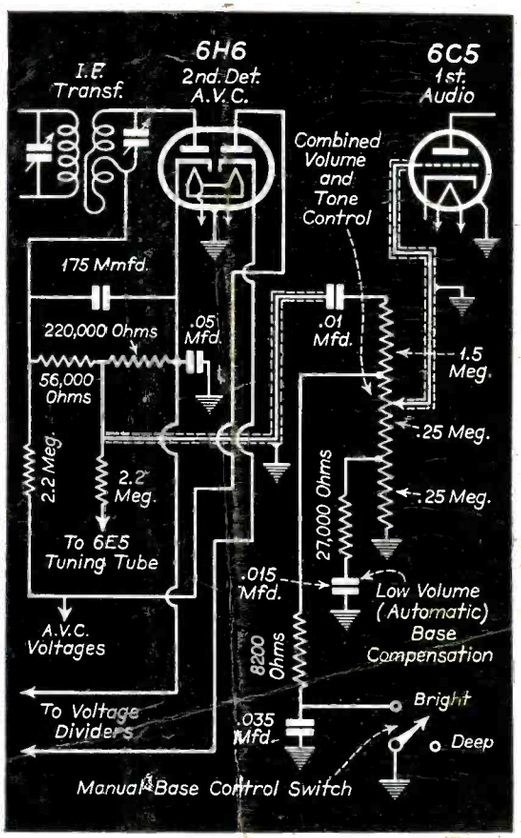
SERVICE

A MONTHLY DIGEST OF

RADIO

AND ALLIED MAINTENANCE



Music-Speech Control Circuit

(See Page 252)

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JUNE
1936

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In pioneering the dry electrolytic condenser, Mallory assumed a definite responsibility in the application and servicing of condensers in radio sets. And Mallory has not stopped with the production of a magnificent replacement condenser line, but has carried the principle of universal application to its logical climax by publishing the Mallory Condenser Service and Replacement Manual.

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YAXLEY

SERVICE

A Monthly Digest of Radio and Allied Maintenance

Reg. U. S. Patent Office. Member, Audit Bureau of Circulations

EDITOR
Robert G. Herzog

JUNE, 1936 VOL. 5, NO. 6

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THE ANTENNA . . .

BATTERY RECEIVERS FOR UNWIRED HOMES

PRACTICALLY ALL THE larger receiver manufacturers, in their 1936 and 1937 lines, feature mantel and console type battery receivers in all price ranges for use wherever electric light lines are not available. Added to this, numerous wind and gasoline driven battery charging devices are being marketed. These items open the vast remote rural radio and service markets for exploitation. Although wind power is probably the oldest type of power harnessed by man, its practical application always has an intriguing and romantic aspect. The idea of "getting power to operate the radio for nothing" is an angle that may help sell both the receiver and the wind driven charger.

• • •

A NEW YEAR IN RADIO

THE RADIO MANUFACTURERS throughout the country have announced or are about to announce their 1937 line of radio receivers. Many features of these sets are worthy of note. The single band receiver is a rarity among the new announcements, and many cover the short-wave bands to as low as five meters. With the inclusion of automatic frequency control (as predicted in a recent issue of SERVICE) in the higher priced receivers, an attempt is made by some of the manufacturers to personalize the receiver by lettering the actual call letters of the stations on the dial. Tuning is remarkably simple in all these models.

Practically all the manufacturers have adopted the octal type tube socket giving the individual the choice between metal and metal-glass tubes.

Cabinets are similar to those presented last year except that the long, low, mantle type is featured to a greater extent. Speakers have also been improved and full high fidelity is available in many models. The famous 6L6 type tube has appeared in several models and over 30 watts of undistorted audio power can be delivered to the output circuits.

• • •

CONVENTIONS AND PUBLIC ADDRESS

THE PUBLIC ADDRESS HORIZON looks bright for the rest of the year what with the many conventions and expositions now in progress or about to begin. At such gatherings in the past public-address equipment played an important role when used for speech amplification, for announcements, for ballyhoo, for sound effects, for entertainment, for intercommunication, for recording of vocal events and numerous other purposes.

This year, decidedly a convention year, people are attending gatherings more than ever before. A much enlarged California-Pacific International Exposition, at San Diego, is running into a very successful second year. Visitors from every state in the Union will attend the Texas Centennial, to be celebrated throughout the state of Texas in cooperation with the main exposition at Dallas. The Great Lakes Exposition at Cleveland, the political conventions at Cleveland and Philadelphia, the nation-wide local political rallies and the countless centennials (such as those held at Bridgeport, Connecticut; Long Island, New York; Newark, New Jersey, and throughout the State of Arkansas); are now in progress or will open soon, many to continue for the rest of the year. In the light of past experience public-address equipment will play an important role, not only as expressed above, but for a host of other purposes still to be conceived.

With the recent improvements in microphones, phonograph pickups, speakers and tubes those prospects that already possess public-address equipment furnish a ready market for these improved accessories or even for rebuilding of their present amplifiers along high-fidelity lines.

• • •

HEARING AIDS

STATISTICS SHOW THAT there are over a million people throughout the United States that experience difficulty in hearing. This definitely shows that the market for hearing aid equipment is not limited.

In all hearing aid advertising it is best to take into consideration the sensitiveness of the deaf to their defect. They usually object to wearing the earpiece because they feel that their deafness becomes conspicuous by so doing. They do not realize that it becomes more conspicuous when they cannot hear.

To aid in making sales it is often advisable to loan an instrument to the prospect for a few days. The ears of the individual that experiences difficulty in hearing are not only deaf but they are also dull. That is to say the ears are unaccustomed to sound and require a little time to adjust themselves to their new found hearing. At first the user of the aid will hear the drone of conversation without being able to understand the individual syllables, unless they are facing the speaker and assisting the amplifier by lip reading. During this ear training period the Service Man can determine which type of earpiece (bone conductor or earphone) is better suited to the individual, and make such minor adjustments in the equipment that might be required. Because of the thrill these individuals experience on regaining their hearing they will carry their enthusiasm to every other deaf person in their acquaintance. Several satisfied customers is all the Service Man needs for a good start in this profitable field.

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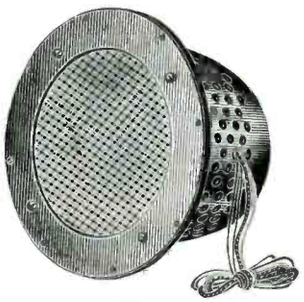

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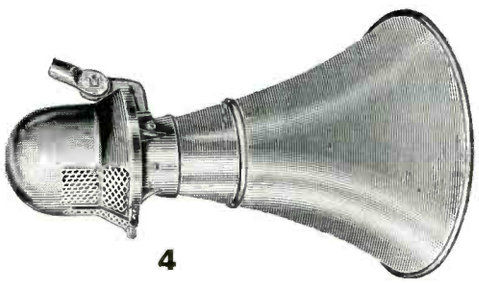

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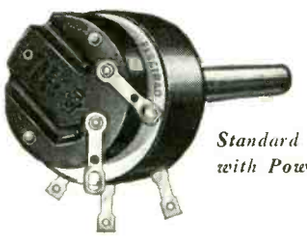

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ELECTRAD, INC.
175 VARICK STREET, NEW YORK

SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR JUNE, 1936

PRACTICAL USES OF THE DECIBEL SYSTEM

By L. T. CHADBOURNE

THE decibel (db) provides a convenient method of measuring and rating amplifiers and other public-address equipment. Simple addition of db ratings indicates whether an amplifier possesses enough gain for a given microphone, or if preamplification is needed, how much gain the preamplifier must have. Or, if the same amplifier is to be used with both microphone and phonograph, for example, it may have enough gain for the first but too much for the second, resulting in overloading. The db ratings again will indicate how much attenuation (loss) must be introduced in the phono circuit. Modern amplifiers are often built with high-gain and low-gain input circuits, and references to db ratings will indicate which type of input device to connect to each.

The db is used in two ways, and these must be carefully distinguished. An amplifier may have, for example, a *gain* of 120 db, but a *power output* of 30 db. There is only one db, but it can be made to express two ideas, both very useful in practical operation provided that the distinction between them is clearly understood.

It will be helpful to consider first the use of the db to express gain, or amplification, and to ignore for the time being its use as a measure of power. In this connection one value lies in the fact that it expresses a large, complicated number by a small, simple number. Modern amplifiers may multiply the sound power applied to their input terminals in the order of a thousand billion times. In the decibel system, such an amplifier is said to have a gain of 120 db. If the amplification is one hundred billion, the gain will be 110 db. If the amplification lies somewhere between the two, the gain may be 115 db, or 118 db, and so on.

To determine the db equivalent of a whole number such as 1,000, simply count the zeros, and multiply by ten. There are 3 zeros in 1,000, and the db equivalent is 3 times 10, or 30. Similarly, in one thousand billion (1,000,000,000,000) there are 12 zeros. Multiply 12 by 10, and the db equivalent of that amplification is 120. In one hundred billion there are only 11 zeros (100,000,000,000) and the db equivalent is 110. Unfortunately in actual practice power ratios do not come out in round numbers such as 10, 1,000, or 100,000 as used here; they are much more likely to be uneven figures like 12 or 976 or 96,354. The advantages of using the db are therefore much greater in simplifying calculations. The db equivalent of 96,354 is 49.8, a number which may not look simple but which is far more convenient to handle than 96,354 and for practical purposes may be considered 50. Simple tables are available for converting any power ratio to db.

A very important advantage of the db in connection with amplification problems is that large and clumsy numbers can always be *multiplied* by *adding* their db equivalents. Thus, a thousand times a thousand is a million. But 1,000 is equivalent to 30 db. Thirty plus thirty is 60. And 60 is the db equivalent of 1,000,000 (6 zeros multiplied by 10).

Suppose the output of a given microphone must be multiplied one thousand billion times before it can be heard by a public-address audience. Suppose the amplifier available is such that it will multiply the input given it by only 100 million. What pre-amplification is needed?

Using ordinary arithmetic, this question becomes: by what number must 100,000,000 be multiplied, to produce 1,000,000,000,000? Dividing the smaller number into the larger one gives 10,000 as the preamplification necessary.

But it is infinitely simpler to use the decibel equivalents of all these numbers, and say: 120 db gain is needed, the amplifier has only 80 db gain; 40 db must be added by the preamplifier.

Two advantages of the decibel system have been outlined thus far: it expresses large, clumsy numbers by small, simple ones and it substitutes addition of small numbers for multiplication of large ones.

However, these advantages are not the chief reason for the existence of the decibel system. So far as arithmetic goes, that system is a convenience but not a necessity. The decibel system is necessary in considering the effect of sound upon the human ear. This will become clear after the second use of the db has been explored.

In addition to expressing amplification, the db is used to rate power level, as a valuable substitute for the watt. Obviously, since the db is capable of comparing the output power delivered by an amplifier with the input power supplied to that amplifier, it can also compare the same output power with any accepted standard, or "reference level." Thus, if the standard were chosen as 1 watt, a power of 100 watts would represent 20 decibels. Actually, 1 watt is not the standard chosen. There are several standards of power level. The most common is 0.006 watts or six milliwatts. Some engineers and manufacturers prefer 0.01 watt, or ten milliwatts. The older standard, however, is still preferred, and is the basis of most db ratings at the present time.

Taking 0.006 watt as the reference standard, assume an amplification of 10. There is 1 zero in ten; multiplying by 10 gives a level of 10 db above zero, or a power of 0.06. An amplification of 100 above zero gives 0.6, and (there are two zeros in 100) a level of 20 decibels. An amplification of 1,000 gives 6 watts, or 30 decibels; of 10,000, 60 watts, or 40 db.

Most microphones and other input sources have power levels far below zero. This is natural, since zero level (0.006 watt) was chosen as representing the minimum power that could be heard when operated through a stand-

ard telephone receiver. A modern microphone may have a level of *minus* seventy db, or lower.

Two practical precautions are necessary in using the db in ordinary work. One is to make sure that all db ratings are based on the same reference level; while the other is to make sure that they are based on actual working conditions, and not on an ideal setup that makes the microphone output or amplifier gain, as the case may be, look larger than they will actually prove in use.

While it is possible to calculate the db gain of an amplifier by consideration of its input and output impedances, the amplification factor of its tubes and the efficiency of the circuits in which they operate, the voltage gain of its transformers, and the losses introduced intentionally or otherwise, in practice it is customary to depend upon the manufacturer's rating. This may be optimistically expressed, and it may be necessary to obtain assurance that the rating given will apply with the input and output impedances actually to be used. Similarly, microphones may be rated under laboratory conditions, and the level that will be delivered to the input impedance of the amplifier used may have to be requested specifically.

Given the correct data, however, it is necessary only to add or subtract db ratings.

Many step-by-step volume controls used in sound work are arranged to change volume in the amount of three db per step. The value three is chosen because of the nature of the action of the human ear.

To understand this point, remember that whenever volume in watts is *multiplied* by ten, the change is expressed in db by *adding* ten. Thus, 6 watts is a level of plus 30 db; 60 watts is a level of plus 40 db, and plus 50 db would be 600 watts.

Now the ear hears only changes in volume that are proportionate to the volume already present. If the sound level is one watt, an increase to 10 watts will decidedly be heard—but a change from 600 to 610 watts cannot be detected by any human being. Heavy traffic, trains or thunder create noise in that order of power, and will mask completely and render inaudible a ten-watt loudspeaker at equal distance from the ear.

The ear will detect an increase in volume only if the volume already existing *is doubled, or more than doubled.* Similarly, a decrease in volume will not be noticed unless the existing volume is reduced to one-half, or less.

If the existing volume is one watt, a change to two watts will be heard; but if the level is 6 watts an increase to less than 12 watts will make little or no impression.

But in the decibel system, it is necessary to multiply volume by ten if 10 db are to be added to the db rating, and merely doubling the volume adds only 3 db.

That being the case, the smallest change in volume that can be heard is one of 3 db, and step-by-step volume controls are built accordingly.

If a loudspeaker system has an output power of plus 30 db, or 6 watts, the level must be increased to 33 db, or 12 watts, for the increase to be noticed. The next change that can be heard is to 24 watts, or 36 db; the next, to 48 watts, or 39 db, and the next (40 db being 60 watts) is to 42 db, or a wattage of 96.

All the figures hitherto used in this article are based upon the decibel system in which 0.006 watt is taken as the standard power level. If 0.01 watt is made the standard the method of calculation remains unchanged, but the resulting figures are altered.

Sound Apparatus	Power in Watts	Level in DB	Amplification	Gain in DB
Velocity Microphone	0.000,000,000,06	—80	10	10
	0.000,000,000,6	—70	100	20
Crystal Microphone	0.000,000,006	—60	1,000	30
	0.000,000,06	—50	10,000	40
Carbon Microphone	0.000,000,6	—40	100,000	50
	0.000,006	—30	1,000,000	60
Phono Pickup	0.000,06	—20	10,000,000	70
	0.000,6	—10	100,000,000	80
Telephone Receiver	**0.006**	**0**	1,000,000,000	90
	0.06	+10	10,000,000,000	100
	0.6	+20	100,000,000,000	110
Small P-A System	6.	+30	1,000,000,000,000	120
Large P-A System	60.	+40	10,000,000,000,000	130

MUSIC-SPEECH CONTROL CIRCUIT

(*See Front Cover*)

THE most common type of tone control, used on amplifiers and receivers, noticeably reduces the volume heard from the loudspeaker when the control is turned to the deep or base position. This makes it necessary for the listener to readjust the manual volume control. Along with the modern trend toward assuring the listener of the maximum in reception and convenience with a minimum of manual control, RCA and other manufacturers have automatically compensated for this reduction in volume. As far as the listener is concerned turning the tone control to the deep position has the effect of *adding* the base response.

The Tone Control Circuit

The circuit which accomplishes this effect is shown on the front cover. The values given are those used in the RCA T10-3 receiver. A 2-megohm manual volume control with taps at 250,000 ohms and 500,000 ohms from the low volume end is used as the grid load for the first audio tube (a type 6C5 in the particular circuit shown). Other values may be used depending upon the type of tube and the amount of compensation required.

Bright Position

If the tone control is left in the normal or bright position the lower quarter of the volume control is shorted by the 8,200-ohm resistor. Characteristic curves for resistance-coupled amplifiers show that the efficiency of an audio stage is lowered (with no material effect on the frequency response) by reducing the resistance in the grid load circuit. The volume heard from the loudspeaker is consequently somewhat less than the receiver would deliver, for that setting of the volume control, if the 8,200-ohm resistor were removed. This loss is suitably compensated in the original circuit design by sufficient increase in the gain obtained from this stage over what normally would be required.

Deep Position

With the tone control in the deep position the 0.035-mfd condenser is connected in series with the 8200-ohm resistor. The higher frequency notes are still effectively shorted, since the resistance of the 0.035-mfd condenser to notes above 3000 cycles is less than 1600 ohms. On the other hand, the resistance of this condenser to the lower frequencies (in the neighborhood of 30 to 50 cycles) is of the order of 100,000 ohms. It is easily apparent that no reduction of volume should result, but

(*Continued on page 266*)

THE PARTS JOBBER

By ADOLPH LANGER*

THE Parts Jobber is called upon to offer every possible assistance to the Service Man in his territory. The successful Parts Jobber must maintain a policy of rendering the most competent service possible at all times. Constant maintenance of a complete, adequate stock of parts and supplies, coupled with an efficient system for rapid delivery, are fundamental factors in rendering proper assistance to the Service Man. But carrying an extensive stock is not the only factor. The Service Man should be assisted to take advantage of the ready source of necessary parts. Providing this advantage is definitely the Parts Jobber's responsibility to his dealers.

The Parts Jobber's Salesman

All salesmen should be thoroughly trained, not only as to the merits and applications of the many diversified items handled by the house, but also in what rightly is their personal obligations to the individual Service Man and dealers upon whom they call. Outstanding above all instructions to salesmen is the one that requires complete dealer satisfaction. Every piece of merchandise sold to a dealer must be exactly what the dealer requires to serve his purpose to the best advantage both as to quality and economy. Strict observance of this house rule by all salesmen will increase good will and avoid misunderstanding.

The Parts Jobber's salesman should also be prepared to help the Service Man build his own business. The salesman should furnish the Service Man with available consumer literature prepared by the various parts manufacturers and help him obtain the greatest advantage therefrom. Posting the Service Man on new saleable products is also part of the salesman's daily work.

Another service the Parts Jobber's salesman can render to his customer is that of advising him as to the variety and quantities of small parts his service department should stock to meet current requirements. The advice given in this respect should be the salesman's honest estimate of his customer's requirements judged from the salesman's experience with similar dealers. Overstocking any customer will hardly add to future goodwill.

The Inside Organization

Naturally a live, successful sales force requires the close cooperation of a trained, competent inside staff. From the moment an order reaches the house until the time it is placed into one of the delivery trucks the order should undergo the strict supervision of highly-trained department heads. Every effort should be made to maintain speedy daily delivery service without sacrificing accuracy and dependability. Capable telephone order clerks especially trained to handle customers' emergency requirements are an integral part of every efficient Parts Jobber organization.

Technical problems, increased tremendously by the many changes and improvements in radio design and construction, make it imperative that the individual Service Man keep himself posted on all the latest service kinks and methods. The Parts Jobber should have a technical staff capable of rendering the Service Man practical assistance on such problems as the tolerance of resistors or condensers, etc. While the Service Man should not expect the Parts Jobber to render assistance in the actual servicing of a particular receiver, the Parts Jobber should cheerfully give aid in answering questions pertaining to manufacturers' ratings and similar problems coming under his proper sphere. To enable the technical staff to handle these inquiries efficiently and thoroughly, all available listings of receiver and accessory manufacturers should be collected and filed for ready reference.

Effective service rendered the dealer by any Parts Jobber, once again, goes beyond merely stocking merchandise and materials to fill the Service Man's requirements. Legitimate Parts Jobbers cooperate with the Service Man and dealer by confining themselves to catering entirely to those customers who maintain actual business establishments. Retail consumers and part-time Service Men should be referred to dealers in their locality.

Handling only dependable quality merchandise and selling at the lowest possible prices consistent with such quality further establishes dealer confidence.

Effective service demands that the Parts Jobber keep in step with modern conditions. Constant adjustment to meet the demands of changing conditions as they arise in the daily course of business is essential. The Parts Jobber should point the way to improvement for his customers.

*H. L. Dalis, Inc.

Mr. Langer at his desk.

General Data . . .

Grunow Chassis 5G

The Grunow 5G chassis is a 5-tube, 3-band receiver with avc, tone control, and a band-spread dial. The tubes used are: 6A7 first detector-oscillator, 6D6 i-f amplifier, 75 second detector-avc-audio amplifier, 42 power-output amplifier and 80 rectifier. The complete circuit diagram is shown in Fig. 1.

The frequency range is divided into three bands or divisions, one covering the band from 550 to 1750 kc (band A), one covering the band from 1700 to 5680 kc (band B) and the third covering the band from 5400 to 18000 kc (band C).

Dial Setting

Turn the knob until the condensers are fully meshed. The dial pointer (hour hand) should be on the horizontal line of the dial, pointing to 9 and 3 o'clock. The minute hand should be at 12 o'clock or in a vertical position.

I-F Alignment

Connect signal lead of test oscillator to grid of 6A7 through .25 mfd condenser. Connect the ground lead to the chassis.

(A) Set dial pointer to 1400 kc and range switch on position A.

(B) Place test oscillator in operation to 490 kc or 465 kc (see note below). Turn receiver volume control and tone control to maximum.

(C) Attenuate test oscillator output to lowest value, consistent with obtaining a readable indication on output meter.

(D) Adjust four i-f trimmers, A1, A2, A3, A4, located on the i-f transformers on top of chassis, see Fig. 2, until maximum output is obtained. During alignment, maintain as low a value of signal as will allow obtaining of accurate adjustment.

Note: Due to interference caused by commercial code stations in some locations, it has been necessary to use two intermediate frequencies on this receiver, one of 490 kc where code interference is in the neighborhood of 455 kc and the other where the interfering stations are operating in the 500 kc band, use an i-f of 465 kc.

The i-f of the receiver is stamped on the rear of the chassis, and if there is any doubt as to i-f peaking, it is only necessary to apply a variable i-f signal to the i-f amplifier and maximum output will indicate resonance or frequency at which the i-f's were peaked.

To further overcome this form of interference, sets peaked at 465 also incorporate a wave filter in the antenna circuit. This filter should be tuned to the same frequency as the i-f transformers. Tuning is accomplished after the set has been completely aligned by applying the i-f signal through to a .0002-mfd condenser to the antenna binding post of the receiver, and tuning the wave filter condenser (A12) (located on the right-hand side of the chassis)

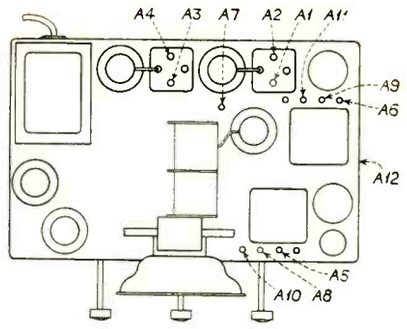

Fig. 2. Chassis view showing trimmer locations

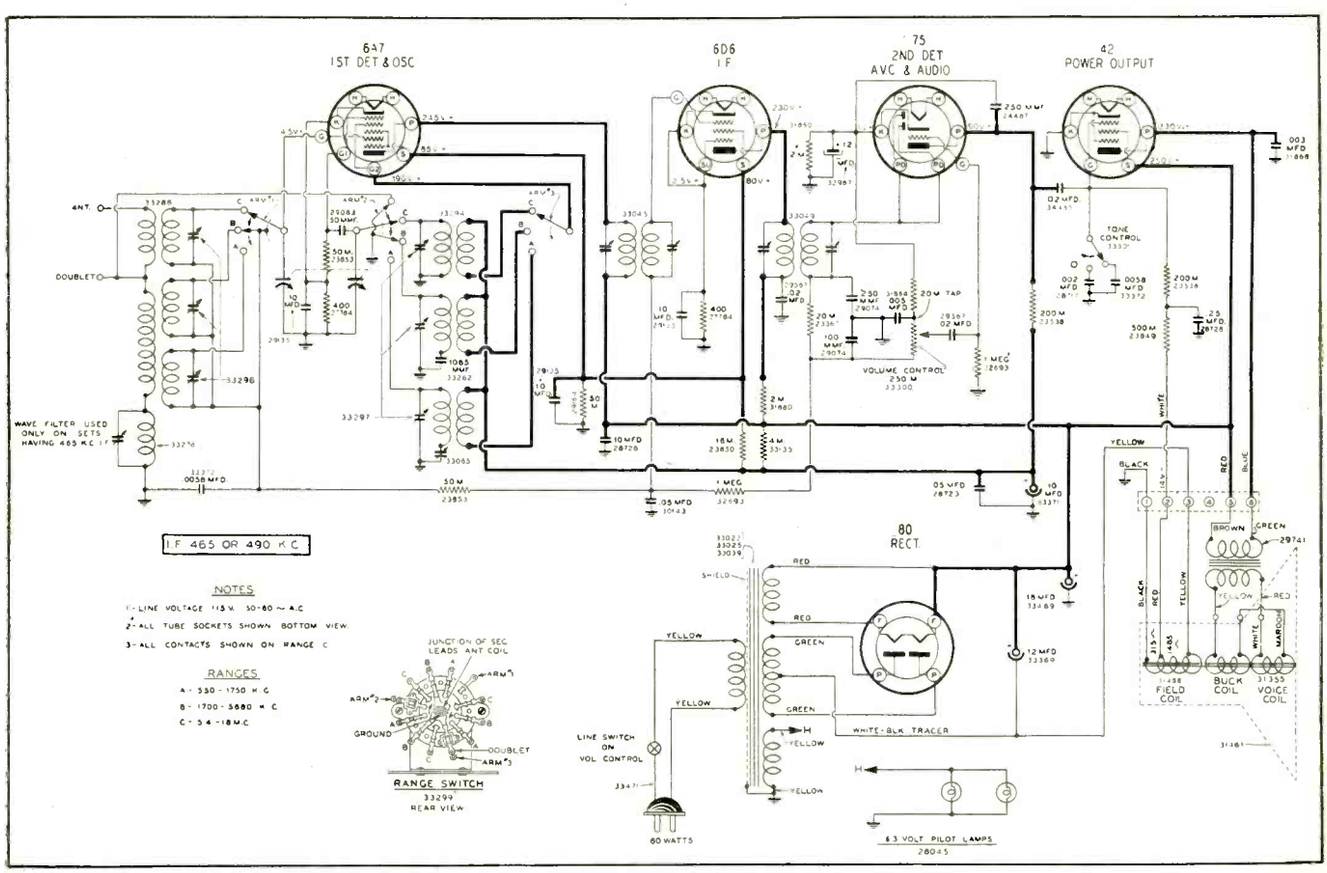

Fig. 1. Complete circuit diagram Grunow 5G.

Technical Features of 1936 General Electric Radio Receivers

Model No.	A51	A56	A52	A55	A53	A54	A63	A65	A64	A66	A67	A70	A75	A83†	A85†	A82	A86	A87	A88‡	A125	A205‡	A208‡	N60
Cabinet	Compact	Console	Table	Console	Table	Compact	Table	Console	Table	Console	Console	Table	Console	Table	Console	Table	Console	Console	Console	Console	Console	Console	Auto.
Line * supply	105-130V. 25-133~ A.C.-D.C.		A-C-V		A-C-V	105-130V. 25-133~ A.C.-D.C.	A-C-V		A-C-V			A-C-V		A-C-V		A-C-V				A-C-V	A-C-V		6V. D.C.
Range	540-1720 Kc. 2.2-7.0 Mc.		540-1720 Kc. 2.3-7.0 Mc.		540-1600 Kc. 2.4-6.8 Mc.	540-1720 Kc. 2.3-7.0 Mc.	540-1600 Kc. 5.4-16.0 Mc		540-1800 Kc. 5.4-18.0 Mc			540-1750 Kc. 1.75-6.0 Mc. 6.0-19.5 Mc.		540-1740 Kc. 1.72-5.8 Mc. 5.8-18.0 Mc.		140-410 Kc. 540-1750 Kc. 1.75-6.0 Mc. 6.0-19.5 Mc.				140-410 Kc. 540-1740* 1.74-5.6 Mc. 5.6-18 Mc. 18-41 Mc.	140-410 Kc. 540-1650 Kc. 1.65-5.45 Mc 5.45-18 Mc. 18-41 Mc.		530-1650 Kc.
Line watts **	52		70		65	60	75		85			100		100		105			150	125	325		7 Amp.
Audio power	1.4		5.0		3.0	1.1	3.5		3.0			3.7		11		7.0			8.1	15	40		4
I.F. Peak	465 Kc.		465 Kc.		465 Kc.	465 Kc.	465 Kc.		465 Kc.			465 Kc.		465 Kc.		465 Kc.				465 Kc.	465 Kc.		175 Kc.
Dynamic sp'kr	6½"		8"	9"	7"	6½"	7"	8"	8"	10¼"		8"	10¼"	9"	11"	10¼"				10¼"	(2) 10¼"	(2) 10¼"	6"
Tone control	2 Point		2 Point		2 Point	2 Point	2 Point		Continuously variable			Continuously variable		Continuously variable		Continuously variable				(2) Treble-bass Continuously variable			Continuously variable
Sensitivity control																Continuously variable				Contin. variable	Continuously variable		
Tuning meter																				Yes	Yes		
Dual speed tuning drive									5½ to 1 55 to 1			5½ to 1 55 to 1		5½ to 1 55 to 1		5½ to 1 55 to 1				5½ to 1 55 to 1	5½ to 1 55 to 1		
"V"-Doublet terminal board							Yes		Yes			Yes		Yes		Yes				Yes	Yes		
Variable condensers	2		2		2	2	2		2			3		3		3				3	3		3
Number of tuned circuits	7		5		5	6	6		6			7		7		7				9	11		6
Dial	Enlarged window		Enlarged window		Window	Enlarged window	Window		Slide rule			Slide rule		Slide rule		Slide rule				Slide rule	Slide rule		Airplane
R.F.												6K7		6K7		6K7				6K7	6K7		6K7
1st. Det. Oscillator	6A8		6A8		6A8	6A8	6A8		6A8			6A8		6A8		6A8				6L7	6L7		6J7
																				6C5	6C5		
Intermediate frequency	6K7		6K7		6K7	6K7	6K7		6K7			6K7		6K7		6K7				Sig. 6K7 A.V.C. 6K7	Sig. (2) 6K7 A.V.C. 6K7		6K7
2nd. Det.	6Q7		6Q7		6J7	6Q7	6H6		6H6			6H6		6H6		6H6				6H6	6H6		
A.V.C.																				6H6	6H6		6Q7
1st. Audio					6F6		6F5		6J7			6C5		6F5		6C5				6F5	6C5		6F6
2nd. Audio	25A6		6F6			25A6	6F6		6F6			6F6		(2) 6F6		(2) 6F6				6F6	6F6		
3rd. Audio																				(2) 6F6	(6) 6F6		
Rectifier	25Z6		5Z4		5Z4	25Z6	5Z4		5Z4			5Z4		5Z4		5Z4				5Z4	(3) 5Z4		6X5
Chassis No.	RB15		RB16		RB10	RB14	RB9		RB8			RB7		RB18		RB6				RB5	RB2	RB1	N60

* A 105-125 V. 50-60~. C 105-125 V. 25-60~. V 105-120 V., 200-230 V. / 115-130 V., 220-250 V. } 40-60~

** 105-125 V. 50-60~

† Speech clarifier

‡ Automatic phono. combination

‡ Fidelity control

so that the incoming signal is at minimum output.

R-F Alignment

1400-*kc alignment*

(A) Connect signal lead of test oscillator through 200-mmfd condenser to antenna binding post.

(B) Connect the test oscillator ground lead to the ground post of chassis.

(C) Place test oscillator in operation at 1400 kc.

(D) Turn dial pointer to 1400 kc.

(E) Turn range switch to range A.

(F) Adjust broadcast oscillator trimmer A5, Fig. 2, to maximum output.

(G) Adjust first detector trimmer (A6), Fig. 2, to maximum output.

600-*kc alignment*

(A) Place test oscillator in operation at 600 kc.

(B) Tune in signal to maximum (this point does not have to be exactly at 600 kc dial setting).

(C) Adjust the 600 kc padding condenser (A7), Fig. 2 (which is on top of chassis to the rear of variable condenser) in direction of signal increase. At same time rock the tuning condenser back and forth through resonance while adjusting padding condenser until maximum output is obtained.

Recheck the 1400 kc alignment.

5-*mc alignment*

(A) Set the range switch at B.

(B) Place test oscillator in operation at 5 mc.

(C) Turn the dial pointer to 5 mc.

(D) Adjust set oscillator trimmer (A8), Fig. 2, to maximum output.

(E) Adjust detector trimmer (A9), Fig 2. to maximum output.

(F) Check dial setting at 1800 kc.

18-*mc alignment*

(A) Connect signal lead of test oscillator through 400-ohm resistor to antenna binding post of chassis.

(B) Connect the ground lead to ground terminal of chassis.

(C) Set range switch to range C and turn dial pointer to 18 mc.

(D) Place test oscillator in operation at 18 mc.

(E) Adjust set oscillator trimmers (A10), Fig. 2, to maximum output.

(F) Adjust detector trimmers (A11), Fig. 2, to maximum output.

(G) On the 18-mc alignment it will be noted that there are two settings at which the signal will be received. Use the lower of the images for alignment point, that is, the setting giving the most capacity or the point at which the trimmer screw is farthest in. Check dial setting at 6 mc.

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Atwater Kent 485Q and 515Q

These are five-tube, two-band, superheterodyne receivers. The 515Q is a midget compact, and the 485Q is a console. The broadcast band frequency range is from 540 to 1712 kc, and the range of the short-wave band is from 5400 to 18,000 kc. The complete circuit diagram with the tubes used and their functions is given in Fig. 1. The various voltages encountered throughout the receiver are also lettered on the diagram. The B battery voltage was 135 volts at the time of making these measurements. The pilot lamp indicated is of the special low drain 2-volt type. The total current drain from the A battery is 0.62 amp. The total B current drain is 25 ma.

When adjusting trimmers, keep the radio volume control turned full clockwise, and turn the tone control to "high." In order to keep below the avc level and secure definite output peaks, it is necessary to use the weakest possible output from signal generator that will give a reading on a sensitive output meter.

Use an Atwater Kent No. 42590 coupling unit to couple the signal generator while aligning the i-f trimmers. The coupling unit may be purchased through any Atwater Kent distributor.

When adjusting i-f trimmers, turn the range switch to broadcast position, and turn variable condenser fully out of mesh.

I-F Alignment

Connect signal generator (450 kc) to second i-f grid cap by means of coupling unit. Peak two trimmers on top of T5 (third i-f transformer).

Connect signal generator to cap of first i-f tube and peak two trimmers on top of T4 (second i-f transformer).

Connect signal generator to cap of first-detector tube and peak two trimmers on top of T3 (first i-f transformer).

I-F Trap

Feed 450-kc signal into antenna and ground of set, using a .00025 mfd condenser in series with the antenna lead. Adjust A1 trap trimmer for minimum response.

I-F Is 472½ kc in Some of These Models

In some Models 485Q and 515Q sets, the i-f is 472½ kc as indicated by label on rear of chassis. With these models, all adjustments mentioned above for 450 kc should be made at 472½ kc.

Dial Pointer Adjustment

With the variable condenser fully meshed, the arrow-indicator disc should be set at 540 kc.

R-F Alignment

In location where severe electrical interference is present, it is necessary, when aligning r-f trimmers, to connect a 40,000-ohm resistor in series with a .02-mfd condenser from the grid cap of the first i-f tube to chassis. This reduces the i-f sensitivity and permits use of a stronger output from the signal generator to override the local noise

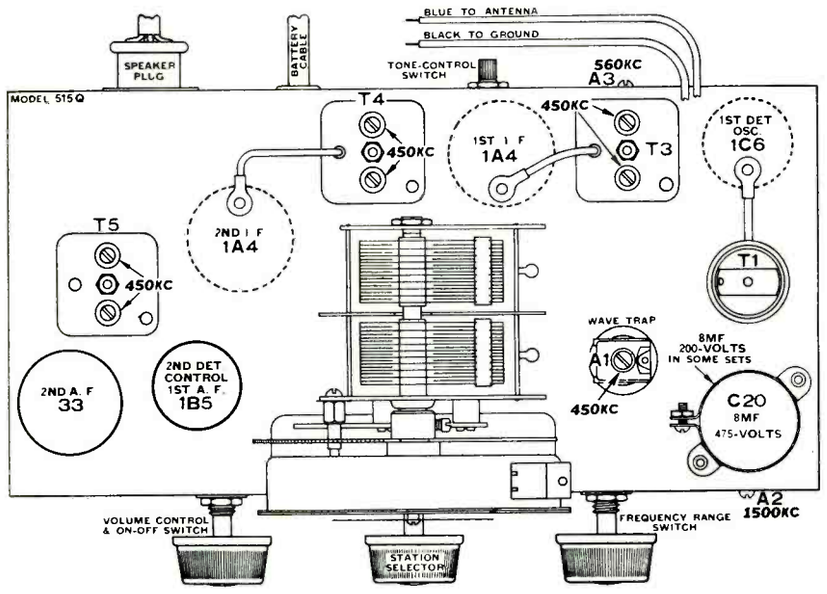

Fig. 2. Chassis view showing trimmer locations.

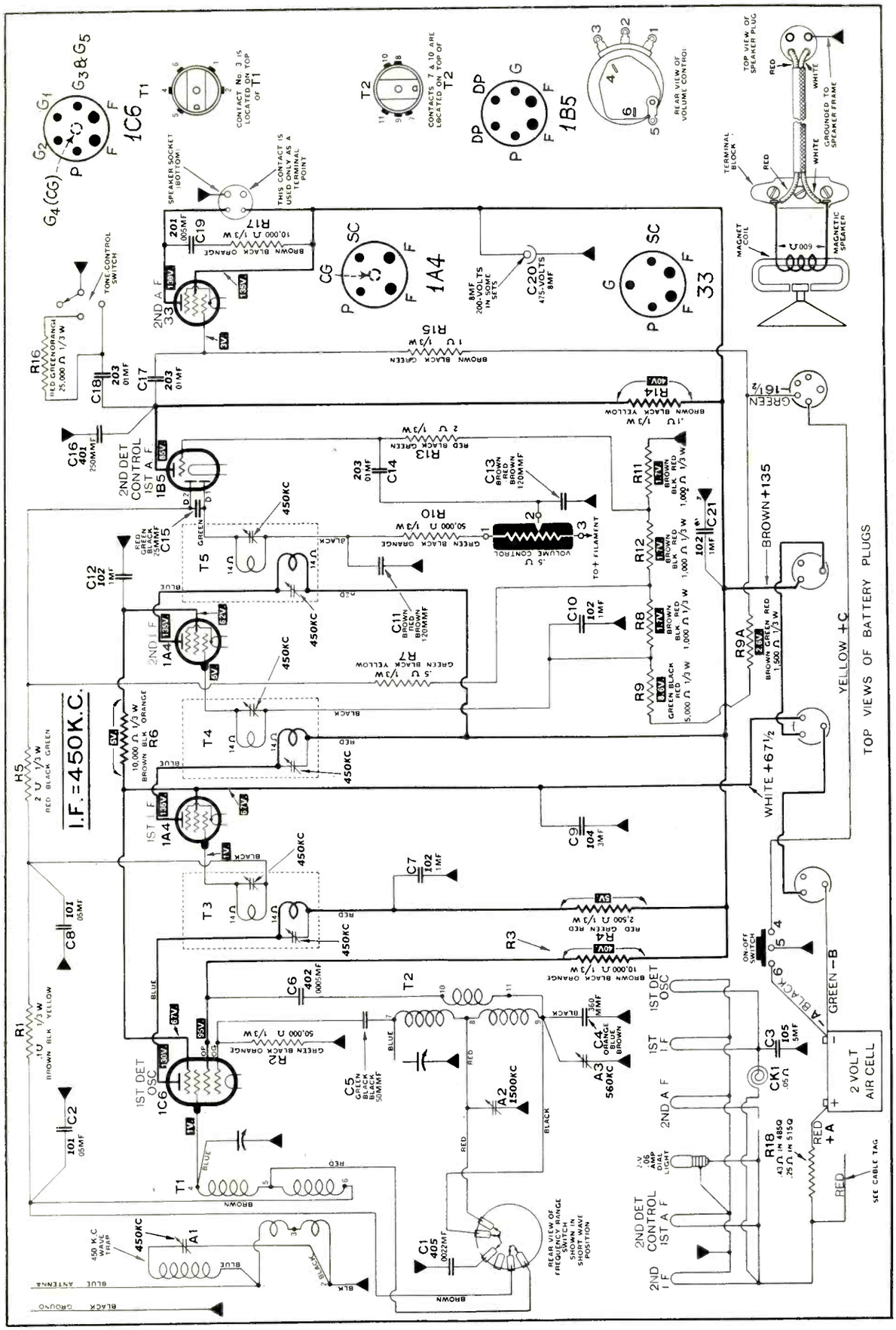

Fig. 1. Complete circuit diagram Atwater Kent 485Q, 515Q.

level without bringing the avc into action.

Short-wave Range

No trimmers on this range.

Broadcast Range

Connect signal generator to antenna and ground of set, using a 250-mmfd condenser in series with the antenna lead. With signal generator and dial at 1500 kc, peak the broadcast oscillator trimmer A2. Use the first peak as A2 is screwed in from a loose position. Tune generator to 560 kc and peak broadcast tracking trimmer A3 while rocking variable condenser one division around the 560 kc mark. Repeat adjustments at 1500 and at 560 kc if necessary.

•

Wells Gardner 7K

This model is a three-band receiver with the following tuning ranges: 148 to 380 kc, 535 to 1,730 kc and 5,750 to 18,300 kc. The maximum power output is 3½ watts. A complete circuit diagram is shown in Fig. 1 with the tubes used, their functions and the voltages encountered throughout lettered on the diagram. The trimmer locations are given in Fig. 2. The voltages were measured with a 1,000-ohm-per-volt voltmeter with the antenna shorted to the chassis and the volume control on full.

Dual Volume Control

A dual manual volume control is employed. In one section the audio voltage applied to the first audio section of the 6B7 tube is varied (R10). In the other section, the r-f and i-f bias is varied (R2). The purpose of the latter section is to reduce the sensitivity of the receiver at the low volume settings in order to cut down noise pickup between stations. The variable section R2 is shorted out through contact No. 4 of the interstage section of the band selector switch when in the short-wave position.

Alignment Procedure

Correct alignment is extremely important in connection with all-wave high-fidelity receivers.

If a station is tuned in with the selectivity control in the broad position and this control is then turned to the sharp position, the station may disappear. This is not an indication that the receiver is out of alignment.

Use a non-metallic screwdriver for the adjustments. The complete procedure is as follows:

I-F Adjustment

Set the signal generator for a signal of 456 kc.

Connect the output of the signal generator through a 0.1-mfd condenser to the grid of the first detector.

Connect the ground lead of the receiver to the ground post of the signal generator.

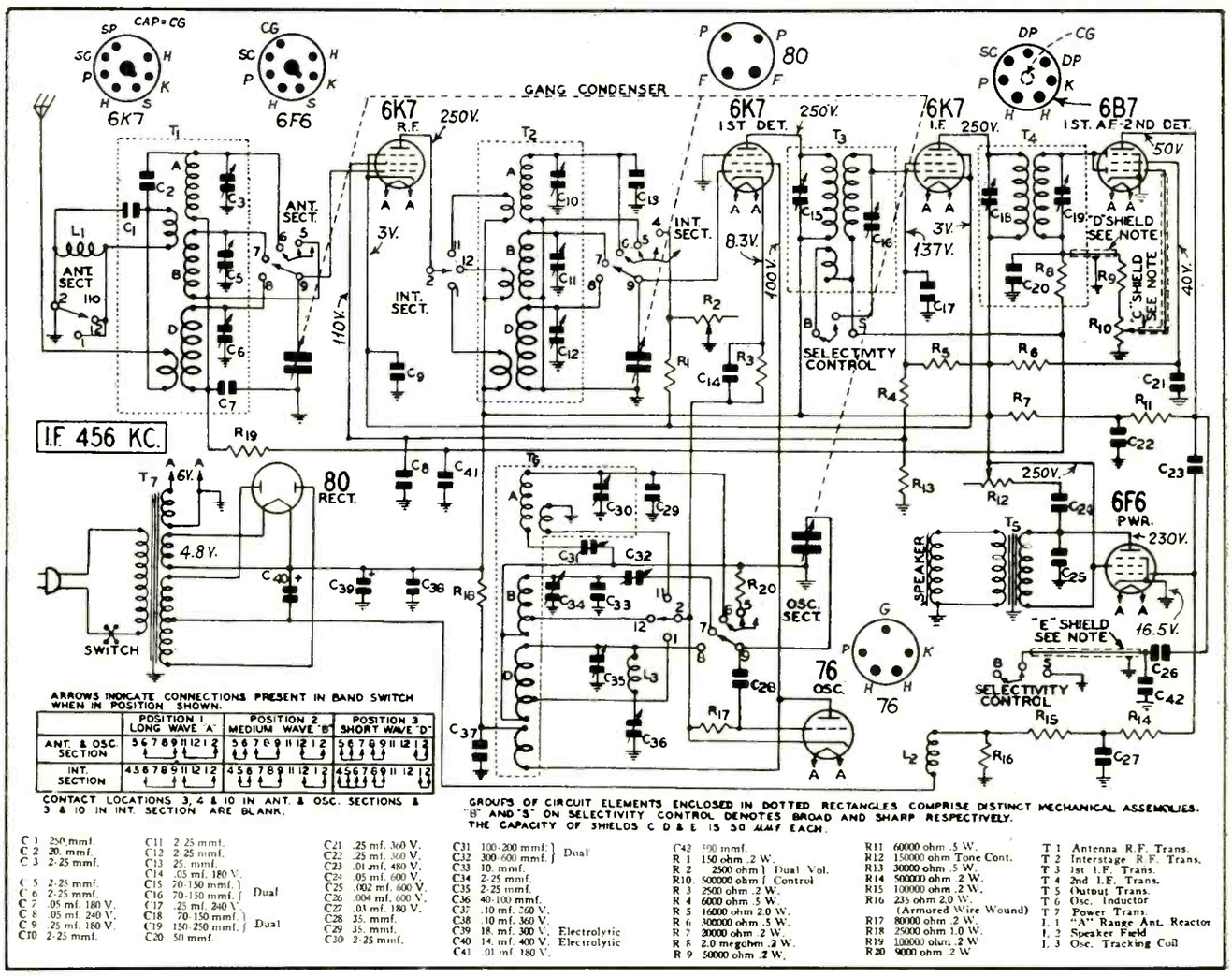

Fig. 1. Circuit diagram Wells Gardner 7K.

Turn the band selector to the range B position (medium-waveband—green dial color).

Turn the selectivity control to the sharp position and keep it in this position for all adjustments.

Turn the volume control to the maximum position.

Attenuate the signal from the signal generator to prevent the levelling-off action of the avc.

Then adjust the four i-f trimmers until maximum output is obtained. The adjusting screws for these condensers are reached from the top of the chassis.

Range A Alignment

380-kc Adjustment

Set the signal generator for 380-kc.

Turn the rotor of the tuning condenser to the full open position.

Turn the band selector to the range A position (long-waveband—purple dial color).

Connect the antenna lead of the receiver through a 200-mmfd condenser to the output of the signal generator.

For this and all subsequent adjustments keep the volume control at the maximum position and attenuate the signal from the signal generator to prevent avc action.

Adjust the oscillator range A trimmer (C30) until maximum output is obtained. The location of this trimmer is shown in Fig. 2.

350-kc Adjustment

Set the signal generator for 350-kc.

Turn the rotor of the tuning condenser carefully until maximum output is obtained.

Adjust the interstage range A trimmer (C10) and antenna range A trimmer (C3) to maximum.

Do not change the setting of the oscillator range A trimmer.

165-kc Adjustment

Set the signal generator for 165-kc.

Turn the tuning condenser rotor until maximum output is obtained.

Turn the rotor slowly back and forth at the same time adjusting the 165-kc trimmer until the peak of greatest intensity is obtained. See Fig. 2 for location of this trimmer.

Range B Alignment

1,730-kc Adjustment

Set the signal generator for 1,730-kc.

Turn the rotor of the tuning condenser to the full open position.

Turn the band selector to the range B position (medium-waveband—green dial color).

Keep the antenna lead of the receiver

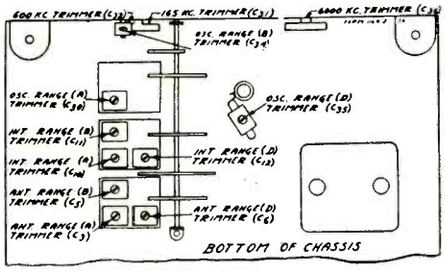

Fig. 2. Trimmer locations, W. G. 7K.

connected through the 200-mmfd condenser to the output of the signal generator.

Adjust the oscillator range B trimmer (C34) until maximum output is obtained. The location of this trimmer is shown in Fig. 2.

1,500-kc Adjustment

Set the signal generator for 1,500-kc.

Turn the rotor of the tuning condenser carefully until maximum output is obtained.

Loosen the pointer set screw and set the large pointer at the 1,500-kc mark on the medium-waveband scale. Retighten the set screw.

Adjust the interstage range B trimmer (C11) and antenna range B trimmer (C5) to maximum.

Do not change the setting of the oscillator range B trimmer.

600-kc Adjustment

Set the signal generator for 600-kc.

Turn the tuning condenser rotor until maximum output is obtained.

Turn the rotor slowly back and forth at the same time adjusting the 600-kc trimmer until the peak of greatest intensity is obtained. See Fig. 2 for location of this trimmer.

Range D Alignment

18,300-kc Adjustment

Set the signal generator for 18,300-kc.

Connect the antenna lead of the receiver through a 400-ohm resistor to the output of the signal generator.

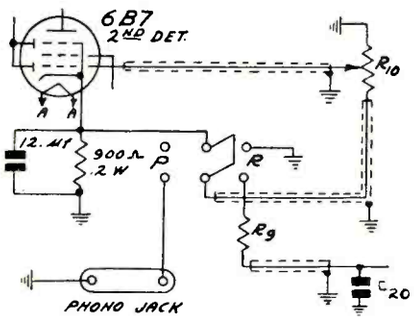

Fig. 3. Phono connections, W. G. 7K.

Turn the rotor of the tuning condenser to the full open position.

Turn the band selector to the range D position (short-wave band—red dial color).

Adjust the oscillator range D trimmer (C35) until maximum output is obtained. See Fig. 2 for location of this trimmer.

15,000-kc Adjustment

Set the signal generator for 15,000-kc.

Turn the rotor of the tuning condenser carefully until maximum output is obtained.

Adjust the interstage range D trimmer (C12) and antenna range D trimmer (C6) to maximum.

When adjusting the interstage range D trimmer, it will be necessary at the same time to turn the tuning condenser rotor slowly back and forth until the peak of greatest intensity is obtained.

Then go back and repeat the procedure as given for the 18,300-kc adjustment. If it is found necessary to make any appreciable change in the setting of the oscillator range D trimmer, the 15,000-kc adjustment must be repeated.

Do not make any further change in the setting of the oscillator range D trimmer.

6,000-kc adjustment

Set the signal generator for 6,000-kc.

Turn the tuning condenser rotor until maximum output is obtained.

Turn the rotor slowly back and forth at the same time adjusting the 6,000-kc trimmer until the peak of greatest intensity is obtained. See Fig. 2 for location of this trimmer.

Phonograph Connections

Phonograph connections can be made as shown in Fig. 3. Knockouts are provided in the back panel of the chassis for mounting the phono jack and phono switch.

•

Philco 70

Intermittent noise: Plate and screen voltages on 47 varies from 38 to 220 v. Check 47 bias section on voltage divider, if defective replace; value 180-ohms.

Al. Beers

•

Philco 87

Hum: If the hum is not due to the filter condenser it may be caused by the two 0.5-mfd condensers (C19, C20) which by-pass the 26 filaments. If their d-c resistance is less than 25-megohms, noticeable hum will result.

Al. Beers

Public Address . . .

THE SIGNAL DIVIDER

By NATHAN I. DANIEL

THE advantages of push-pull operation of power tubes are well known. The greater power output and the decreased distortion, due to cancellation of even order harmonics, are highly desirable features of a push-pull circuit.

But in order to obtain push-pull action certain requirements must be met. The signal to be amplified must be supplied to both branches of the push-pull circuit with the same amplitude and in opposite phase. It has been general practice to resort to one of two methods or modifications of them, to satisfy the required conditions. Both, however, suffer drawbacks.

The Common Method

The most common method of obtaining push-pull operation is to make use of an input transformer with a center-tapped secondary, which supplies each grid with a signal of equal magnitude and opposite phase. This would be ideal were it not for the fact that a really good transformer is rather expensive.

Phase Inversion

The other method of obtaining push-pull is phase inversion. This makes use of the fact that the signal at the plate of an amplifier tube is exactly out of phase with the signal at its grid. In operation one grid of the push-pull stage is fed directly from the preceding tube which also feeds an extra amplifier tube, which in turn feeds the other grid of the push-pull stage. The signal as applied to one grid of the output stage has passed through one more tube than the signal at the other grid and is consequently out of phase with it. In order to keep the signal voltages equal at both grids the extra or phase inverter tube receives only the correct fraction of the full output of the preceding tube. This is done as a rule by tapping the load resistance at the proper point.

Since one branch has one more tube than the other it is difficult to keep the overall amplification of both branches the same at all frequencies. Furthermore, the balance tends to be upset by changing the tubes or even by natural aging when they are not changed.

Another type of push-pull amplifier has appeared which at first glance seems to use neither a transformer nor a phase

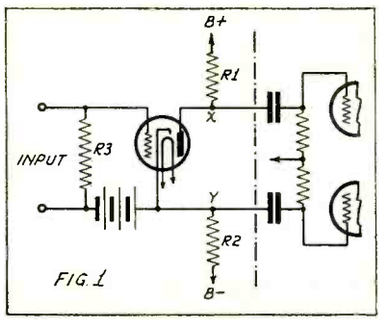

FIG. 1

inverter. In this type, the grid of one of the output tubes is connected in the usual manner (resistance coupling gen-) erally) to the preceding amplifier tube. The other output tube obtains its signal from the plate circuit of the first output tube. Upon analysis it becomes apparent that this is also a phase inversion circuit, one tube performing the dual role of output tube and phase inverter.

In spite of its limitations, the phase inverter had enjoyed considerable success. This is due, of course, to the ease with which it lends itself to resistance coupling with the accompanying low cost and high-fidelity possibilities.

The preceding discussion has made it evident that it would be highly desirable if a push-pull circuit could be found that would permit of the use of resistance coupling, and also avoid the instability of the phase inverter.

Just such a circuit is presented in the following:

The Signal Divider

Fig. 1 represents an ordinary triode with resistor R1 connected between plate and B plus, resistor R2 between cathode and B minus. Each resistor is approximately half the value of the plate resistor that would ordinarily be used with this tube in straight resistance coupling. R3 is the grid return resistor and is connected from grid to cathode through a grid biasing battery of the proper size. If a signal is now applied between grid and cathode, it will be amplified and appear across each of the load resistors R1 and R2 with equal amplitude but in exactly opposite phase. That this is so is evident from the following considerations. Since the current flowing through R1 and R2 is identical, and both resistances are equal in value, whatever voltages are developed across them must also be equal (providing of course that incidental capacities due to tube structure or wiring are kept to a negligible value, or are equalized). Also note that as the plate current decreases the voltage drop across both load resistors decreases. Accordingly the potential at point X becomes more positive approaching B plus potential as a limit, while the potential at point Y becomes less positive and approaches B minus potential as a limit. When the plate current increases, the opposite relations hold true, points X and Y approaching each other in potential, with the theoretical limit that both can reach the voltage half way between B plus and B minus, or half the B supply voltage.

Perhaps a simpler way to look at the circuit is to regard the cathode-to-plate space as a variable resistance, Z, in series with R1 on one side and R2 on the other. As Z becomes large (due to the signal on the grid going further negative than the normal biasing voltage) point X is crowded toward B plus potential, while point Y is crowded toward B minus. As Z becomes smaller (as is the case when the grid goes less negative) points X and Y approach each other in potential. Evidently the potentials on points X and Y are always varying in the opposite directions and with equal magnitudes.

All that needs to be done now to obtain perfect push-pull operation is to connect points X and Y to the respective grids of the next stage through coupling condensers, as indicated to the right of the dotted line in Fig. 1.

For the sake of brevity and in order to avoid confusion, we shall hereafter refer to the above described circuit as a signal divider stage.

Without Bias Battery

In Fig. 2 is shown a method of dispensing with the biasing battery. R4 is the self-biasing resistor of the usual value for the type of tube being used and C1 is a high capacity by-pass condenser of the low voltage electrolytic type.

Care must be taken that the tube chosen for the "signal divider" stage be capable of supplying an output volt-

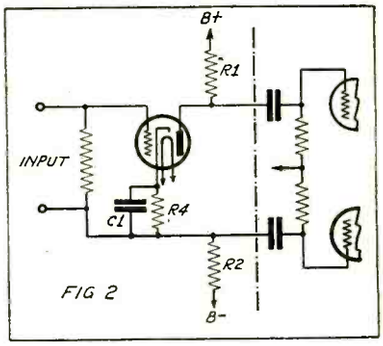

FIG 2

2 out of 3
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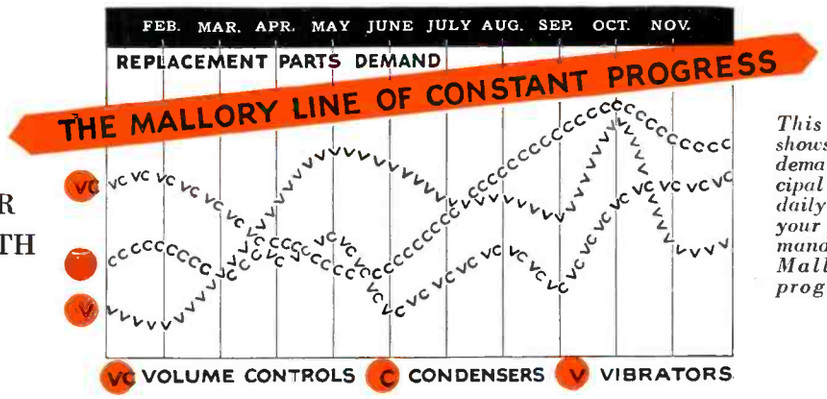

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MORLEN BEAM TUBE AMPLIFIERS

A SUPERB ACHIEVEMENT IN PUBLIC ADDRESS AMPLIFIERS

THE new MORLEN MC60 and MC120 amplifiers, using the 6L6 Beam-Power Tubes in the output stages, make available to the rental operator and p.a. installer, two amplifiers, unexcelled in operating features and performance. The 6L6 beam-tube is a tetrode of high-power input sensitivity—the *utmost* in performance is obtained from tubes of this type by their use in the recently announced MORLEN "Power-Driver" circuit, as used in the latest MC models.

THE MC60 and MC120 amplifiers incorporate universal, dual channel input, with full mixer control, a main gain control, and tone control. The output is a dual winding transformer having 500 ohms impedance across one winding and 15 ohms tapped at 8 and 4 ohms across the second winding. Practically any combination of speakers or other load devices can be operated from the MC output. Also included is a dual AC receptacle, a fuse under protective cover and a main AC ON and OFF switch. All MC amplifiers are complete on one chassis, from input to output and in power ranges from 19 to 120 watts.

Due to the elimination of interstage transformers (a feature of the "Power-Driver" circuit), the frequency response of the MC 6L6 amplifiers is essentially flat from 40 to 14,000 cycles, thruout a wider power range than with any other system.

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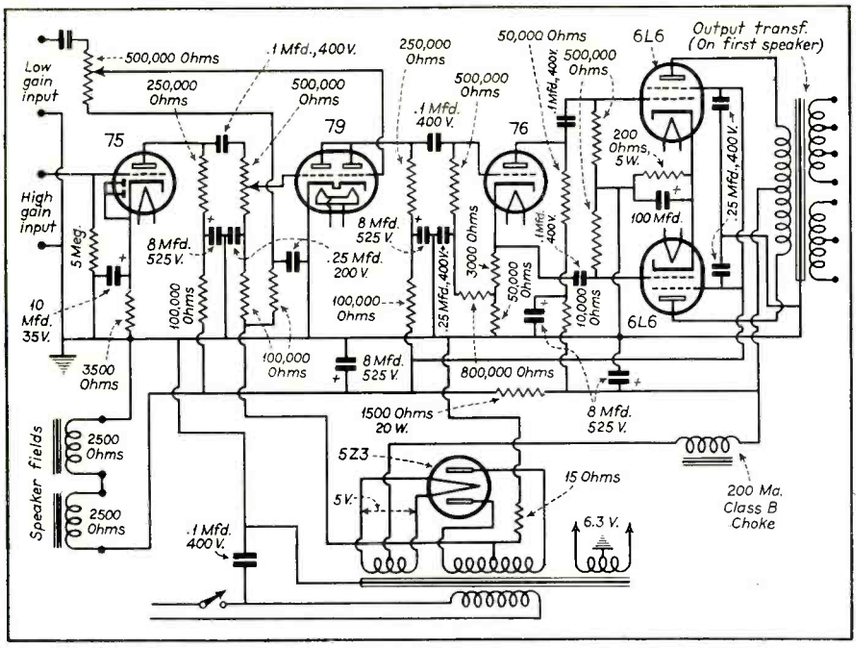


Fig. 3. High-gain amplifier using signal divider.

age sufficient to drive the power stage to full output. If the power tubes require an unusually high driving voltage (e. g. the 2A3 which requires 124 peak volts grid to grid) it becomes necessary to use a resistance coupled push-pull voltage amplifier stage ahead of the output stage. It is possible but not desirable, to boost the output voltage by using inductance instead of resistance in the "signal divider" load.

The Complete Amplifier

The schematic of a complete amplifier is shown in Fig. 3. The problem of including amplification ahead of the signal divider was solved, and the results were well worth the effort.

The layout of parts aside from following general practice is not critical. The absence of transformers which might cause inductive hum pickup contributes to this flexibility.

Bias is provided for the 76 signal divider stage by the 3,000-ohm resistor in series with the 50,000-ohm cathode load resistor. The grid return is led to the proper potential by means of the 800,000-ohm resistor which also serves to isolate the grid circuit from the cathode circuit. This resistor, which is in parallel with the 50,000-ohm cathode load resistor as far as the signal currents are concerned, is of such value that the shunting effect offsets the series effect of the 3,000-ohm bias resistor. Thus the cathode load is kept at the same value as the plate load.

The 15-ohm resistor in the transformer high-voltage return circuit need not be by-passed because of its low value. The 79 grid return network may be simplified by using a grid bias cell from each return to the ground. This not only eliminates the 15-ohm resistor but also eliminates both 100,000-ohm resistors and their 0.25-mfd condensers.

The signal delivered by the 79 appears across its load resistor, the B plus side of which is necessarily by-passed to ground. Therefore the signal when applied to the 76 appears between grid and ground instead of between grid and cathode. As a result the signal divider stage loses most of its amplification properties, due to degeneration caused by the unby-passed load in the cathode circuit. The ratio of input signal to output signal appearing across cathode load is approximately one-to-one but as the signal across the plate load equals the signal across the cathode load, the total amplification of the signal divider is approximately 2. This holds true regardless of what type tube is used as signal divider as long as the signal is impressed between grid and ground instead of grid and cathode.

This partial loss of amplification is unimportant as it is easily made up for by the high gain of the 79. The important thing is that perfect push pull action with excellent fidelity is obtained at low cost.

Hearing Aid Devices

The following paragraphs taken from "The Volta Review," a monthly magazine for the hard-of-hearing, written by Florence Woolley under the title "Hearing With Deaf Ears," is a good argument to help put over the sale of the hearing aid amplifier.

"Do you know that to everyone, except those born totally deaf, hearing is just as necessary to physical well being as walking, seeing, eating, etc.? Of course a person can live without walking but he cannot live a normal, healthy life; the same applies to the other functions. I know that a great many of my friends will become indignant and say that the lack of hearing has no effect on their physical condition. I beg their most humble pardon and disagree. In the first place, every hard-of-hearing person suffers from some form of nervousness, which unconsciously he acquired with his loss of hearing. In the second place he lives under a constant strain that is anything but beneficial. And in the third place his mental attitude is not, and cannot be, that of a normally hearing person. All of this has a tendency to cut him off and leave him in a little world of his own, partly because he could not find any way to prevent it, but mostly because he was sensitive. The hardest thing for the hard-of-hearing person to say is, 'I cannot hear.' When I began to lose my hearing, I found out that strangers who did not realize I was deaf thought I was stupid. Now I would rather have people know that

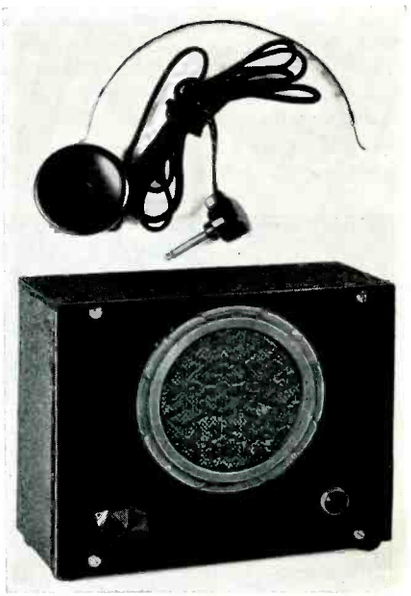


Fig. 1. Typical hearing aid.

I am deaf, and I find it a splendid alibi for any lack of brains.

"I was an entirely different person after I lost my hearing from what I had been when I had normal hearing. The only time I could be sure of not missing anything was when I was doing the talking, and I was actually getting tired of it. About this time, the hearing device manufacturers had a brain storm, or inspiration from heaven, or something, and began to make *real* instruments. It seems unbelievable that, after floundering along for so many years, they have made such rapid strides in the past three years. Hope furnished me with a real weapon and I made up my mind that I had been buried in silence long enough."

Hearing aid amplifiers are older than radio. In the early days of the vacuum-tube repeater they were used on telephones to assist the partially deaf in hearing telephone conversations. Carbon button microphones with button amplifiers were also used, and are still used, as portable lapel hearing aids. With the advances in tube and microphone design hearing aids were also improved. Portable battery amplifiers as well as all electric (a-c, d-c) aids are obtainable for every type of installation. In the home, at the office, on the street, in the theatre, church, or opera the partially deaf need no longer have difficulty in hearing—no more than a myopic individual need do without the convenience of glasses.

Typical Hearing Aid

The amplifier shown in Fig. 1 is a typical all-electric type for use at home, in the office, or wherever electric current (either a-c or d-c) is available. The cabinet in which the aid is housed can be chosen to best match the surrounding furniture. Soft rubber feet must be used to prevent shocks from reaching the microphone. The microphone itself is mounted in its ring with flexible rubber bands. A sensitive carbon microphone is used in the amplifier pictured.

The complete circuit diagram is shown in Fig. 2. Metal tubes are used throughout. A 6F5 high-mu triode in the first stage, a 6C5 in the second stage and another 6C5 as the rectifier. The two stages are resistance coupled to each other. Microphone current is also supplied from the house mains through the rectifier-filter system.

Portable Aids

Portable types of hearing aid, making use of the '30 series of tubes, are also available. In this type the cabinet is usually designed for light weight and small size with due consideration to its long-life qualities under rough use. In the portable both the microphone and the chassis should be rubber mounted to completely prevent transmission of shock to the tubes or the microphone. Very small A and B batteries are available and suitable compartments must be provided. The entire aid, including batteries, need weigh no more than 7 pounds.

In some of the portable aids now available larger size batteries may be connected, through the use of suitable plugs, to provide economical use of the aid in the home or office.

In practically every hearing aid amplifier, using tubes for its amplification, a user with a 95 per cent loss of hearing could not only hear and understand normal conversation in a large office, but could also differentiate among speakers. The same user could take no part in the conversation when using the conventional label type of carbon button amplifier except through lip reading.

Sales Sources

The Service Man will find little difficulty in obtaining or building suitable equipment for a particular customer. His chief difficulty, rather, will be in locating and selling prospective customers. In small communities where each individual and his intricacies are known the partially deaf may be located by judicious questioning. Sales pressure must be tactful and is usually best in the form of printed matter, skillfully worded.

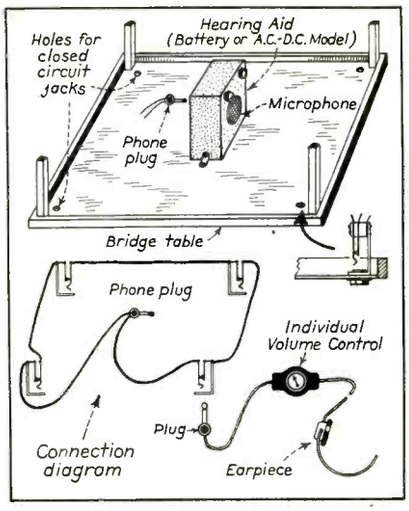


Fig. 3

In larger communities hard-of-hearing individuals often form clubs or leagues. The names and addresses of the members of these leagues can be obtained from the secretary and used for direct-to-the-customer mail advertising.

Often the hard-of-hearing congregate in small groups and spend much of their time playing bridge or similar forms of group entertainment. A bridge table connected in the fashion shown in Fig. 3 will prove a convenient accessory to the complete enjoyment of the game. The loan of such equipment for an evening provides the entering wedge that may result in a sale of the complete unit.

A single desk or portable amplifier can be used in the circuit shown in Fig. 3 with a separate earphone for each player. The jack in each corner of the table is so connected that the dummy position (or any other position) can remove his earpiece without interrupting the functioning or disturbing the volume of the remaining players. Individual control of volumes at the earpiece is, of course, necessary in such installations. Similarly interconnected jackboxes can be constructed in the form of ash trays, chip-holders, etc., for multiple earphone connection to a single hearing aid amplifier.

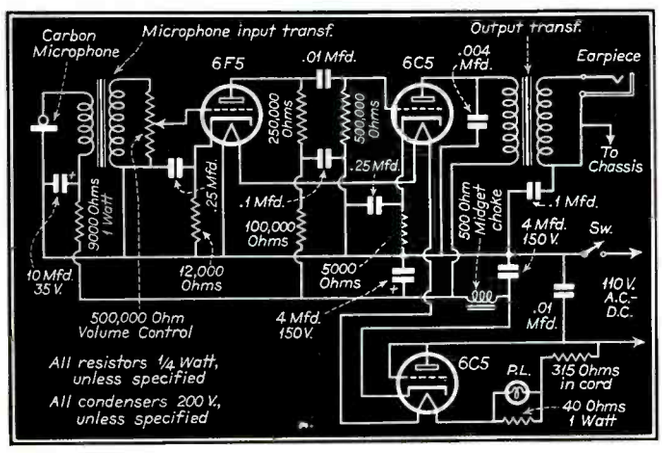
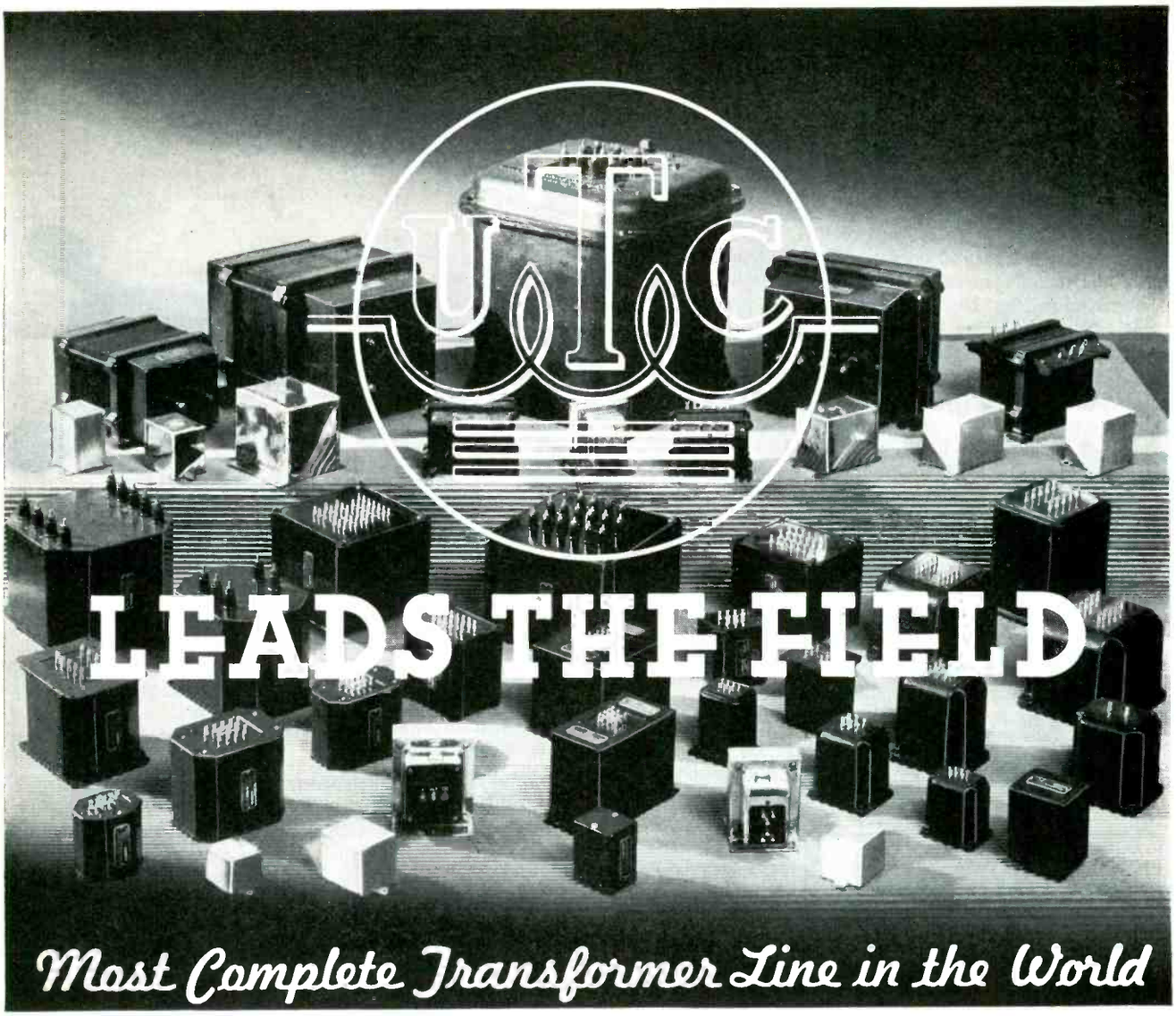


Fig. 2. Typical hearing aid circuit.



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A "RELAYED FREQUENCY PICKUP"

By Mirko Paneyko*

ELECTRICAL SOUND REPRODUCTION is based on the design and operation of a large number of components. It is generally assumed that the amplifier is the heart of a reproducing system and that the characteristics of the whole system are specified simply in terms of amplifier specifications. The design of the other two links of the system, the microphone or pickup and the loudspeaker, have lagged behind amplifier research.

We are here concerned with one particular link of a reproducing system, the phonograph pickup.

As the first link of a reproducing system, the similarity of the pickup and the microphone is immediately apparent. Both constitute the first "electrical image-creating apparatus," the microphone being actuated by air vibrations and the pickup by record groove undulations. The difficult task of design of the phono pickup becomes apparent when one bears in mind that not only

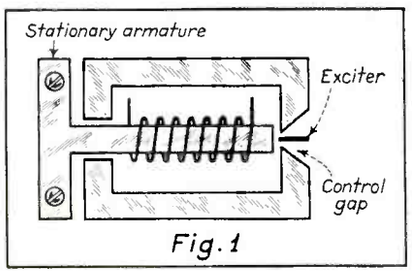

Fig. 1

must it be mechanically coupled to the record groove, but also in a high-impedance pickup sufficient displacement or stress must take place within the unit to generate approximately 2.0 volts—about two million times more than the output of a high-grade microphone. Despite commendable refinements in a few cases, the pickup of today is still a rather crude instrument—crude in comparison with the microphone—and it awaited definitely a new sort of idea, a new type of design.

The ideal pickup should have stability and dependability; a response characteristic which is flat from 50 to over 8,000 cycles, maintaining this response under large amplitude variations and changing weather conditions. It should also be able to withstand a temperature rise of from 40 to 60 degrees above 72 degrees F without ill effects and with normal response. The needle pressure on the record should not exceed 2.75 to 3 ounces. The unit should be ruggedly built and adaptable to either low or high impedance. Further, it should be made as simple as possible to facilitate local servicing. The output could afford to be somewhat smaller than that of previously available models. Modern amplifier design scarcely calls for the necessity of large input voltages. The new unit to be described fulfills all the aforementioned conditions and great advance over present type units.

The reader is no doubt aware of the importance of the principle of relay, trigger or valve action. A small amount of motion, a small amount of energy is made to control large effects. If it were possible, in the described pickup unit, to keep the general dimensions of the magnetic circuit the same, and yet control the flux paths by the motion of a very small element rather than by that of the bulky armature, the problem of inertia and limited frequency response would be solved. This is exactly what has been accomplished in the new unit as may be seen from Fig. 1.

The armature is broken up into two parts: the major part, on which is wound the coil, is permanently clamped and stationary, while a very small portion, which the inventor refers to in his patent papers as the "exciter," reflects the motion of the needle and changes the magnetic reluctance of the armature path by changing the size of the "control air gap."

The moving system is reduced to the needle in its pivot and to the small exciter. The inertia of this system is considerably reduced, for not only is the mass of the exciter very small (see Fig. 2), but also the exciter is placed near the center of the axis of rotation so that the main part of the weight is that of the needle. A definite control of total effective inertia is obtained by using a longer or heavier needle for increased bass response, or a short and light

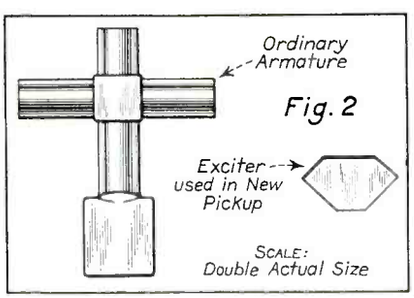

Fig. 2

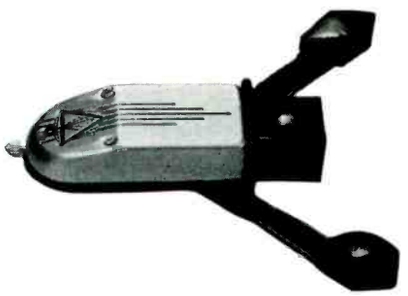
Fig. 3. The new pick-up.

needle for a flat overall response. The increased frequency range changes the surface scratch from standard records to a higher frequency hiss which is much less objectionable and easier to eliminate. The new unit when tested had a needle pressure of only 1.5 ounces on the needle point.

The construction of this pickup unit is very simple. The main part of the armature being stationary and solidly clamped, the oscillating part is easier to adjust and maintain in its proper position.

•

MUSIC-SPEECH CONTROL CIRCUIT

(Continued)

rather a slight increase since the grid load has been increased. Thus the net effect to the listener is an addition of the base notes.

LOW VOLUME COMPENSATION

Base compensation for the low volume settings of the manual volume control is a permanent part of the circuit. The circuit elements that provide this compensation consist of a 27,000-ohm resistor and a 0.015-mfd condenser which are connected to the 250,000-ohm tap of the manual volume control as shown in the cover diagram. When the volume control is at or below this tap the total resistance in the grid circuit to frequencies above 3,000 cycles is less than 30,000 ohms. For frequencies below 50 cycles the total impedance in the grid circuit is of the order of 150,000 ohms. This lower resistance to the high notes will effectively by-pass them to the ground circuits allowing the lower notes to feed the grid of the audio stage which in turn passes them on toward their final destination—the listener's ear.

*Chief Engineer, M.P. Installations.

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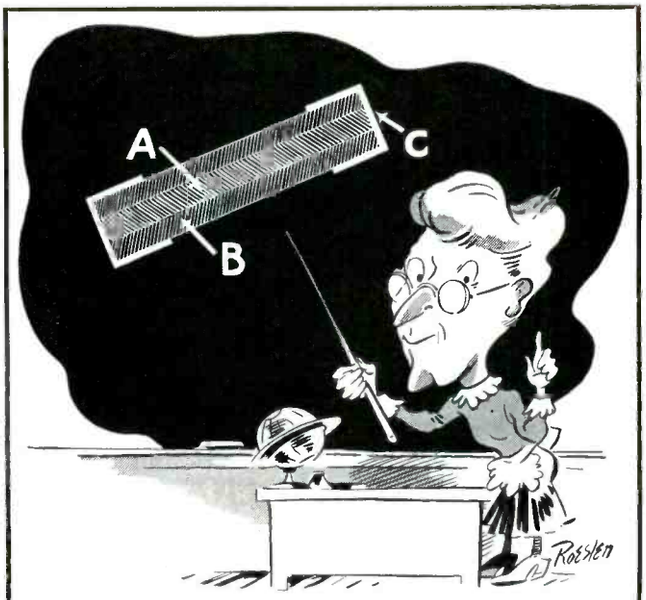

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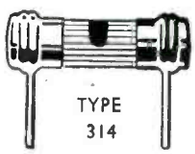

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Auto-Radio . . .

Bosch 636, 637

The Bosch model 636 is a single-unit auto-radio chassis, power pack, and speaker with a separate remote control. The set is contained in a cylindrical housing. The model 637 differs only in that it uses a separate header type loudspeaker, installed on the header bar, above the windshield.

The complete circuit diagram is shown in Fig. 1, with complete information as to tube functions, socket connections, resistance and condenser ratings, voltages encountered, etc. The voltages given were measured with a 1000-ohm-per-volt voltmeter with the antenna connected to the chassis and the volume control on full. The voltage at the battery measured 6.3 volts.

Alignment Procedure

1. Set test oscillator to 175 kc.
2. Set condenser gang to approximately 600 kc. This will be at a point where the condenser plates are nearly all in mesh. Turn the volume control on full.
3. Connect output meter across voice coil of speaker. This may be done by connecting one lead of the output meter to the blue lead of the speaker terminal strip and the other lead to the frame of the chassis. The impedance of the voice coil is 3 ohms.
4. Apply test signal to grid of 78 i-f tube through a 0.5-mfd blocking condenser and adjust trimmer A to maximum output reducing output of test oscillator as required.
5. Apply test signal to grid of 77 first detector-oscillator and adjust trimmers B and C to maximum output (see Fig. 2).
6. Set test oscillator to 1500 kc and rotate condenser gang until the plates are wide open. Place a piece of paper (approximately 0.015" thick) between rotor and stator plates at the bottom of the gang and close the rotor down to this spacing. This is the exact setting of the condenser gang for the receiver oscillator at 1500 kc and should be carefully set as the resultant alignment of the receiver is directly dependent upon it.
7. Adjust trimmer D to maximum output, and then remove the paper gauge.
8. Set test oscillator and condenser gang to 1400 kc.
9. Apply test signal to grid of 77 r-f tube and adjust trimmer E to maximum output.
10. Apply test signal to antenna lead through a 0.0002-mfd condenser and adjust trimmer F to maximum output.
11. Check sensitivity at several points.

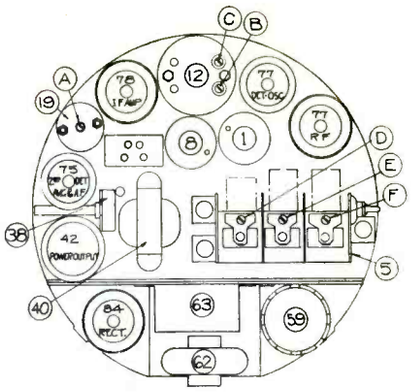


Fig. 2. Chassis view showing trimmer locations.

Zenith 7-M-91S, 7-M-91D

These 7-tube auto-radio receivers are so designed that one or two separate speakers may be used.

The complete circuit diagram is shown in Fig. 1, together with the speaker connections, the functions of the various tubes, their base connections, a parts list, and the voltages encountered throughout the chassis. These voltages were measured with a 1000-ohm-per-

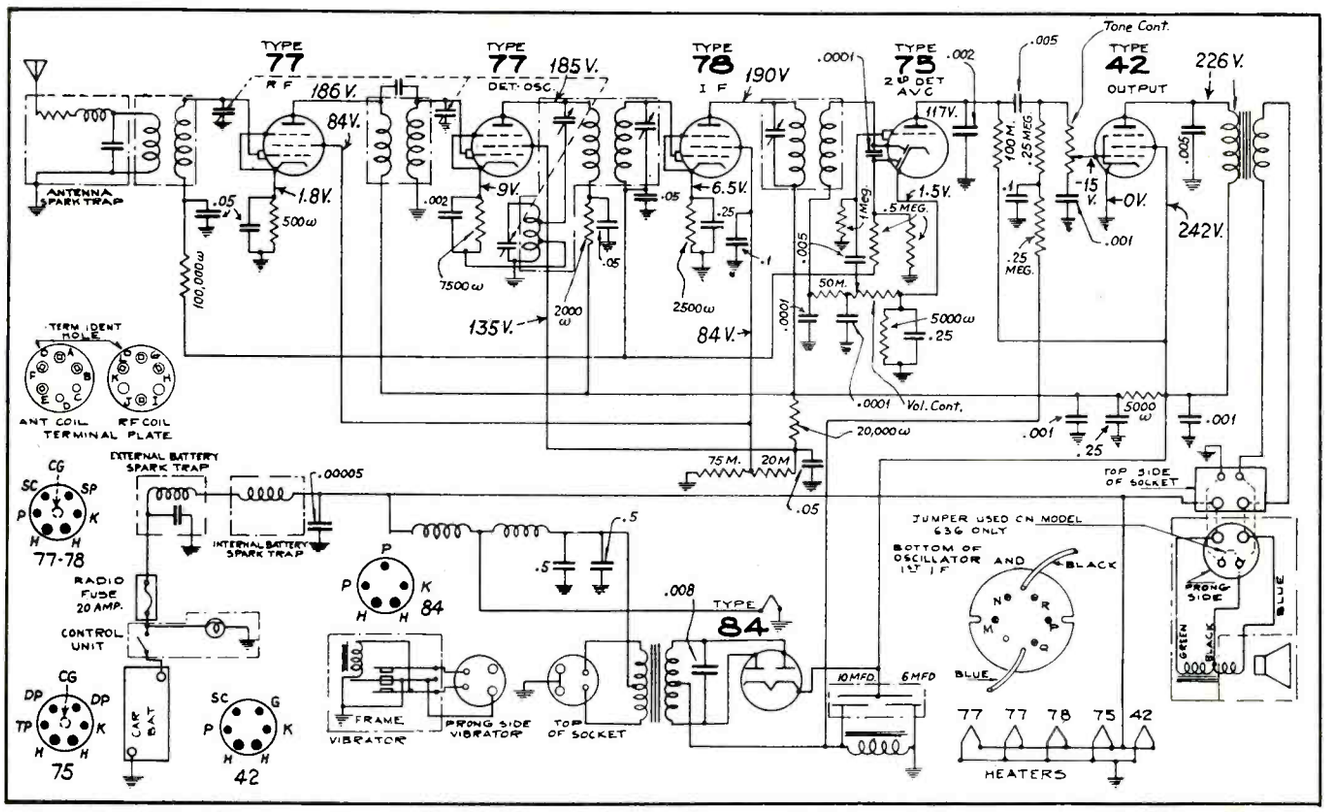


Fig. 1. Complete circuit diagram Bosch 636, 637.

volt voltmeter with the antenna shorted to the chassis. Actual values may vary 15 per cent from those given. The volume control and the sensitivity switch should be on maximum during all measurements and adjustments.

A. Connect the service oscillator to the control grid of the 6A8 tube and the chassis.

Connect the output meter across the primary of the speaker transformer.

Set the service oscillator to 252.5 kc and adjust the trimmers on the i-f transformers for the greatest output reading. These adjustments should be repeated several times using as weak an input signal as possible so as to obtain greater accuracy.

B. Change the service oscillator lead from the grid of the 6A8 to the antenna connection. A male Delco Remy connector may be used in making a connection to the antenna lead.

Set the service oscillator at 1400 kc.

Rotate the gang condenser one and one-fourth turns from the minimum setting. At the proper position eight teeth on the tuning gear will be visible past the gear bracket.

Adjust the oscillator, r-f, and antenna trimmers in that order to the point giving the greatest output.

C. Set the service oscillator at 600 kc and rotate the gang condenser to tune in this signal. Move the gang condenser to and fro past the signal meanwhile adjusting the oscillator padder condenser until the combination of adjustments giving the greatest reading of the output meter is obtained.

D. Repeat operation B.

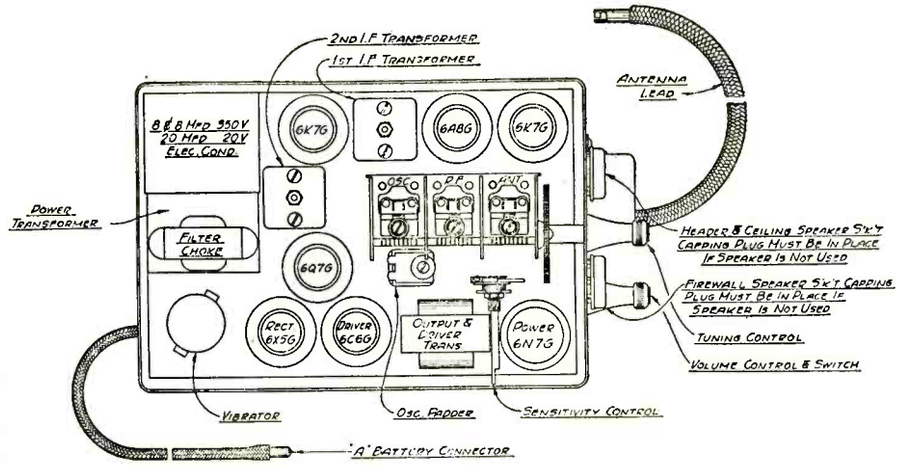
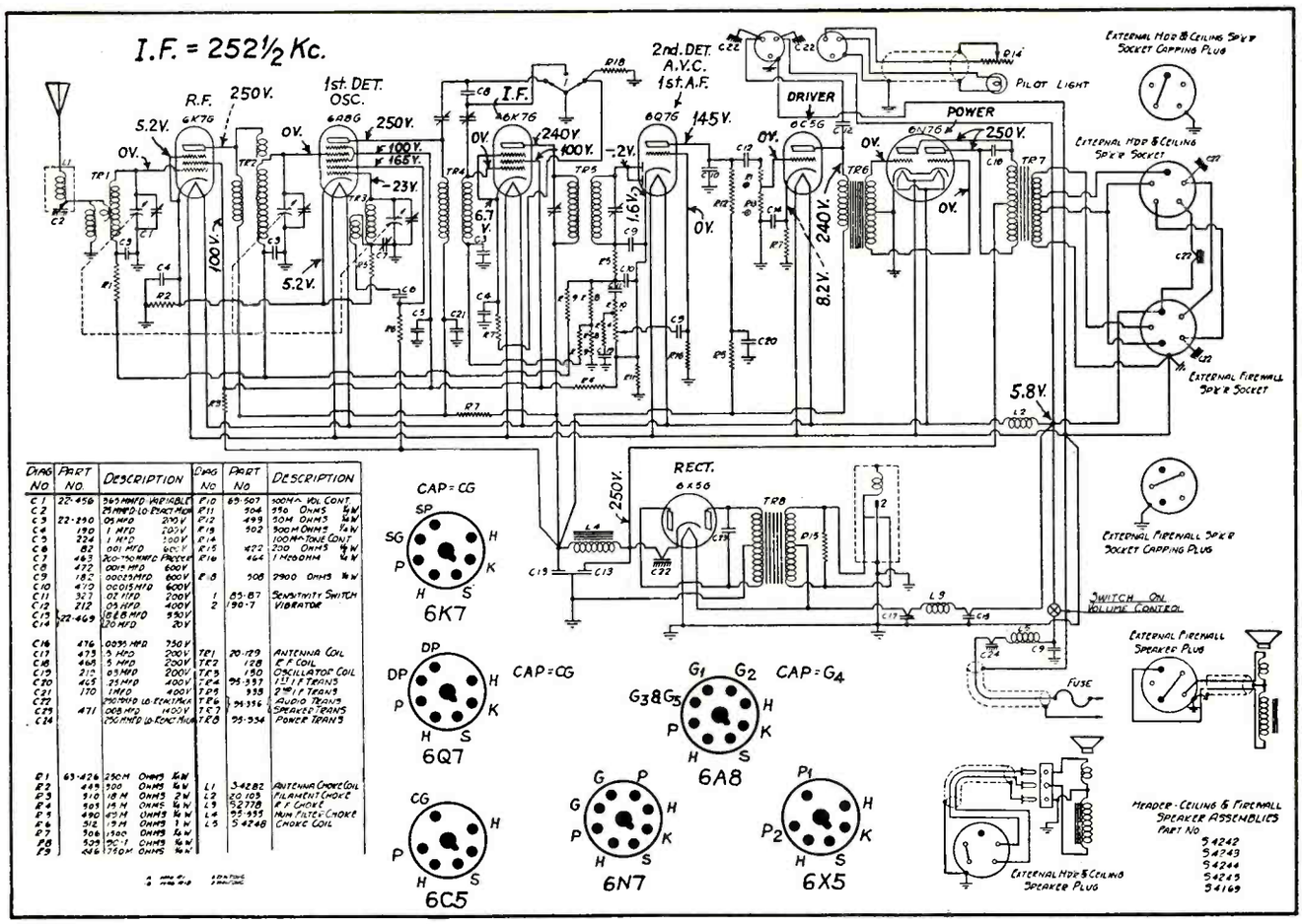


Fig. 2. Chassis view showing trimmer locations.



DIAG NO	PART NO.	DESCRIPTION	DIAG NO	PART NO	DESCRIPTION
C1	22-456	365 MMFD VARIABLE	R10	69-507	100M VOL CONT.
C2		29 MMFD LO FREQ MICA	R11	504	250 OHMS ½W
C3	22-390	.05 MFD 200V	R12	499	50M OHMS ½W
C4	390	1 MFD 200V	R13	502	500M OHMS ½W
C5	324	1 MFD 400V	R14		100M TONE CONT.
C6	82	.001 MFD 600V	R15	472	200 OHMS ½W
C7	463	200-700 MMFD PADDER	R16	464	1 MEGOHM ½W
C8	472	.004 MFD 600V			
C9	182	.00025 MFD 600V	R18	508	2900 OHMS ½W
C10	473	.0015 MFD 600V			
C11	327	.02 MFD 200V	1	85-87	SENSITIVITY SWITCH
C12	212	.05 MFD 400V	2	90-7	VIBRATOR
C13	22-469	8&8 MFD 350V			
C14		20 MFD 20V			
C16	476	.0035 MFD 750V			
C17	473	.5 MFD 200V	TR1	20-179	ANTENNA COIL
C18	468	.5 MFD 200V	TR2	128	R.F. COIL
C19	210	.05 MFD 200V	TR3	130	OSCILLATOR COIL
C20	465	.25 MFD 400V	TR4	95-337	1ST I.F. TRANS
C21	170	.1 MFD 400V	TR5	938	2ND I.F. TRANS
C22		250 MFD LO FREQ MICA	TR6	94-356	AUDIO TRANS
C23	471	.008 MFD 400V	TR7		SPEAKER TRANS
C24		250 MFD LO FREQ MICA	TR8	95-334	POWER TRANS
R1	63-426	250M OHMS ½W	L1	5-4282	ANTENNA CHOKE COIL
R2	449	500 OHMS ½W	L2	20-105	FILAMENT CHOKE
R3	510	1.8 M OHMS 2W	L3	92-778	R.F. CHOKE
R4	503	.5 M OHMS ½W	L4	95-935	MAIN FILTER CHOKE
R5	490	.45 M OHMS ½W	L5	5-4248	CHOKE COIL
R6	512	.9 M OHMS 1W			
R7	506	1500 OHMS ½W			
R8	509	150-1 OHMS ½W			
R9	446	750M OHMS ½W			

Fig. 1. Complete circuit diagram Zenith 7-M-91S, 7-M-91D.

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TEST EQUIPMENT . . .

Supreme 89C Tube Checker

A practical tube tester should indicate the quality of a tube on the basis of good or bad transconductance emission, and should be capable of indicating any leakages or short-circuits between the elements, which impair the proper functioning of a radio tube. The maximum value will be realized in the use of this tester when the Service Man appreciates its technical features.

The Circuit

The complete circuit diagram of the Supreme Model 89C tube tester is shown in Fig. 1. A single 0-1 ma d-c meter is used for emission indications as well as line measurements. The a-c is rectified by the 01A tube. The 2-watt, standard base, neon tube is used for leakage tests. Five tube sockets are used for all tests, one for each of the existing type of tube base. The tester is flexible as to filament selection, enabling the testing of both filaments on the 6Z5, 12Z5 and 12A5 without the use of adapters. On octal base tubes the filament return circuit is selected by the operator by means of a rotary switch on the panel. Another rotary switch is used to obtain accurate primary adjustment. An off position is provided should the tester be used permanently connected to the a-c line. Several models of the tester are obtainable for various voltage and frequency ratings.

Tube Tester Accuracy

The standard preferred test of amplifier types of tubes is known as the mutual conductance test, which involves laboratory equipment for measuring mutual conductance in terms of micromhos with specified d-c potentials applied to the tubes. Obviously, such elaborate equipment is impractical for field uses because of the complexity of the set-up for each type of tube, and because of the prohibitive cost of such equipment. Any departure from such equipment necessitates some compromise in accuracy for the sake of simplicity of operation and lower unit cost per tester. The user of this tester, or of any other tube tester, should appreciate the fact that the tester is not a graduated qualitative tester in which a tube which tests at a meter reading of 80 is necessarily better than a tube which tests at 76, but that the tester is useful primarily as a means for separating bad tubes from good tubes. In other words, a bad or very bad tube may test anywhere in the "BAD" or "?" sectors of the meter scale, and a good or very good tube may test anywhere in the "GOOD" sector of the meter scale. The final verdict as to whether or not a tube is satisfactorily operable is whether or not the tube operates satisfactorily in an operative radio; and, even with such a simple, practical and apparently conclusive criterion as an operative radio, it is sometimes found that a tube which is almost completely inoperative in one operative radio circuit may be found quite satisfactorily operative in another operative radio circuit. The facilities of the tester for indicating inter-element leakages and short-circuited conditions constitute an invaluable auxiliary test for weeding out unsatisfactory tubes; it is often found that more tubes of a particular radio require replacement because of inter-element leakages than require replacement because of loss of trans-conductance (mutual conductance) incidental to the depreciation of the electron-emitting qualities of the tubes involved. The tester is an invaluable selling tool for the Service Man and a very useful item in the equipment of the professional radioman whose practical mind necessitates his quicky approximating a practical solution for every tube and service problem which confronts him in his daily routine.

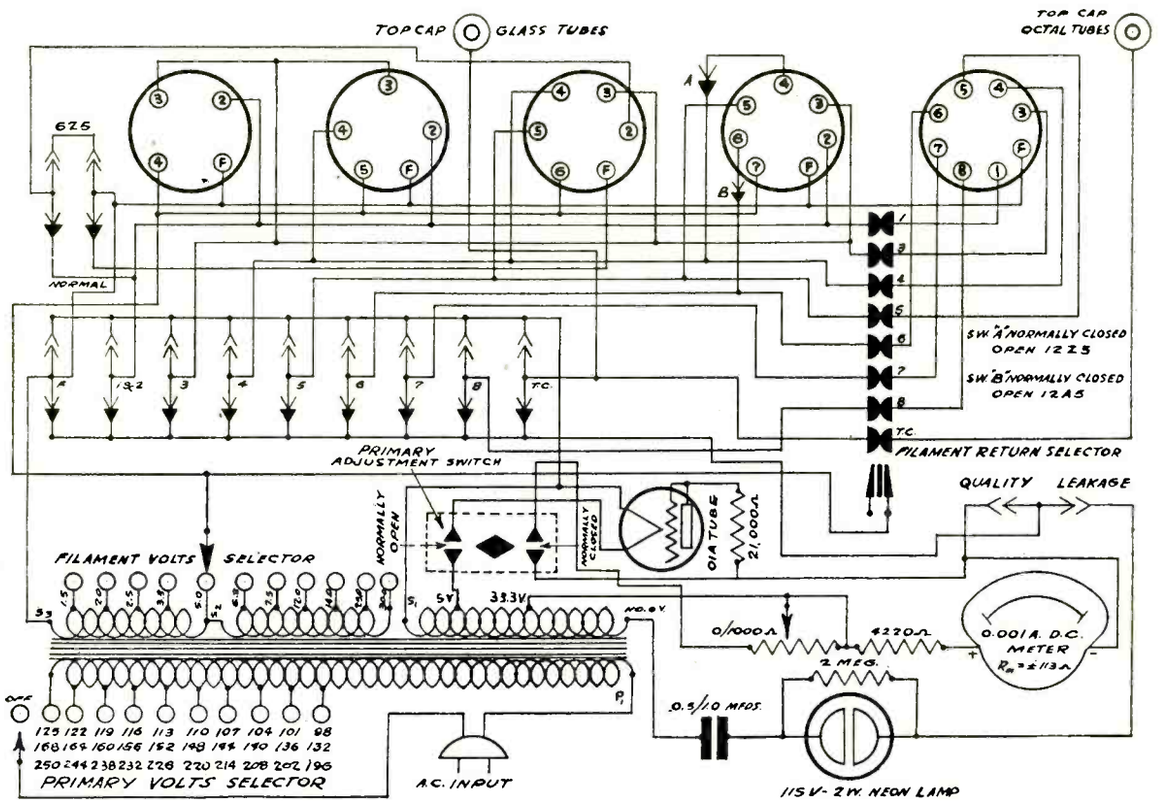
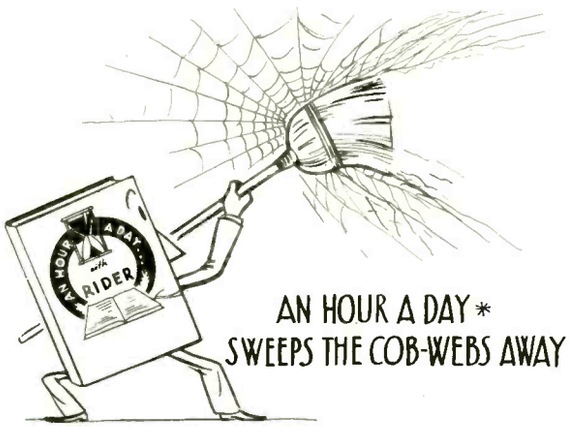


Fig. 1. The complete circuit diagram of Supreme 89C tube tester.



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Through National Union's help, radio service dealers everywhere have been able to set up better equipped shops to do better work; also to obtain merchandise helps that produce more customers. National Union has constantly put the latest advances in scientific equipment as well as modern selling aids within the reach of the service dealer. The National Union deal calls for a dealer deposit which is rebated when the specified number of tubes have been purchased. Over 50,000 completed deals. Every service dealer should investigate.

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RECEIVER CASE HISTORIES

Aetna Midgets

When marked B. R. C. Chicago: These receivers are made by Belmont Radio Corp. and can be found in manuals under that name.

H. J. Hicks

•

A.K. 55

Poor high-frequency response: The high-frequency response of this model can be improved by removing the "quality condenser" connected across the plates of the 45's. The condenser is located in the audio transformer assembly. Remove the transformer from the chassis, take off the cover, and heat the assembly. The condenser will be found near the top of the can.

Allan Epstein

•

Apex 99

Low volume: When all voltages check low test the 4- and 8-mfd filter condensers for open or lowered capacity. A drop in plate voltage as great as 40 volts has been found with one of these condensers open.

Under such conditions very little hum is present which would otherwise throw suspicion upon one of these condensers at once.

Howard J. Surbey

•

Bosch 360

Oscillation on weaker stations, sometimes intermittent: This is usually caused by poorly grounded tube shields. The aluminum tube shield bases are attached to the chassis with rivets and as the bases tend to loosen and corrode in time so that the shields make a poor ground. The remedy is to bond the tube shield bases to the chassis with aluminum solder.

On the first model 360's the same rivets holding the tube shield bases on the top side of the chassis also hold soldering ground lugs on the under side. Naturally, these also tend to loosen and make a poor ground so it is also necessary to bond these ground lugs to the chassis with short pieces of wire.

Dead: Commonly caused by either filter condensers, C-39 and C-40, shorting or a section of R-3 resistor opening. The resistance of the sections of R-3 resistor, the values of which are not given on all diagrams, is in order from high side to ground as follows: 1,000, 12,000, 8,000, and 6,000 ohms.

Paul D. Shields

•

Bremmer Tully 82

Low volume: Low volume in this receiver is frequently caused by a break in one of the two parallel wires of the ballast tube. This can be determined by inspection of the tube. A shorted r-f cathode by-pass can also cause low volume; replace with 0.5-mfd.

Harvey H. Schock

•

Brunswick 11

Poor high-frequency response: This receiver is exceptionally well designed, except for its high-frequency cut-off, which is due to too much by-passing after the second detector plate. Remove the small 0.001-mfd condenser connected to the second detector plate. Insert in its place a condenser of 0.00025-mfd.

W. Manola

•

Coronado 7700

Distortion: Earlier models experienced speaker troubles which were later eliminated by using speakers with bakelite voice coils. The input transformer also gave trouble on this model.

J. E. Steoger

•

Crosley 167

Inoperative: One 58 heater too bright, the other 58 heater does not light at all. Remove the lead from the dial lamp socket which runs through the chassis; insulate with spaghetti. The original lead often grounds to the chassis.

E. M. Prentke

•

Crosley 175

Inoperative: If the set drops out as the dial is tuned to the lower frequencies, replace the 7000-ohm cathode resistor in the oscillator circuit with one of 5000-ohm; realign.

Harvey H. Schock

•

Emerson A-C 7

Oscillation and weak reception: The 12,500-ohm, 2-watt resistor (G.R. 30 in the schematic) often drops in value to as low as 1600 ohms; replace with a 10-watt wire-wound unit. The screen by-pass condenser may also develop leakage. The condensers in this receiver should have a terminal resistance better than 100 megohms; replace any under this value.

Al. Beers

•

Grebe HS 4

Intermittent, noisy reception, oscillation: Replace both 8500-ohm resistors in screen feed circuit, using wire-wound ten watt units. Remove entire 6 section metal cased by-pass condenser. Replace the r-f and i-f cathode by-pass condensers with 0.1-mfd units; the second detector cathode by-pass with 0.5-mfd; and the tone control condenser with a 0.02-mfd. The screen by-pass condensers are also 0.1 mfd.

E. M. Prentke

•

High-Gain Amplifiers

Hum: In many p-a amplifiers having a gain of over 100 db that are built on the same chassis with the power supply have a residual hum level that is more than desirable and is difficult to locate and persists in spite of the utmost effort spent to eliminate it.

Two simple remedies may be applied, and will always result in a marked reduction. The first is to ground every "ground" connection to a heavy copper bus-bar. This should be soldered securely to the chasis at several points. The second is the by-passing of the primary of the power transformer to the chassis by means of a 0.1-mfd or 0.25-mfd condenser. It is important to by-pass only one side of the line. By-passing both sides may result in more hum.

E. M. Prentke

•

Kolster K70, 72, 75, etc.

High pitched whistle: Some of these sets whistle because of interaction between 47 tubes and p.p. input transformer. This can be eliminated by soldering leads bonding the sections of the transformer case to the chassis in several places.

Allan Epstein

•

Midwest 16 Tube

Distortion at resonance: Realign the avc i-f transformer; if this stage is not peaked the avc voltage will be insufficient.

Poor quality, especially on phonograph: Replace the cathode by-pass condensers on all the audio tubes with 5-mfd, 25-volt units of some well-known manufacturer.

Allan Epstein

•

Philco 5 Auto Set

Inoperative: No plate or screen voltage, primary circuit draws 10 to 15 amperes, filter condensers and buffer check O.K. The cause of this condition is breakdown of power transformer windings. A new transformer is indicated.

E. M. Prentke

•

RCA R-75

Low volume: In many cases this receiver can be pepped up by changing the three 0.1-mfd by-pass condensers in the avc circuit.

Allan Epstein

Wells-Gardner 6F

Excessive hum: Excessive hum may be encountered in the early models of this receiver. These models can be identified by the letter A stamped on the under side of the chassis. Should hum exist follow the steps outlined below:

Check the 6B7 and 6F7 tubes. Several new tubes should be tried and the effect noted.

A cardboard shim about 3/32 in. thick should be placed under the choke (L4, see service manual).

The 4-mfd, 150-volt electrolytic (C35) should be replaced by a 12-mfd, 300-volt condenser.

If the hum level is still objectionable after the above changes have been made, the following procedure should be followed:

1. Remove the heater connections from the 6B7 and 6F7 sockets, leaving the ground connection on the 6F7 socket. Remove the ground from the terminal strip to the A power cable plug terminal, and from this terminal connect a wire (white) to a ground lug near the 6K7 second i-f as shown in the accompanying diagram.

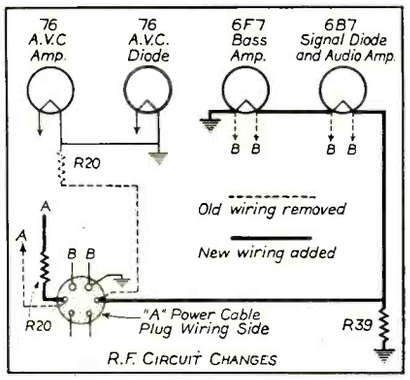
Remove the wire connecting the heater of the 76 avc diode tube to the insulated terminal strip. The other heater connection of this tube should be removed from the terminal of the A power cable plug and connected, as shown, to the lug on the insulated terminal strip, to which one terminal of candohm resistor R20 is also connected. This last heater connection and the heater wire for the 6K7 second i-f tube and the ground wire (white) from the A power cable plug, referred to above, should be twisted together and kept away from the 6B7 and 6F7 tube sockets as shown.

Connect the other terminal of candohm resistor R20 to the opposite terminal of the A power cable plug with reference to its former position, as shown in the accompanying illustration.

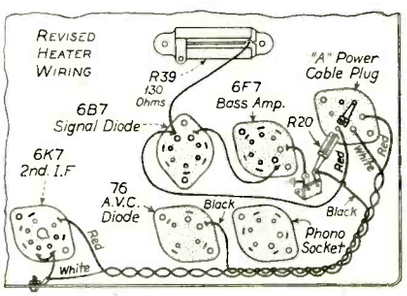
2. Connect the 6F7 and 6B7 heaters in series between ground and the terminal of A power cable plug to which the candohm resistor R20 was formerly connected.

3. A new resistance of 130 ohms, 2.5 watts (candohm R39) is placed near the volume control in the position shown in the illustration. As shown in the diagrams the ungrounded lug on R39 is connected to the heater terminal of the 6B7 which also connects to the A power cable plug.

4. The pilot light lead, which formerly connected to the 6B7 heater, is now connected to the 76 oscillator tube

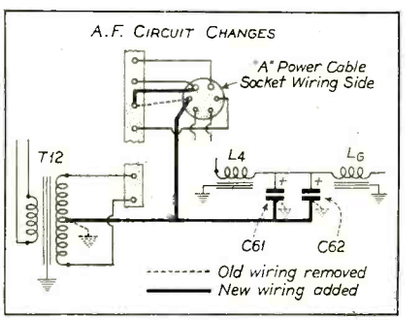


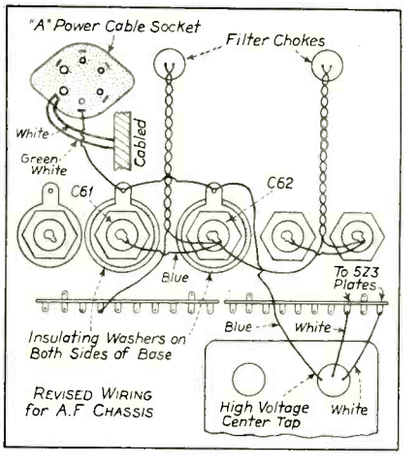
R.F. Circuit Changes



heater. This is best accomplished by drilling a ¼ inch hole in the chasis near the oscillator tube socket and bringing the lead down from the left-hand side of the dial assembly.

5. Remove the filter condensers (C61 and C62) from the chassis. Enlarge the holes to 29/32 in diameter. Place an offset washer on each electrolytic and





mount on the chassis so that the offset part of the washer fits into the hole. Put on a plain fibre washer, contact lug, lockwasher and nut, respectively.

6. Then disconnect the high voltage center tap of B power transformer T12 at the ground lug and connect it to the negative contact lug on one of the electrolytics. Next connect the negative contact lugs together, as is shown in the accompanying illustration.

7. Replace the choke wires on the positive side of the electrolytics, C61 and C62, and also the blue wire connecting the two positive terminals together.

8. At the A power socket, disconnect the green and white tracer wire at the cathode terminal and connect to the cathode heater terminal. Connect the cathode terminal to the contact lugs on the electrolytics, as illustrated.

•

Westinghouse W 24

Noisy reception: If the receiver develops noise at the slightest vibration suspect the tube sockets. These may be tightened in the usual manner with a long-nose pliers.

Harvey H. Schock

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Westinghouse WR 5, WR 6

Noisy reception: Noisy reception in this model is often caused by a poor connection of the electrostatic shield in the power transformer to the chassis. The lead to this shield (which usually consists of an extra layer of winding between the primary and the secondaries) should be scraped free from the tar surrounding the transformer and grounded to the frame and the receiver chassis.

Harvey H. Schock

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Zenith A-B-C-D

Poor operation: Check the plate, screen, and bleeder resistances in these models. Generally some of the resistors will have increased to a much higher resistance than their correct value. The bias resistor of 900 ohms for the 45's should be replaced with a 10-watt resistance.

Paul D. Shields

•

Zenith 91, 92

Inoperative: If this receiver is inoperative until the 24A tube used as the avc rectifier is removed from its socket, check the avc voltage divider connected between the cathode and screen. This section if open will stop reception Replace with a one watt 15000-ohm resistor.

RCA Radio Service Tip File

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ASSOCIATION NEWS . . .

INSTITUTE OF RADIO SERVICE MEN REPORTS

The IRSM Qualification Plan

We need not reiterate concerning the unsavory conditions that existed, and to a large extent still exist, in the radio service field in the larger cities. Unscrupulous and incompetent Service Men without proper equipment are recognized, and reap rewards in many cases larger than those obtained by honest, competent, well-equipped technicians. The harm created through the continued activity of such Service Men to both the victimized public and the service profession in general cannot be estimated. Numerous guilds, trade unions and associations (among them the IRSM) were formed to fight such vicious practices. These organizations, while successful in so far as individual Service Men are concerned, have affected the conditions only slightly in some of the larger cities. Unscrupulous service agencies still reap large profits and incompetent Service Men still drag along.

With a view to overcoming these conditions, the IRSM is attempting to establish a qualification project. This project has as its object the "development of a means to ascertain the technical ability of persons engaged in radio servicing and to establish and maintain ethical business standards in the radio service industry." To advance this end the IRSM has already created a "profitless" corporation called the National Radio Service Qualification Project, Inc. This corporation in turn is to be the parent of two additional "profitless" corporations which will be incorporated in the near future.

The first of these, The National Board of Radio Standards, Inc., is to have representation from the manufacturers, the broadcasters, the service employers, the service employees, and the public. Its purpose is to "prescribe an examination to determine the technical qualifications of persons engaged in radio servicing; to employ examiners . . . a staff to grade papers; and certify qualifications. . . ."

The other corporation, Radio Service Registry, Inc., is to be composed of the group passed upon in accordance with the qualifications of the first corporation. Continued membership in this group is dependent upon the Service Man's conduct as a member.

Examinations will be conducted in cities that the Service Men can reach with a minimum of expense. The IRSM will prepare a question-and-answer book which prospective applicants may borrow in order to properly prepare for the examination.

Persons franchised under the Qualification Project shall be required to show that they are keeping abreast of development in the radio arts in order to hold their franchise. The Board of Directors in organizing the program has stipulated that there shall be a re-examination every two years; and that such re-examination shall be based on developments during a two-year period ending six months prior to the date of the re-examination.

The Board of Directors has established an initial fee of $10.00, payable with application. The aforementioned fee shall cover the cost of the examination, and, in the event that the applicant fulfills the requirements, the issuance of credentials. What remains will be used for the purpose of promoting the project to the radio public and protecting the rights of those who are entitled to the benefits of the project. The aforementioned fee of $10.00 shall also cover the registration for one year thereafter.

For a limited time, a reduction in the initial fee shall be effective in accordance with the approval given by the Board of Directors. (The exact amount will be announced later.)

The annual fee after the first year shall be $5.00.

In the event that an applicant fails to pass the examination prescribed by the National Board of Radio Service Standards, he shall be permitted to take the examination again on the next succeeding examination date, or at any time when an examination is conducted in a city conveniently located to him. The applicant shall be required to pay an additional fee of $1.00 for each such additional examination necessary for him to qualify.

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Cleveland Chapter IRSM

All members of the Cleveland Chapter having survived the recent trade show held in the "Windy City," have settled down to business again.

Mr. Quinn, chairman of our technical papers committee has worked out a V.T.V.M. Construction data and diagrams are available.

Along with our service forum we conduct a publications review; several members are assigned to cover the highlights of news and new developments as they are introduced.

On May 25 the executive officers of the Cleveland Chapter drove down to Akron and set up an Akron Chapter of IRSM. Twenty-four members constitute the chapter group and from all indications they are going to town in a big way.

Plans are well under way for a co-operative Service Men's picnic, to be held the latter part of August, including a parade of sound trucks and service cars to the picnic grounds.

At one meeting each month the Cleveland chapter of the IRSM gives over a part of the time to a review of radio publications of interest to Service Men. Several are appointed to prepare and deliver the reviews, changing the reviewers from time to time. Chark Quinn, an officer of the section, started the idea and it has proved to be of value in stimulating the men to later look up and read valuable articles which might have been overlooked, thus increasing their knowledge and efficiency. This idea is submitted with the hope that other service groups will try it out and find it helpful and interesting.

L. Vangunten.

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Brooklyn, N. Y., Chapter

The Brooklyn Chapter has really gotten under way, and is growing by leaps and bounds. They have acquired a meeting place of their own in the Oddfellow's Hall in Brooklyn, and meet on the third Monday of every month.

Over 150 members and guests put up their tools for the evening and turned out for the first meeting in the new quarters. Atwater Kent and its distributor for the New York area provided the speakers of the evening. Mr. Kelley, of the Factory Service Department, who was introduced by Mr. C. Craig of the Sales Force, described the circuits of the new Atwater Kent receivers. Refreshments in the form of beer and pretzels were served after the meeting and a good time was had by all.

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New York Chapter

The New York Chapter has been having some very fine meetings, the latest of which was given by Stromberg-Carlson, at which time Mr. O. Wells, who is Service Manager for their New York distributor, gave the boys some service hints on repairing Stromberg-Carlsons. Mr. P. J. Collison of the same firm gave a short talk on the methods of selling and installing p-a systems with special reference to quality and right type of equipment for the job. A Service Forum was held before the meeting, Charles Seidman presiding. *Joseph Flaum, Secretary.*

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NRI ALUMNI NEWS

New York Metropolitan Area Chapter

The first issue of our little magazine, *"The Metropolitan Area Chapter Tattler,"* is just off the press and is already asserting itself as a worthy contender for Chapter bulletin honors. The Editor, Mr. R. Pettit, assures the boys he is going to do everything within his power to make it interesting, informative, and give the rest of the Chapter bulletins a run for their money.

Social meetings will be the first Thursday of every month—where we will have a get-together and have fun. For more details on the social meetings attend the business meetings. The business meetings will be held on the third Thursday of each month. The address is 12 St. Marks Place, New York City (near 3rd Avenue).

You can get full information about joining our ranks by writing Mr. L. J. Kunert, 66-11 74th St., Middle Village, L. I., N. Y.

•

Philadelphia Camden Chapter

A great deal of the credit goes to Mr. J. P. Hornbrook and Mr. William Trimble for the continued success of our Radio bulletin, *The Philcam Key.* These live wires are getting the news and material we need to put our bulletin over in a big way.

Four meetings are held every month—one business meeting and three service meetings. Every member is urged to attend as many meetings as possible. We cannot fail to note that the fellows we see here the most are the same boys who make the most money. Apparently these fellows are the ones who realize that it takes plenty of good hard study and an ever increasing desire to know more to go to the top.

(Continued on page 282)

SO MUCH for SO LITTLE!

Years of antenna specialization and the largest plant devoted exclusively to antenna kits makes this new quick-selling system possible. Just compare these features—and the price.

- ★ All-wave, self-selecting, noise-reducing system; factory assembled, wired, soldered.
- ★ Armored (steel-strand) copper antenna wire for maximum strength. Non-corroding wire and joints.
- ★ Special twisted-pair downlead cable. Automatic-switching set coupler.
- ★ Complete. Attractively packaged. Ready to string up. Only $4.50 list! A big value for small price.

Write for technical and sales data on this new kit. Also on Type 200 DeLuxe Kit for those extra fussy customers of yours who insist on superlative results.

• **TECHNICAL APPLIANCE CORP.**

Pioneers in Noiseless Antenna Systems

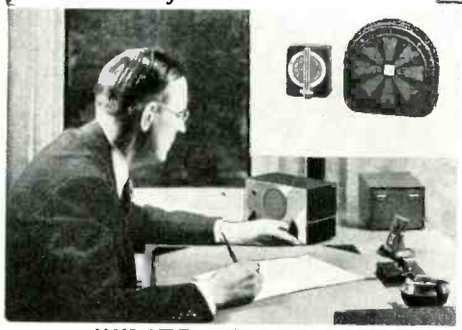
17 EAST 16th STREET :: NEW YORK CITY

TACO

Famous makers of P. A. equipment offer another **WINNER**

BELfone

A complete Intra-Department Communicating System *for* $39.50



Mr. Radio Man! Here's a red hot seller. Just what restaurants, offices, factories and stores want. Permits two way conversation. A demonstration closes the order—puts profit in your pocket.

Interesting proposition for jobbers.

WRITE TODAY FOR DETAILS

BELL *Sound Systems, Inc.*
61-62 East Goodale St.
Columbus, Ohio

BELL SOUND SYSTEMS

Dramatize Your Resistor Stock!

Insulated CONTINENTAL Carbon Resistors

This attractive cabinet FREE with the purchase of 70 CONTINENTAL Carbon insulated resistors consisting of two each of 35 selected standard values. The cabinet is 7″ x 10″ x 6′ deep, with ample room for 500 resistors in the four drawers. Two handy, self-calculating resistor charts are provided for convenient reference. Ask your CONTINENTAL Carbon distributor for full details.

Send for Resistor Engineering Bulletin 104, free!

CONTINENTAL CARBON Inc.

13912 Lorain Ave., Cleveland, Ohio Toronto, Ontario

HAIL... THE NEW RANGER EXAMINER

- ★ Accurate to 2%
- ★ Molded Case
- ★ Selector Switch
- ★ With Test Leads and Two Alligator Clips

Pocket D.C. VOLT-OHM-MILLIAM-METER—Model 735

DEALER PRICE . . .

$10.80

A Sensational Development at a Sensational Price

Here is the handy, general purpose instrument you have always wanted . . . Precision built, D'Arsonval movement . . . Accurate . . . At the unbelievable price of $10.80.

Slips in the coat pocket, provides all the D.C. measurements required by the radio serviceman. The selector switch makes opeartion as simple as the larger multimeters.

Reads D.C. 15-150-750 volts at 1000 ohms per volt; 1.5-15-150 Milliamperes; .5-1000 low ohms; 0-100,000 high ohms at 1.5 volts.

MAIL COUPON NOW

RANGER EXAMINER

READRITE METER WORKS
617 College St., Bluffton, Ohio
Please send me more information on the Ranger-Examiner.....
Name .....
Address .....
City ..... State .....

HIGHLIGHTS . . .

THE ELECTRAD CONTACT

Electrad, Inc., 175 Varick St., New York City, publishes a magazine called "Contact." Service Men may obtain issues of this publication by returning two complete Electrad volume control cartons to the manufacturer.

•

PURCHASE PREMIUM PLAN

The Tilton Electric Corp., 15 E. 26th St., New York City, makers of the Ex-Stat line of volume controls and resistors, offer premiums to the Service Men who continue to use their products. Complete details of the plan as well as premium catalogues may be obtained at the above address.

•

WESTON REDUCES INSTRUMENT COSTS

Prices as much as 25 per cent less than previous levels on standard test equipment are made possible by a new policy in merchandising recently applied by the Weston Electrical Instrument Corp., Newark, N. J. No departure from previous standards will be made.

•

ISOLANTITE GRID INSULATION

The Raytheon Engineering Department reports the perfection of a method for spinning Isolantite grid cap insulation wafers into metal tubes designed for conversion and r-f amplification. The use of Isolantite in place of bakelite reduces r-f losses in the grid circuit of tubes like the 6A8, 6L7, and 6K7 to values equivalent to the lowest glass bulb losses.

It is recalled that Raytheon, working in cooperation with a phenolic insulation manufacturer, developed a phenolic material with losses midway between the original phenolic wafer and Isolantite. This improvement, announced in November of last year, is retained in the metal tubes used chiefly for audio work.

•

MILLER CATALOG

The J. W. Miller Co., 5917 S. Main St., Los Angeles, Cal., publish a catalog (No. 36) describing their line of coils, coil shields, r-f chokes, etc. Copies may be obtained directly from the Miller Co.

•

GHIRARDI ADVISES TELEVISION STUDY

A. Ghirardi, author of "Modern Radio Servicing," believes that the Service Man who has thoroughly mastered the principles of both electricity and radio and brought himself up to date in all his methods will have an overwhelming advantage when television is finally introduced to the public.

•

G.E. RADIO TOUR

Following the initial presentation of the G. E. Focused Tone Radio Line to the eastern G. E. distributers at Bridgeport, Conn., June 4, the G. E. Radio Division is conducting a nation-wide series of meetings to present the sets to dealers and their salesmen in each sales district.

CORNELL-DUBILIER APPOINTMENTS

The Cornell-Dubilier Corp., 4377 Bronx Blvd., New York City, announces the following appointments: Mr. R. W. Mitscher as sales representative for the state of New York with offices at 487 Ellicott Square Bldg., Buffalo; Mr. Stanley Walters, graduate engineer from M.I.T., has been appointed to the Engineering Department.

•

UTC BULLETIN

The research department of the United Transformer Corp., 72 Spring St., New York City, has completed a study of transmitter and p-a circuits and applica-

tions. This information has been compiled into an attractive 44-page illustrated bulletin. A limited number of copies will be available at local distributors for the nominal sum of 25c.

•

FERRANTI IN LARGER QUARTERS

Ferranti Electric, Inc., manufacturers of transformers, instruments, surge absorbers, etc., have just announced the removal of their executive and sales offices to larger quarters at 30 Rockefeller Plaza, New York City. Mr. W. R. Spittal, manager, stated that this move was necessary due to increased sales of Ferranti products.

•

OHIOHM INFORMATION SHEETS

Two information sheets giving interesting test data, dimensions and hookups for the Ohiohm series of auto-radio interference suppressors by the Ohio Carbon Co., 12508 Berea Rd., Lakewood, Ohio, are now available upon request.

•

VOLUME CONTROL CHECK TEST

To acquaint Service Men with recent refinements, Clarostat Mfg. Co., 285 N. 6th St., Brooklyn, N. Y., is asking interested parties to check the latest Clarostat units and report their findings. Standard Clarostat volume controls are being sent free to authorized Service Men requesting same together with a check test form to be filled out and returned to the manufacturer.

Any Service Man interested in making the check test may write to Clarostat for a volume control of either the wire-wound or the composition-element type, any resistance value and any standard taper.

GENERAL ILLUMINATING CATALOG

The General Illuminating Corp., 16 Calender St., Providence, R. I., have released a loose-leaf catalogue describing the complete line of General Exponential Equipment.

This interesting book illustrates all-aluminum trumpets, horn adapters, deflector baffles, stands, and cone speaker trumpets.

A copy will be mailed upon application.

•

ARCTURUS G ADDITIONS

Since introducing G tubes a year ago last April, the Arcturus Radio Tube Co., Newark, N. J., experiencing a demand for this line, has had to round out that series.

•

LENZ WIRE CATALOG

The Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago, publish a catalogue obtainable upon request. A novel feature of this catalogue is a chart showing the various uses to which each type of Lenz wire can be put in wiring a radio receiver.

•

EASTERN MIKE-STAND CATALOG

Eastern Mike-Stand Co., 56 Christopher Ave., Brooklyn, N. Y., manufacturers of "Eastern" microphone stands, announce a new catalogue describing their complete line of microphone stands.

Among the new items are listed a short circuiting switch-swivel unit and a shock absorber coupling.

A copy of this catalogue may be had by writing to the above address.

•

ASSOCIATIONS—Continued

Chicago Chapter

Mr. P. W. Kidd, of the Supreme Radio Service Company, will continue his series of informative talks on the popular subject of radio servicing. We can't give you his subjects, but we can promise you that they will be something you cannot afford to miss. Come on down and learn how another expert does it!

Baltimore Chapter

The *Baltimore Bulletin* continues to be a highly informative and interesting publication. Under the editorship of Mr. Wilmer B. Giese, whose prolific pen has captured the attention of large radio manufacturers, a great deal of the credit goes to him. The last issue came out with a bright green cover.

Detroit Chapter

The regular round table discussion of radio receiver troubles is being continued with great success. It is surprising how much a fellow can learn by attending these meetings and taking part in these discussions. So any of you members who have some technical problem, or a particular receiver giving you difficulty, let us know what it is. We will all take a hand in trying to "iron" it out.

P. J. Murray—NRI News.

THE MANUFACTURERS . . .

OPERADIO TURRET PROJECTOR

There are many instances where directional sound projection calls for a horn. Operadio model 42 was designed and built to adapt a dynamic cone speaker to this type of horn service.

Specifications and further details may be had by writing to Operadio Mfg. Co., St. Charles, Ill., for catalog 10-E.

•

SMALL CANNED ELECTROLYTICS

The lasting quality of the metal-can electrolytic, together with a marked reduc-

tion in bulk for a given capacity, is achieved in a new line of dwarf units just announced by Aerovox Corp., 70 Washington St., Brooklyn, N. Y.

•

WEBBER SERVICE LABORATORY

The Engineering Department of Earl Webber Company, 1217 Washington Blvd., Chicago, has announced a complete radio service department on wheels, known as the Webber Official Radio Service Laboratory.

For complete details write for bulletin R9.

•

TRIMM HEARING AID EQUIPMENT

The Trimm Radio Mfg. Co., 1770 W. Berteau Ave., Chicago, manufacture a complete line of hearing aid amplifiers for individual and for group use. They also feature a complete line of hearing aid equipment such as earphones, microphones, remote control boxes, etc.

Complete information on these items can be obtained from the manufacturer.

•

TACO ANTENNA KITS

The Technical Appliance Corp., 17 E. 16th St., New York City, announce two all-wave antenna kits. The standard type 500 and a deluxe type 200. Both are completely assembled at the factory. Armored

copper wire is used for the aerial sections. An automatic switching set coupler is used.

Complete information is available from the factory.

INTER-COMMUNICATING SYSTEM

The Bell Sound Systems, 61 E. Goodale St., Columbus, Ohio, introduces a new line of intra-department communicating systems under the trade name of Belfone.

With a combination of three standard units and very simple wiring a number of variations of multiple hookups can be provided.

Complete details can be obtained from the manufacturer.

•

PORTABLE SERVICE LABORATORY

Model 1206 Triplett Master Unit Test Set is a complete radio service laboratory in portable form. Included in the master set are Models 1200 volt-ohm-milliammeter; 1210-A tube tester; 1220-A free point tester; and 1231 direct-reading all-wave signal generator.

Complete information may be obtained from the Triplett Electrical Instrument Co., Bluffton, Ohio.

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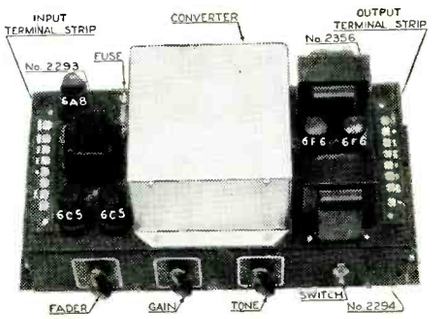
STENTORIAN AMPLIFIER

The General Transformer Corp., 500 S. Throop St., Chicago, has added a 15-watt



high-gain amplifier nucleus to their line. A bulletin describing the kit may be obtained upon request.

•

CONTINENTAL BATTERY CHARGER

Continental announces a new self-starting gasoline-driven six- and twelve-volt battery charger and auxiliary lighting plant unit designed principally to be used as a battery charger for battery operated radio sets.

Complete information can be obtained from the manufacturer, Continental Motors, Detroit, Mich.

•

BRUSH CRYSTAL HEADPHONES

The Brush Development Co., East 40th St. at Perkins Ave., Cleveland, Ohio, has just announced the introduction of two new models of Brush crystal headphones to supplement the Brush Type A 2-phone model.

Additional information may be obtained from the manufacturer.

•

MUSIC MASTER SOUND SYSTEMS

The Turner Co., Cedar Rapids, Iowa, features three complete sound systems each designed for portable use. Power ratings are from 12 watts on the smallest to 20 watts on the largest. Complete description of these "Music Master" systems can be had from the manufacturer.

WARD RUNNING BOARD ANTENNA

The Ward Products Corp., 2135 Superior Ave., Cleveland, Ohio, feature a streamlined running-board antenna. The entire antenna is rubber covered and has a moulded rubber lead wire connection. A special type of mounting bracket eliminates the necessity of drilling the running board.

•

WRIGHT-DE COSTER EXTENSION SPEAKER

The Wright-DeCoster eight-inch Nokoil Reproducer has been housed in the cabinet illustrated for use as an extension speaker in connection with any auto-radio receiver. The speaker is equipped with a

universal output transformer which matches all output tubes.

Complete information can be had from the manufacturer.

•

TOBE BRIDGE

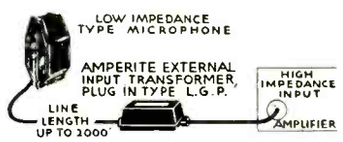
A bridge designed about the 6E5 cathode-ray tube offers visual null indication in the measurement of inductance, capacitance and impedance. The bridge, manufactured by the Tobe Deutschmann Corp., Canton, Mass., is completely self-contained, comprising the usual standards, ratio arms, 60- and 1200-cycle oscillators, power supply, amplifier and indicator tube. In addition to the 6E5, a 6J7 is employed as the dual frequency oscillator, while an 84 is used in the rectifying circuit.

The sensitivity of the electric eye is adjustable, facilitating a rough balance, and providing the sensitivity desirable for a precise null. The range of the bridge is from 2 mmfd to 100 mfd in capacity; from a fraction of one ohm to one megohm in resistance; and from 10 microhenrys to 100 henrys of inductance.

•

AMPERITE CABLE TYPE TRANSFORMER

The Amperite Corp., 561 Broadway, New York City, offer a cable type of external input transformer designed to operate low-impedance microphones directly into amplifiers having high-impedance input. It permits the cable of the low



impedance microphone to be any length up to 2,000 feet.

Additional information can be obtained from the manufacturer.

Send for general catalog. Also sample copy of monthly Research Worker.

Handy Handful

Just that! Compact cardboard case PBS series electrolytics for general use. Reliable. Inexpensive. • Single, dual, triple section units. 200 and 450 v. working. Popular capacities. • Ideal for AC-DC midget set replacements. Also for experimental hookups. • Ask your dealer for the PBS line.

AEROVOX

CORPORATION

80 Washington Street Brooklyn, N. Y.

JUST OFF THE PRESS!

SIX PAGE CATALOGUE

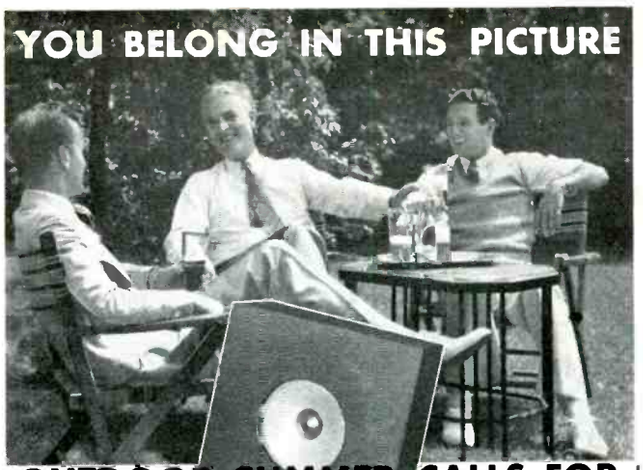
DESCRIBING MOST COMPLETE LINE OF QUALITY

Mike Stands

Write for Your Copy to:

EASTERN MIKE-STAND CO.

56 CHRISTOPHER AVENUE BROOKLYN, N. Y.



OUTDOOR SUMMER CALLS FOR *Magic Magnet Extension Speakers*

THE tremendous extension speaker market, practically untapped and highly profitable, is opened to the servicing field for the first time on a practical basis by the Cinaudagraph Magic Magnet Speakers.

Every owner of a radio receiver (and there are some 22,000,000 in America!) is a prospect. For porch, garden, bedroom, for every spot not reached by the set. They're a cinch to sell—these Magic Magnet Speakers with their high fidelity characteristics, sturdy construction, and simple installation features—only two wires being required for hook-up.

Extension speakers have proven a boon in England. Why not here? Just try selling your customers on the idea. You will be surprised at the response. *Details sent on request.*

CINAUDAGRAPH CORP. • STAMFORD, CONN.
Speaker Div. Dept. "A"

CINAUDAGRAPH

Here Next Month:

Tru-Fidelity

by

THORDARSON

Most Sensational Audio Development in Radio History

"NOISE-MASTER"

Makes every receiving set a BETTER set

Electrically AUTOMATIC in operation

LIST PRICE **$6.75**

Also available with special transformers for European broadcast bands . . . list $7.00

Eliminates static on both broadcast and shortwave bands.

CORWICO

QUIET is what the set-owner craves, and here's the way to give 'em what they want. This A.A.K. licensed product, designed and engineered with typical CORWICO thoroughness, needs no manual operation after a qualified service-man has adjusted it. It eliminates noise and improves reception EVERYWHERE. Use it on your next installation!

Write for descriptive literature on this and other CORWICO units.

Cornish Wire Co., Inc.

30 Church Street New York City

GET ON THE LIST FOR THESE BIG FREE CATALOGS

• The four mastheads, illustrated show the four big catalogs sent to every Burstein-Applebee customer this year. Each catalog is brim full of latest information and lowest wholesale prices on Radio, Electrical and Refrigeration Equipment. Write today—get your name on the list to receive every Burstein-Applebee catalog issued.

BURSTEIN-APPLEBEE CO.

1012-14 McGee Street Kansas City, Missouri

INDEX TO ADVERTISERS

I WILL GIVE YOU Both THESE SUPREME INSTRUMENTS FOR ONLY $9.50 DOWN + $8.49 PER MONTH

Your Parts Jobber

189 SIGNAL GENERATOR

Supreme 189 Signal Generator — both modulated and unmodulated — self-contained 400 cycle audio oscillator — unusual frequency stability through special electron-coupled circuit — carrier frequencies directly calibrated. Only $4.00 DOWN and $3.66 PER MONTH.

It is no longer necessary to save money to buy a SUPREME. Get the instrument now and pay for it on the easiest possible terms while you use it. Ask your Parts Jobber or write the factory about the S. I. C. Easy Payment Plan. Everybody's doing it!

SUPREME INSTRUMENTS CORP. GREENWOOD MISS., U. S. A.

EXPORT DEPT., ASSOCIATED EXPORTERS CO., 145 W. 45th STREET, NEW YORK, N. Y., CABLE ADDRESS: LOPREH, N. Y.

Here's a new

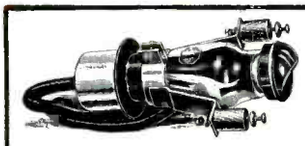
RCA AUDIO OSCILLATOR

...essential in service work

AND AVAILABLE ON EASY TERMS*

Every shop needs an audio oscillator. For instance, when trying to locate a speaker rattle without one, you have to tune in a program and wait until the rattle frequency happens along. With the oscillator you just run up and down the scale until you hear the rattle. You do the job in a few minutes, impress the customer, earn your fee in quick time. Other uses: checking P. A. systems, demonstrating fidelity, testing transformers and amplifiers, determining frequencies observed on screen of RCA Oscillograph. Also used in conjunction with RCA Test Oscillator. Case is same size as the latter instrument . . . This new RCA Audio Oscillator is an outgrowth of the famous $215 laboratory model RCA Audio Oscillator, designed and made by same engineering and factory staff. Price made possible by quantity production. Now ready for delivery. Ask your distributor for complete information.

New RCA Beat Frequency Oscillator has many features not obtainable elsewhere. Wider frequency range, 30 to 15,000 cycles. Tapped output transformer permits matching impedances of 5,000, 500 and 250 ohms, all balanced to ground. Easily and quickly calibrated at 30, 60, 120, 180, 240 cycles, with neon indicator. Entirely AC operated. Output 60 milliwatts. Weight only 10¾ pounds. Contains 4 new-type RCA acorn tubes, plus rectifier. Tubes alone cost $20.35. Complete with tubes ready to operate, $64.50 f.o.b. Camden, New Jersey.



For your customers who want to

TUNE BY EYE

RCA offers a genuine RCA Cathode Ray Tuning Indicator Kit. Can be installed in almost any receiver that has automatic volume control. The kit is complete, everything you need, including tube, socket, cable, clamp and bracket, escutcheon. Easily and quickly installed. Price $3.00. Stock No. 9688.

★ See your RCA Parts Distributor for RCA Test Equipment now available on an attractive time payment plan. Parts Division, RCA Manufacturing Co., Inc., Camden, N. J.

1935 VOLUME of *RCA Victor Service Notes* NOW READY!

Includes not only all the RCA Victor Service Notes, but a wealth of technical charts and data. Substantially bound in durable cloth. Price $1.00 f.o.b. Camden.

RCA Parts