent pool. It is from the pool that they derive their licenses to manufacture receivers, power amplifiers and tubes. So many patents are necessary for proper manufacture of any of these that to be denied the privilege of a license by any dissolved unit of the group might put present licensees out of business. The owner of a patent is under no legal compulsion to license anybody. All he needs do is put the patent to use himself.

It is not possible to enact pre-adjudicated laws, or deprive affected parties of their right to appeal legal questions to the courts. Our experience as a country has been that the judiciary is by far the strongest branch of our Government, and consistent with the conferring of that wreath, we are too willing to crowd more duties on the courts than they should have to perform.

In radio affairs, as in others, we would like to see some finality attach to the administrative decisions of the board empowered and directed to render them. Representative Lehlbach, in a salutary bill passed by Congress, tries to remedy the situation as regards to assignment of frequencies, power, hours on the air, and the like. The administrative board would do this work, but any legal questions disputed by adverse party could be taken before the court, and only decisions as to really legal matters could be taken to the court. That would confine the court to legal questions, and stop judicial decisions on engineering matters.

It may be argued that the Commission may make mistakes on engineering questions, too. Yes, but on engineering questions the court is more likely to be wrong, and we should rely on our engineers for engineering decisions, just as we rely on our courts for decisions on legal questions.

The slow process of stabilizing radio law is proving expensive, to stations no less than to patent owners and licensed manufacturers, but the problems have crowded themselves in to-day's picture, as if to make a complete masterpiece of uncertainty. It is to be hoped that the doubts will be resolved as speedily as is consistent with justice, so that weak legal legs will not continue to render precarious the foundation of a great industry.

Forum

Automatic Volume Control Experiences

IN the debate, "Resolved, That Automatic Volume Control is Necessary," Mr. J. Morse. On a few points Mr. Morse is absolutely wrong! He states that the automatic volume control holds the sound output the same "no matter how much the strength of the signal varies." Mr. Morse, take a set with this new invention and set the manual volume control for fair room level on any weak **local** station and then turn the dial to the strongest **local** station and see what happens. I have yet to hear the set that keeps the same volume on both stations and I have to demonstrate them to customers by the dozens.

Another point: Mr. Morse states that on distant stations fading occurs mostly when the station announcement is made and that on an ordinary set, even by coaxing the manual volume control, the station can not be brought in clear enough to hear what the announcer says. Mr. Morse, I believe, wrote some strictly theoretical literature. Most sets without the automatic will bring in the station announcement fairly well by coaxing, but no set with the automatic will do the same without coaxing, because though amplification is increased it is the static level, and both are not at full power as long the manual control is set for room level.

I do agree with Mr. Morse that the automatic volume control is a convenience, as it smooths out the volume to a certain extent, but he should not forget that it is not possible without a visual indicator, as Mr. Lthrope pointed out very well in the affirmative of the debate.

As far as I am concerned automatic controls are, as I said before, a convenience on local stations but almost useless on those coming from far distances.

Furthermore the special tube starts to work only after an increase in volume has set in already, which goes to show you that the same volume can never be had on all stations.

WALTER STEUDEMAN,
513 West 176th St., N. Y. City.

* * *

First Practical Television

WE have always followed your articles with interest and we notice in the June 21st issue of your magazine an article which states that Baird is generally credited with giving the first practical demonstration of television in 1926.

We are enclosing herewith a photostat of the front page of "The Washington Star," June 14th, 1925, which tells of the first motion picture transmission by radio by C. Francis Jenkins.

We believe that in the interest of truth this should be of advantage to you. Mr. Jenkins has been very hard at work for a long time on this subject which we are now following through commercially and we believe it only fair to give American experimenters their just dues.

JENKINS TELEVISION CORP.
D. E. Replogle.

A THOUGHT FOR THE WEEK

DON'T you believe it—not even if you tell it to yourself! Business in some lines may be slack, but radio is not stepping, falling or passing out of the picture, so far as sales are concerned. To be sure, the average set owner is not quite so quick in buying new parts in summer as in the cold weather, but he buys those parts sometime and thus there is a big hangover of purchasing power that makes itself felt late in the summer and early in the fall. Besides, what about that radio suit for $30,000,000 *that one radio concern has instituted against another? That suit shows the extreme of optimism and the belief that somebody has a lot of money somewhere.*

QUEST OF GOLD HELD BLOW TO AIR EDUCATION

Washington.

How the increasing value of broadcasting to commercial interests, that use it as a means of selling, has forced the educational aspect into the background, is outlined in a report by the Advisory Committee on Education by Radio, submitted to Secretary Wilbur of the Department of the Interior, who appointed the committee.

A report, made in 1923 concerning the last half of 1922, was recalled by the committee. This report was found in an educational survey, and read:

"In radio, education has found a new and powerful ally. Sixty educational institutions are broadcasting educational and musical programs, forty-seven of them being colleges and universities."

Distrust of Commercialism

While commercial interests offer to help education by radio, the committee finds that lack of co-operation exists between the commercial and the educational groups. This is ascribed to widespread distrust among educators of commercial motives and propaganda and the practice of commercial stations offering educational programs mostly for the good-will and publicity value, that is, to help the station itself, rather than to build up a sound educational method and research with the help and guidance of educational experts.

Educational stations, continues the committee report, feel they are given the inferior positions on the broadcasting spectrum and in the allotment of hours.

Armstrong Perry, of the Payne Fund, who acted as a special investigator for the committee, and toured the country, reported:

"The only considerable group of broadcasting stations devoted primarily to educational purposes was composed of those owned and operated by colleges and universities, many of which were State institutions. As the well-organized and powerful commercial broadcasters struggled to acquire radio channels, the educational stations were more and more restricted.

Less Power, Unfavorable Waves

"The tendency was to drive them off the air in the evening and confine their operation to the daylight hours, when their effective range was only one-tenth of the radius covered at night and when listeners were more likely to be at work than sitting at their receivers.

"There developed also a tendency to restrict the amount of power used, and to assign to the educational stations wavelengths at the ends of the tuning scale, where it might be difficult or impossible for listeners to tune in their programs."

Amos 'n' Andy Now Real Life Taxi Men

Amos 'n' Andy, of Fresh Air Taxicab fame, have been made life members of the National Association of Taxicab Owners. At a national meeting of the taxicab men in Chicago the two comedians were unanimously voted a life membership. Cards were presented to them at the National Broadcasting Company's headquarters in New York City.

NBC Willing to Aid Teaching by Radio

Washington.

M. H. Aylesworth, president of the National Broadcasting Company, wrote the Committee on Education by Radio reasons for the apparent tardiness of commercial broadcasting companies or stations in systematic presentation of educational material. His reasons were:

(1)—The National Broadcasting Company has felt that both in the interest of education and of industry, it was important that educational programs should be developed not by broadcasters, but by representative educators themselves in order that any taint of commercial propaganda might be avoided. Educators so far have failed to act in furnishing us with such programs in spite of offers to make nation-wide facilities available.

(2)—Educators have so far failed to adapt their material to the technique required by the new art.

GETTING READY FOR HAGUE, '32

Washington.

Organization of representative American radio engineers into committees to make recommendations for the solution of problems not decided by the International Radiotelegraph Conference held at the Hague, Holland, last Fall, was perfected. The meeting was called by the Federal Radio Commission and was attended by engineers of the Government and of private companies interested particularly in communications.

Four committees were appointed. They will hold meetings during the Summer and submit their reports to the full membership of the general committee at a meeting September 4th. Action will then be taken. The adopted program will be submitted by the American delegates to the International Technical Consulting Committee, which will meet in Copenhagen, Denmark, next year.

The action in Copenhagen will be recommendatory, also. In 1932 the International Radiotelegraph Convention will be held in Madrid, Spain, at which time the recommendations of the Copenhagen meeting will be presented for final action. Dr. C. B. Joliffe, chief engineer of the Commission, was chosen executive chairman of the conference of American engineers. Officers and members of the four committees were selected, also.

STATIONS GET SAFEGUARD BY NEW LAW RULE

Washington.

The rules and regulations of the Federal Radio Commission are being changed. Already the rules for legal procedure before the Commission have been amended, and copies of the new legal rules will be sent to all licensed stations. Next the engineering and licensing rules will be changed.

In the legal category, the most important change concerns hearings. Whenever an application is made by one party, that may adversely affect the interest of any other station, a hearing must be held. A quorum of the Commission need not be present, but if not present, then the testimony and a written report and the findings must be sent to the full Commission, and a copy to each of the parties.

May File Exceptions

"A copy of such report," states the new rule, "shall be mailed by the Commission to each party participating in the hearing and such party or parties shall have the right, provided the same is exercised within a period of fifteen days from the mailing of such report, to file exceptions to said report."

This is a complete change from the previous method, whereby the recommendations to the full Commission in cases of this kind were not made public, nor even known to the contestants, hence there was no opportunity to review the report and findings, for making exceptions, unless on appeal of the decision to the Court of Appeals of the District of Columbia.

May Reduce Number of Appeals

It is expected that this rule, already in effect, will have a tendency to reduce the number of appeals taken to court, since the objector may present his arguments before the Commission itself. The Commission is said to feel that reduction of the number of court appeals will enhance the smoothness of the performance of the Commission's work.

THE BIGGER PROBLEM

A MANUFACTURER and a retailer debate where they would get off under a price fixing law, but what we're more interested in is how are we to raise the price, whatever it is?

N. B. C. Chicago Studios Classy

Chicago

HIGHLY decorative and artistic effects will prevail in the six studios in the new home of the National Broadcasting Company's studios atop the Merchandise Mart.

Two lobbies, one on each floor of the broadcasting company's specially-constructed building, will be executed in a Pompeian motif. Hand Pompeian decorations will be painted over an ivory background, while chairs and tables will be furnished with black, patent-leather coverings, to harmonize with the period.

Different Colors

Each of the six studios will be finished in different color schemes, with adjoining client and observation rooms colored to harmonize with the studio proper. Tinted and acoustically treated tile walls will blend with the ceiling in each particular studio.

Specially constructed lights will hang from the studio ceilings so that every portion of the room will have equal lighting, yet one will be able to gaze directly into the lamps without fear of glare.

World's Largest Studio

Studio A, the largest studio in the world, built especially for broadcasting, will have the first installation of Sunlight lamps in addition to the regular lighting equipment in this studio.

Throughout the various corridors and lobbies will be special carpeting that deadens footsteps. Made of twisted yarn, the carpeting will offer a spring-like effect.

MAJESTIC ASKS POOL DAMAGES OF $30,000,000

Washington.

The threatened legal action by the Grigsby-Grunow Company, of Chicago, makers of Majestic sets and tubes, against the Radio Corporation of America and associates, has taken the form of a suit for $10,000,000 damages. The complaint in the suit sets forth that by maintaining a patent pool the defendant companies conspired to violate, and did violate, the Sherman anti-trust law. Under this and the Clayton Act treble the actual damages are allowed, if the actual damage is proved, hence the plaintiff's $10,000,000 claim is for thrice the alleged actual damage.

The other defendants include the General Electric Company and the Westinghouse Electric and Manufacturing Company.

The attorneys for the Grigsby-Grunow Company in the suit are former United States Senator James A. Reed, of Missouri, and Ernest R. Reichman, of Chicago.

Paid $6,000,000 Royalties

To date, states the complaint, the plaintiff has been compelled to pay to the patent pool almost $6,000,000 in royalties, arising almost entirely from the payment under a license the Grigsby-Grunow Company obtained from RCA and associates to manufacture receivers for home use. The license fee is 7½ per cent., with an annual minimum of $100,000.

More recently the plaintiff has taken out a tube manufacturing license, and some of the royalties apply to this account.

The license fee demands were exorbitant and illegal, states the complaint, charging that the high royalty is intended to limit unlawfully the number of persons and companies engaged in the manufacture of receivers, and even then the licensor refused to permit the manufacture of sets for use in schools, in communication for tolls, for airplanes, hotels, churches, and public institutions generally.

The terms of the complaint, on the score of monopoly and violation of the Sherman and Clayton acts, follows closely the complaint recently filed in Delaware by the Federal Government against RCA and associates, charging monopoly and conspiracy, and asking the court to order the dissolution of the offending parties to the patent pool.

Claims Injury by "Tube Clause"

Grigsby-Grunow makes a major point of the "tube clause" inserted by the patent pool in set-manufacturing licenses, whereby the set makers were compelled initially to equip all their sets with RCA or Cunningham tubes (RCA owning 51 per cent of the Cunningham stock). RCA discontinued the clause, admitting it was bad policy. A court held this clause to be illegal.

Now Grigsby-Grunow recites that it was damaged $3,000,000, because RCA and associates failed to make delivery of tubes when they were badly needed, but meanwhile dealers and distributors selling RCA sets had no trouble in obtaining tubes. Other items of damage are listed.

The complaint sets forth there are more than 4,000 patents involved in the cross-licensing pool of the "conspirators."

Gave $240,708 and Got License

Kansas City, Mo.

What Grigsby-Grunow paid for the set license it says is now a burden was revealed in the suit against the RCA group.

To obtain a market, after dealers and distributors had been "intimidated," the Majestic makers say they were compelled to accept "unlawful dictation" and pay $160,000 for the set-making license, plus $80,708 damages for alleged prior infringement, and pay "an onerous, burdensome and confiscatory royalty" of 7½ per cent., minimum $100,000 a year.

PETRIE IS NEW NBC ANNOUNCER

Howard A. Petrie, who in ten months at WBZ-WBZA, Springfield and Boston, Mass., has resigned from Westinghouse and joined the announcing staff of the National Broadcasting Company.

Petrie joined the Boston staff of WBZ-WBZA last August as junior announcer.

Petrie sold securities for five years before entering radio. Successful in his song recitals at local stations, he soon developed the studio presence and microphone confidence so essential in announcing. And it was not long before he was fully launched on a radio career. Petrie found that broadcasting afforded outlet for much of the musical and dramatic training he had had at school.

His early preparation for a career was pointed toward music. At high school he conducted the glee club, played with various instrumental groups and appeared in dramatic productions. As soon as he was done with school, Petrie hurried off to specialize in music. For several years he studied with Ivan Morawski in Boston, in the meantime devoting his spare time to choir work at various churches. Last year he did some dramatic work with Clayton W. Gilbert at the New England Conservatory of Music, appearing in "The Trial of Mary Dugan."

Petrie was born in Beverly, Mass., and at present lives with his parents, Mr. and Mrs. James Petrie, at Somerville. His singing and announcing voices are a sonorous bass. Petrie is also a violinist.

Plants Closed By Universal

Buffalo, N. Y.

Legal troubles have caused the Universal Wireless Communications Company to shut down some of its plants temporarily. These included plants at New York, Chicago and Buffalo that have been operating under licenses granted to Universal when it won coveted short-wave assignments for which the Radio Corporation of America was competing.

The RCA is one of the plaintiffs. It is suing the domestic radio telegraph concern for alleged violation of five patents. The Dubilier Condenser Corporation also has a suit against Universal. The third action is a bankruptcy proceeding, not directed against the operating company, but against a manufacturing adjunct.

Officials of Universal said that not only are the closings temporary, but that the company is well able to prevail in the law suits.

THIRD NATIONAL CHAIN IN VIEW, WOR TO BE KEY

Washington.

WOR, Newark, N. J., which was key station for the Columbia Broadcasting System prior to Columbia's purchase of WABC, has applied to the Federal Radio Commission for a 50,000-watt license. It now uses 5,000 watts.

At the time WOR's contract with Columbia terminated, the station announced it was most effective when serving New Jersey and the metropolitan New York district distinctively, especially as it was owned by the Bamberger department store. It relished a greater intimacy with its listeners and its own program identity.

Since then, however, WOR has become part of a small hookup, in which WLW, Cincinnati; WMAQ, Chicago, and WMBF, Binghamton, N. Y., are the other members, these four being known as The Quality Group.

Chain Needs Lots of Money

For the attainment of its objectives stated when it resumed its standing as a station independent of any chain, WOR does not need 50,000 watts, therefore it is assumed that it desires the extra power not only to enjoy greater service area, but also to elevate its rank. As the key station of a chain it would not need any more power, but it is usual for key stations to be powerful transmitters themselves.

The prospect of a third national radio chain has come up several times, both in connection with WOR and as a commercial undertaking by others, but the others have not succeeded, as enormous capital is necessary. The plan was to try to start the chain, then find the customers, but the newer plan is to find the customers first, and start the chain later. In some reports the proposed new chain is said to have a large customer, a motion picture corporation which seeks to have adequate air representation, to combat the similar position occupied by Radio Pictures and by Paramount.

A. J. McKosker, director of WOR, said the possibility of his station becoming the key of a new chain would be enhanced by authorization to use 50,000 watts. Of this power, half is granted outright, the other half "experimentally," under a rule of the Commission.

Seek More Power

The stations now on a 50,000-watt basis are nine in number, using eight different transmitters: WBAP, Fort Worth, Tex.; WEAF, New York; WENR, Chicago; WFAA, Dallas, Tex. (same transmitter as WBAP); WGY, Schenectady, N. Y.; WLW, Cincinnati; WTAM, Cleveland; WTIC, Hartford, Conn., and KDKA, Pittsburgh, Pa. Of these nine stations, only one is the key station of a chain, and that is WEAF, which, with WJZ, serves as outlet for the National Broadcasting Company. WJZ uses 30,000 watts. WABC, the Columbia key station, 5,000 watts, has a construction permit for 50,000 watts, but no license for that power has been granted yet.

There are nine holding 50,000-watt licenses, five more holding construction permits for that power, and now, with WOR on the list, fourteen other applications on file. The Commission has limited the total number of licenses to twenty, so eight will be disappointed.

NEED OF CENSOR CITED ON WAVE FROM ABROAD

Washington, D. C.

DISSEMINATION of propaganda on an international basis by broadcasting stations operating with power sufficient to blanket large portions of the globe could be effected without violation of existing radio laws, either international or national, it was pointed out by Federal Radio Commissioner Harold A. Lafount.

It is conceivable, said the Commissioner, that a station could be set up in Mexico and blanket the entire continent without transgressing the International Radio Telegraph Convention. Similarly, he said, Soviet Russia might erect a station of "fabulous power" to broadcast to the world the precepts of communism.

"Military administrations of all large nations, I understand, are giving thought to the problem presented by radio broadcasting as a means of propaganda and counter-propaganda in wartime," he said. "Censorship, which is generally invoked on all modes of communication in national emergency, would have little effect on broadcasting, since radio knows no barriers, and booming power will carry the voice over vast expanses of territory."

Penetration by Short Waves

It probably is far-fetched, from the technical standpoint, that a station even with 50,000,000 watts power, located in Russia, could reach the millions of listeners on the American continent, said the Commissioner. With far less power, however, a broadcasting station in the soviet union could cover the entire European Continent.

"But a station anywhere in the world broadcasting on short waves with only a comparatively small amount of power can be heard internationally," he declared. "It is to be remembered, however, that only those possessing short wave receivers could pick up these programs, and the short wave audience consists of a handful of listeners who have technical training or are so inclined."

Requires Actual Care

The international radiotelegraph convention, Mr. Lafount said, does not in any manner touch upon censorship of programs. It permits the "rebroadcasting" of programs in an unrestricted manner. The radio act of 1927, which is the American radio law, he added, according to "The United States Daily," likewise does not prohibit the rebroadcasting of foreign programs although it does forbid unauthorized rebroadcasting of programs originating in stations within the borders of the country.

"The question presented by the possible use of radio for propaganda dissemination is an interesting one," declared the Commissioner. "In wartime it is of great significance. But not until a specific instance arises somewhere in the world and a controversy is precipitated will there be world-wide consideration of it."

BOARD BACKS WLEX RULING

Washington.

The Federal Radio Commission has filed a brief with the court in support of refusal of permission to WLEX, Lexington, Mass., to move to Worcester, Mass. After the denial the station appealed to the court to reverse the decision of the Commission.

Beats of Hearts Heard Overseas

Heart pulsations and sounds made in the lungs by breathing were transmitted from Buenos Aires to Madrid by radiotelephone with such clearness as to enable Spanish physicians in Madrid to diagnose diseases from which patients used in the experiment were suffering, says a special cable from Buenos Aires to "The New York Times." The experiment lasted for an hour.

The heartbeats of several well persons also were sent to Spain. In every case the doctors telephoned back the condition of the heart and lungs heard.

The transmission was made over an ordinary commercial telephone circuit from an instrument recently invented by an Argentine surgeon which sends sounds from the heart and lungs greatly amplified through a loudspeaker and at the same time registers their intensity on a galvanometer.

NEW RULES FOR AIRPLANE RADIO

Washington.

Regulations governing the use of radio facilities by commercial aviation, embracing established transport service as well as itinerant craft, were adopted by the Federal Radio Commission in a new general order.

The order supersedes all other orders and regulations having to do with aviation radio, says "The United States Daily," and sets forth the channels, totaling about 30, in the low, intermediate and high frequencies, set aside for radiotelegraph and radiotelephone communications along established airways and for point-to-point, plane-to-ground and ship-to-shore, as well as experimental operations.

The order specifies that there be five distinct radio aviation chains, comprising a continuous series of stations along a particular airway, which shall initially be established. These are to be maintained cooperatively by the various air transport lines, and they shall be "open to all the cooperative participants upon an equal basis and then only to the extent of the actual aviation needs of the users," states the order.

It is specified at all times the licensees of point-to-point service shall be required to transmit, without charge or discrimination, emergency messages for the general public which involve the safety of life or property.

"In no event," continues the order, "shall the use of any frequency by a licensee extend to commercial correspondence or to paid or toll messages in the sense in which these terms are generally understood and accepted."

In connection with the order it was explained orally at the Commission that the air transport operators to which frequencies have been allocated recently organized a new public utility aeronautical radio corporation, under the name Aeronautical Radio, Inc., to which these frequencies are being assigned. Herbert Hoover, Jr., son of the President, is president of the corporation.

ANYBODY who thinks Summer isn't a great radio season must be a swimming instructor or professional golfer.

ROXY THEATRE LEADS IN VAST PICK-UP PLAN

THE most elaborate remote control pickup systems used by the National Broadcasting Company are in the Roxy Theatre, New York City.

There are two main divisions, the broadcast studio on the sixth floor of the theatre, and the theatre proper.

In the studio there are sixteen microphone outlets, enabling the engineers to have any combination of microphones necessary for a particular broadcast, though actual tests have proven that a single condenser microphone placed in the proper position, with the orchestra balanced properly, will give excellent results.

Three Mikes

At present three condenser microphones are used on the average studio pickup, one for the orchestra, one for a chorus, and one for S. L. Rothafel (Roxy).

The theatre proper is where the field engineer's ingenuity is taxed to the utmost, as this pickup point is of such enormous size and the variation of program is so rapid, that every week when a new show is broadcast fresh problems present themselves.

The broadcast from the threatre has been accomplished by the use of from one to sixteen microphones and as many as fourteen may be opened at one time, although generally no more than three are used at once.

Outlets Everywhere

There are microphone outlets in the footlights, backstage, in the wings, in the orchestra pit, in the boxes, on the roof, and even in the balcony.

Experimentation of difficult pickups is always being carried on.

The broadcast control room is situated on the sixth floor of the theatre next to the studio and has double windows to enable the engineers to view the proceedings in the studio. When a broadcast is planned from the theatre on Monday night, many rehearsals of this broadcast are made so that all fine points and kinks, which are hardly noticeable to the untrained ear, can be eliminated.

The power room is next to the control room and all power units are in duplicate in case of failure of one set.

WLS SUES COMMISSION

Washington.

WLS, Chicago, operated by the Prairie Farmer Publishing Co., has filed suit in the United States district court at Chicago to enjoin the Federal Radio Commission from enforcing an order granting WENR one-half time on the 870-kc channel previously used by WLS five-sevenths of the time.

WRAW APPEALS TO COURT

Washington.

WRAW, Reading, Pa., which was refused permission by the Federal Radio Commission to install a new transmitter, and use 500 watts, unlimited time, on 620 kc, has filed an appeal in court. At present WRAW is using 100 watts on 1,310 kc, sharing time with WGAL, Lancaster, Pa.

WHAM OBTAINS ANOTHER WRIT TO KEEP WAVE

Washington.

The Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., obtained another injunction against the Federal Radio Commission, prohibiting the dislodgement of WHAM, the company's station, from 1,150 kc by the Commission without a hearing. Justice Hitz, of the Supreme Court of the District of Columbia, issued the injunction.

The new writ was issued to supersede the one formerly issued by the same court.

The Commission proposed to shift WHAM from 1,150 kc to 1,160 kc under the reallocation which several injunction suits temporarily halted, and which is in abeyance pending determination of those cases.

One of 26 Changes

The shift was one of 26 changes affecting clear-channel stations, and was said by the Commission to be in the interest of decreased interference. However, as to WHAM, interference would be increased, that station maintained. The fight is not over the mere difference of 10 kc.

The Commission, in a tabulated interference schedule recently made public, listed those stations affected by the order, and gave the computed result in interference in respect to each station.

Interference Reduced, Says Board

The case of WHAM was cited as one where interference was greatly reduced, the figure being 203, while only three stations rated increase in interference under the plan, these being WHAS, Louiesville, Ky., 25; WGY, Schenectady, N. Y., 50, and KMOX, St. Louis, 68. Distance and intensity were taken into consideration in obtaining the figures, which denote "interference miles."

WHAS, Louisville, and KYW, Chicago, obtained injunctions several weeks ago.

New Rule for Use of 900-Meter Wave

Washington.

The following order was issued by the Federal Radio Commission respecting use of 333 kc (900 meters):

"The frequency, 333 kilocycles, shall not be assigned for use in any radio station in the United States or on board any aircraft except those flying beyond the limits of the United States, and then, only on such aircraft during the time when they are in communication with foreign nations," the order reads.

"The frequency, 333 kilocycles, now assigned to certain stations within the limits of the United States and to certain aircraft operating within the limits of the United States is hereby changed to 393 kilocycles, and the use of 333 kilocycles is prohibited effective July 1, 1930."

TUBES USED TOO LONG

Persons who use the same tubes continuously for more than a year do not get as good reception as they would by replacement.

New Television Method Claimed

Invention of a method of television transmission and reception that avoids the necessity of strict synchronism and which also permits a sound track without disturbing the picture frequencies in any way, is announced by Lieut. George Wald, of the Quartermasters Corps, U. S. A., Scott Field, Mo.

No motors or scanning discs are used, but a special type of disc inside which are inductors that cause self-distribution of the transmitted frequencies among the inductors corresponding to those frequencies.

At the transmitting end selenium cells are used, and the process is in reverse of what it is at the receiving end.

The luminosity and definition are said to be good.

5.36 TO 11.9 M. O.K.'D FOR USE

Washington.

Establishment of the first commercial radio service using the "ultra-high frequencies," or channels beyond the range recognized as practicable for regular service, was authorized by the Federal Radio Commission, with a grant of 16 channels beyond the 23,000-kilocycle limit to the Mutual Telephone Company of Hawaii.

The company, in application filed recently with the Commission, sought these channels for the maintenance of inter-island telephone communication. Experiments conducted over a six-month period proved the feasibility of these hitherto commercially unused frequencies for the linking of the regular land-line telephone systems on the islands. The service will make possible two-way telephone communication among the islands with both land-line and radio links, and without distortion of the voice, it was claimed.

It was explained orally at the Commission, says "The United States Daily," that the recognized radio "outpost" for commercial work is 23,000 kilocycles, although experiments are authorized beyond this limit. Under international agreement, however, 23,000 kilocycles is designated as the extreme upper end of the radio spectrum.

The channels granted the company are 48,400, 47,000, 38,500, 53,900, 51,700, 56,000, 49,500, 52,800, 47,300, 46,200, 37,400, 36,300, 42,900, 41,800, 35,200 and 39,600 kilocycles.

The highest, 56,000 kc, is 5.36 meters. The lowest, 35,200 kc, is 11.9 meters.

SLICE OF WBT IS PURCHASED BY COLUMBIA

Washington.

Following up its recent acquisition of WPG, Atlantic City, the Columbia Broadcasting System has bought an interest in WBT, Charlotte, S. C., from Station WBT, Inc. The frequency is 1,080 and the power 5,000 watts.

This makes the ninth station to be acquired by Columbia for its chain of "systematic ownership," whereas the chain itself consists principally of stations in which Columbia has no financial interest. The National Broadcasting Company has six "ownership stations."

The purchase of part interest in WBT gives Columbia an opening in the South that it had been looking for, since the National Broadcasting System is represented in this field.

Competitors Frank in Discussion

WBT will be operated as a non-exclusive chain station, at least for the present, as a canvas of listeners proved that interest was high in many of the NBC features broadcast by WBT. The subject was a knotty one, but officials of the two competing chains threshed the matter out frankly.

The NBC appreciated the value of WBT as an outlet, the listeners appreciated the value of favorite NBC features, and Columbia made a smiling compromise, with the best of good nature, according to one present at the conference.

So WBT has been transmitting the choice features of the two big chains and is giving its listeners a type of service that is high indeed even for a 5,000-watt clear-channel station, which it is.

Amos 'n' Andy Retained

Meanwhile other avenues are being sought by Columbia, which has sent out Sam Pickard, formerly a Federal Radio Commissioner but now a Columbia vice-president, as a sort of scout. Mr. Pickard has had several interviews with representative of Southern stations, and it is expected that Columbia's position will be strengthened further in this region.

One of the NBC features retained by WBT under the Columbia regime is Amos 'n' Andy. This feature has been causing Columbia some worry on a national scale, as the tuning-in when these two blackface comedians are on the air is so heavy as to require only a little extra to make it unanimous, so Columbia features on the air at the same time have been wondering as to the magnitude of the audience.

KYW Takes Dig at Commission

Chicago.

KYW, the Chicago "Herald and Examiner" station, operated by Westinghouse, accuses the Federal Radio Commission of being actuated by a whim in authorizing a 50,000-watt installation and refusing to allow the use of more than 10,000 watts. The station issued the following statement:

"The transmitter, first one in the United States to utilize screen grid radio frequency amplifier tubes of high power, is only working at twenty per cent efficiency because of a whim of the Federal Radio Commission.

"Its full power is 50,000 watts, but it has never been operated at this power, for the Radio Commission will not permit the station to use but 10,000 watts power. The Commission granted the construction permit for the station and okayed plans for it to be of 50,000 watts power. Then, after it was built and ready to launch on the air, the members of the Commission refused to allow KYW to employ more than 10,000 watts of the available power."

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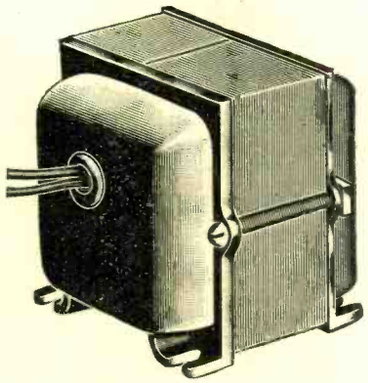
New Polo Power Transformers and Chokes

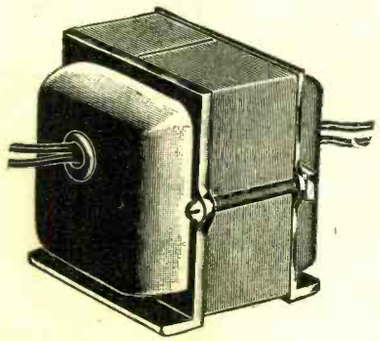


Shielded single choke, 200 ohms D.C. resistance, non-saturable at 100 milliamperes, with two black outleads, each 6 inches long. For filtration of B supplies. Inductance, 30 henrys.
Cat. SH-S-CH, price.....$5.00

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 171, 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

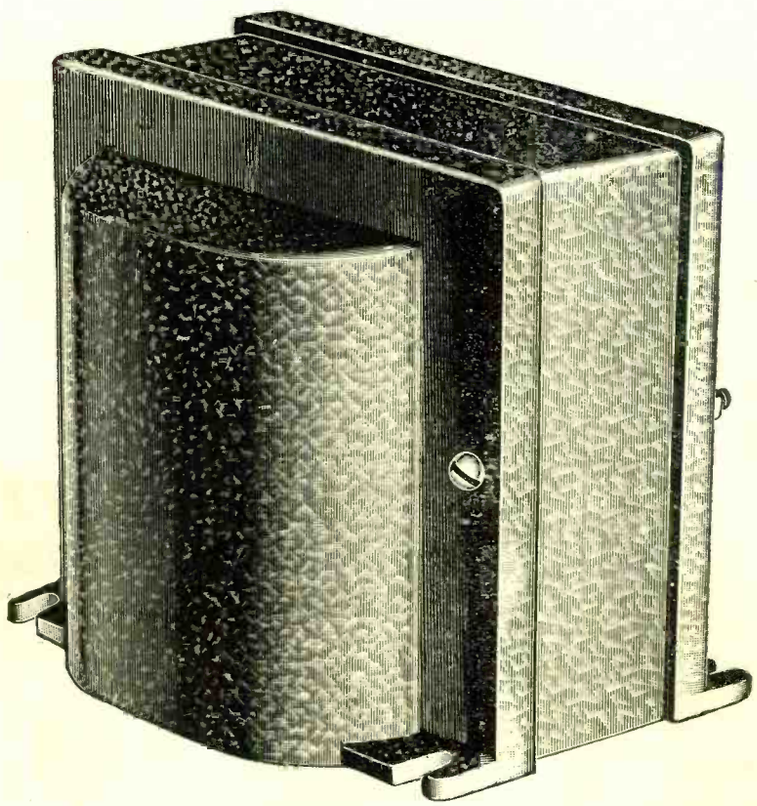
In the same type of case a 20-volt secondary filament transformer, for 110 volts, 50-133 cycle, may be obtained for use in conjunction with dry rectifiers, such as Kuprox, Westinghouse, Benwood-Linze and Elkon, in dynamic speakers or A battery eliminators. Not made for 25 or 40 cycles. Order Cat. SH-F-20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



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

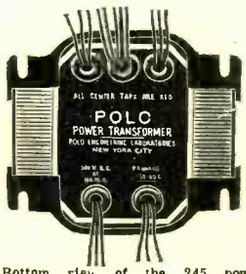
In a different type case, square, of cadmium plated steel with four mounting screws built in, size 4½ inches wide by 3⅝ inches high by 4 inches front to back, a 50-60 cycle filament transformer is obtainable with the same windings as the 245 power transformer, except that the high voltage secondary is 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 @.....6.50
[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 ma rating, 30 henrys inductance, for B filtration or single output filter of speaker, is our Cat. US-S-CH @.....$1.25



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

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 11½ lbs., is 7 inches high, 4⅞ inches wide, and 4¼" 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., 550 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 choker 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:

☐ Cat. 245-PT @...$8.50	☐ Cat. 245-FIL @...$4.50
☐ Cat. 245-PT-40 @ 9.50	☐ Cat. 245-FIL-40 @ 7.00
☐ Cat. 245-PT-25 @ 12.00	☐ Cat. 245-FIL-25 @ 8.50
☐ Cat. SH-S-CH @ 6.00	☐ Cat. SH-F-20 @. 2.50
☐ Cat. SH-D-CH- @ 6.00	☐ Cat. UN-S-CH @. 1.25
☐ 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.

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