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Twelfth Year 578th Consecutive Issue

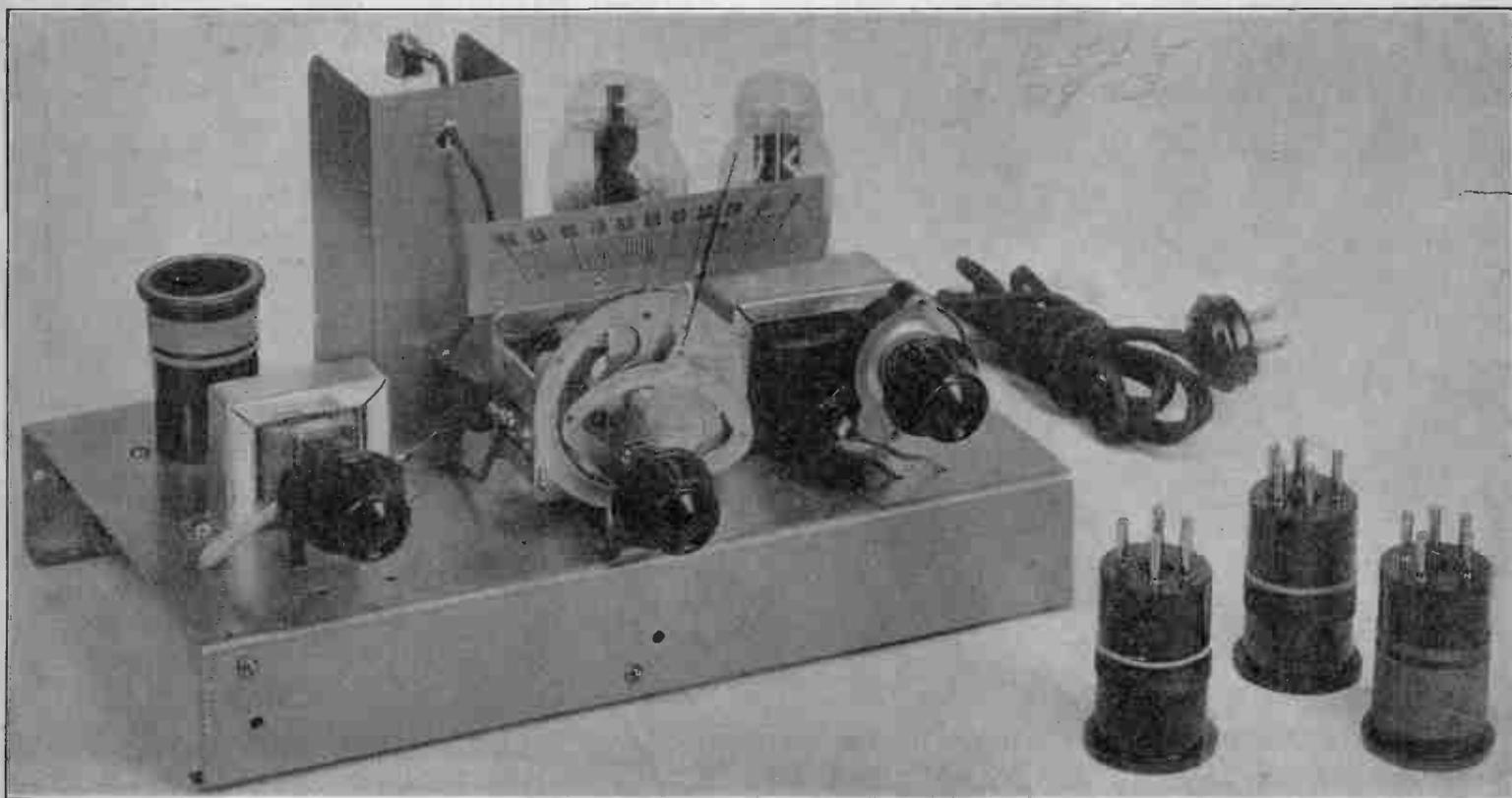
4 - TUBE AUTO SET

Using 6A7, 6B7, 75 and 89

HOW TO USE

2B7, 6B7, 55, 75, 77 and 85
In Resistance Audio

3-TUBE, AC-DC SHORT-WAVE SET



An inside view of the "Prizewinner" short-wave receiver, showing the arrangement of the parts.

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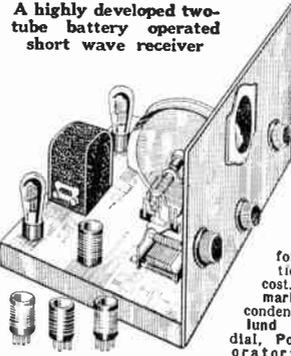
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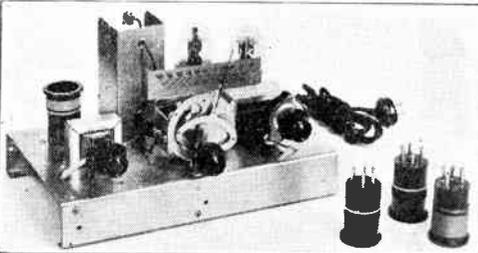
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4-TUBE AUTO SET

By J. E. Anderson

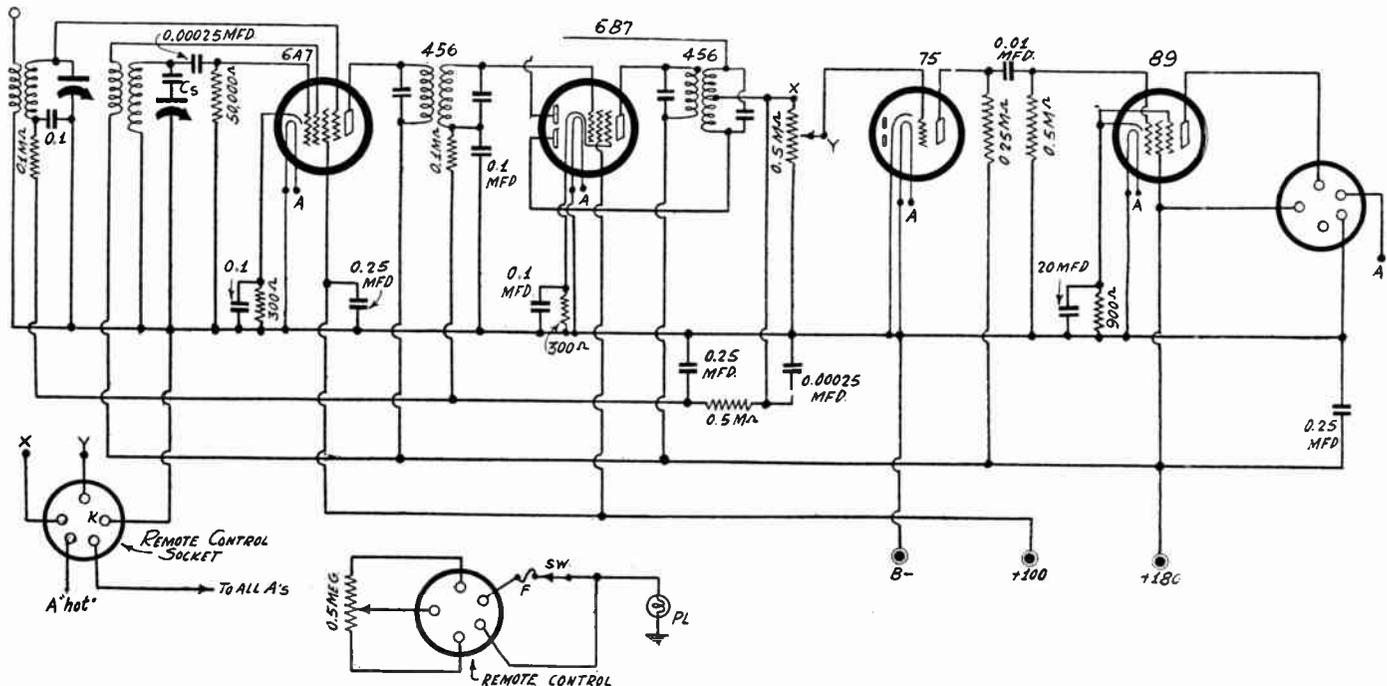


FIG. 1

The diagram of a four-tube automobile superheterodyne, which is equivalent to a six-tube set with ordinary tubes.

THERE is constant demand for small receivers, sets using only a small number of tubes. Yet these receivers must be sensitive and selective. It cannot be expected that a set having only four tubes, say, will be as sensitive as one having eight or ten, but the introduction of the new and improved tubes has made it possible to design a receiver of four tubes

that is quite sensitive, and a superheterodyne receiver at that. The diagram of such a circuit is shown in Fig. 1.

Those who have read the description of the automobile receiver in the April 15th issue will have noticed that the two are designed along the same line, except that in the present circuit two of the amplifiers have been omitted. The omitted tubes are

one r-f amplifier and one i-f amplifier.

Although the circuit has only four tubes it is the equivalent of one having six of the older tubes. No, it is better, for the tubes are better. In the first stage is a 6A7, used for the dual purpose of oscillator and first detector. This tube has a remarkably high conversion efficiency when

(Continued on next page)

LIST OF PARTS

Coils

One shielded r-f tuning coil for 350 mmfd. condenser.
One shielded oscillator coil, as described
One shielded 456 kc doubly tuned i-f transformer without center tap
One shielded 456 kc doubly tuned i-f transformer with center tap

Condensers

One gang of two 350 mmfd. condensers
One padding condenser, adjustable to about 345 mmfd.
Two 0.00025 mfd. condensers

One 0.01 mfd. condenser
Four 0.1 mfd. by-pass condensers
Three 0.25 mfd. by-pass condensers
One 20 mfd. electrolytic by-pass condenser
One 0.006 mfd. condenser across 89 output (optional but recommended)

Resistors

Two 300-ohm bias resistors
One 900-ohm bias resistor
Two 0.1-megohm resistors
One 50,000-ohm grid leak
One 0.25-megohm resistor
Two 0.5-megohm resistors

One 0.5-megohm potentiometer (built into remote control)

Other Parts

Two five-contact sockets, one for remote control and one for speaker
Two six-contact sockets, one for 75 and one for 89
Two small seven-contact sockets, one for 6A7 and one for 6B7
Four grid clips
One four-lead cable
One automobile loudspeaker for 89 tube
One chassis and a remote control

(Continued from preceding page)
operated under correct conditions. And it has the advantage over autodyne circuits in that the oscillator and the detector components of the tube can be adjusted independently for optimum operation. The oscillator can be a good oscillator and the detector a good detector. It is not necessary to compromise by having a single tube do the work of two in an indifferent manner.

Simplification of Oscillator

A simplification of the oscillator coil is also possible by the use of the 6A7 because it is not necessary to provide for any coupling between the oscillator and the detector. That eliminates the pick-up winding on the coil. The coupling is automatically provided for by the arrangement of the electrodes inside the tube.

There is a 50,000-ohm grid leak in the oscillator circuit. This is a value recommended by the manufacturers of the tube. There is also a 0.00025 mfd. grid stopping condenser in the grid leak. These values of grid leak and stopping condenser have been found to give a good stable oscillation with grid leak blocking.

There is a 300-ohm bias resistor in the cathode lead of the tube and this is shunted with a condenser of 0.1 mfd. This bias is used mainly for the detector part of the tube to establish a minimum operating bias. It does not appreciably affect the oscillation.

The oscillator is of the tuned grid type, and the series padding condenser is placed on the high potential side of the tuning condenser. This is a sensitive position and in adjusting it a screw-driver with a long insulating handle should be employed. There are two ways of wiring this condenser, and one is considerably better than the other in respect to sensitiveness to body capacity. The side to which the screw is connected should be connected to the stator of the variable condenser, for the stator is at a lower potential than the grid.

In wiring the oscillator the mistake of connecting the grid to the stator should not be made, for if that is done, the circuit may not oscillate at some settings of the tuning condenser. The intensity of oscillation will be more variable, being weakest at the low frequencies.

The Tuner

For tuning the circuit a two-gang condenser, 0.00035 mfd. per section, is used. It has been found that a superheterodyne with this type of tuner is adequately selective provided a high intermediate frequency is used. For station separation there will be ample selectivity in the intermediate selector and the main function of the r-f tuner is to suppress images. It requires no great r-f selectivity to do this when the intermediate frequency is high.

Since there is only one r-f condenser there is only one r-f tuning coil, and that is the antenna coupler.

While this tuner has been designed for padding, a tracking condenser can also be used, provided that it has been designed for the intermediate frequency employed, and also provided that the oscillator coil has been designed for this condenser and this intermediate frequency. This writer prefers the padding method because it is more flexible. It is much easier to change the inductance of a coil by adding or removing turns than to change the capacity of a variable condenser. By the padding method the variable condenser can, in effect, be changed by changing the series padding condenser.

For an intermediate frequency of 456 kc, with an r-f inductance of 245 microhenries, the inductance in the oscillator should be 136.5 microhenries and the series padding capacity should be 345 mmfd. A condenser of rated range of 350-450 mmfd.

will just about fit. However, if the capacity cannot be made low enough two methods are available for getting the right capacity. A large fixed condenser, say 1,000 mmfd. can be connected in series with the 350-345 adjustable condenser, or a fixed condenser of about 250 mmfd. can be connected in parallel with a small trimmer condenser of about 100 mmfd.

Design of Oscillator Coil

If the oscillator winding is put on a one-inch form and wound with No. 32 enameled wire, 80 turns will be needed. This is the inductance when the coil is not in a shield. Since the shield will reduce the inductance by about 8 microhenries, the number of turns should be increased by two or three. This assumes that the shield has a diameter of about 2.5 inches.

The tickler winding can consist of about 50 turns of the same size wire wound over the tuned winding. It should be placed near the ground end and there should be a separation of at least 1/32-inch, and the insulation may be empire paper or cloth or even wrapping paper soaked in paraffine.

The end of the coil that is farthest away from the tickler should be connected to the grid and the other end of that winding to ground. The terminal of the tickler that is near the ground end of the form should be connected to the anode and the one in the middle to B plus. This assumes that the two windings are in the same direction, that is, either right-handed or left-handed.

Operation of Second Detector Tube

The 6B7 is first used as an intermediate frequency amplifier and then as a diode detector. A 300-ohm bias resistor is connected in the cathode lead and is shunted with a condenser of 0.1 mfd. This bias resistor is desirable from the point of view of the amplifier but not for the detector. However, due to the very high amplification constant of the pentode, the bias is very low and therefore the handicap placed on the diode is of no importance. From one point of view the handicap is even desirable because to some extent it limits noise.

The output of the diode is delivered directly to the grid circuit of a 75 high mu tube. In this the two diode plates are not used.

Automatic volume control is used, and the automatic bias is taken from the diode load resistance as usual. The only two grids that can be controlled automatically are those of the 6A7 and the 6B7 and accordingly these grids are returned to the load resistance, first through 0.1-megohm individual filter resistors and then through a common 0.5-megohm resistor. This third resistor is necessary only to prevent the audio frequency signal from being short-circuited through the necessary by-pass condensers. There are through of these associated with the automatic bias arrangement. There is a 0.1 mfd. condenser for each 0.1-megohm filter and then there is a common 0.25 mfd. by-pass.

The 0.00025 mfd. condenser placed near the 0.5 megohm resistor is for the purpose of by-passing the i-f ripple around the input potentiometer to the 75 a-f amplifier.

Manual Control of Volume

The manual volume control is put in the input circuit of the audio amplifier. Physically, it is in the remote control unit. The designations "X" and "Y" show the proper connections to be made between the control unit and the circuit. The 0.5-megohm potentiometer appears twice in the diagram, once in the circuit and once in the remote control insert. There will, of course, be only one in the circuit. If the set is not to be controlled at a distance from the set the proper connection

is indicated directly on the circuit diagram.

There is a special reason in the circuit for connecting the manual control in the input to the a-f amplifier and not in the r-f portion of the circuit, as has been done in many other sets of the same general type. The 75 is a high mu tube and if it is overbiased it will not amplify at all. On strong signals it might become overbiased before the automatic volume control has had a chance to cut the signal down sufficiently. Or the a.v.c. might not be able to reduce the signal enough before the drop in load resistance is so high as to cut off the current in the 75 completely. When the manual control is put in the grid circuit of the 75, it is always possible to move the slider down where the bias is right regardless of how great the total drop across the resistance is. There is no danger of overloading the two preceding tubes because the a.v.c. will handle the gain in respect to them.

Ample Bias For Signal

Neither is there danger of not having enough bias on the 75 for the signal, not as long as the modulation is not excessive, and if it is, no manipulation of the volume control would help it. The bias will always be greater than the amplitude of the signal voltage, regardless of how near the ground the slider of the potentiometer may be.

The 75 is capable of a high voltage gain when operated under the voltage and load conditions indicated. It will be at least 50 times, and the output voltage possible before overloading of the grid of the 75 occurs will be much greater than that required by the grid of the 89 when that is operated at maximum permissible input. There will be at least a 2-to-1 margin. Thus the weakest link in the chain is the power tube, and that is as it should be. "Weakest" in this sense has nothing to do with the power handling ability of the 89. If the signal peak is of the order of 17 volts, the power output will be close to 1.5 watts.

The grid of the 89 is slightly overbiased by the use of a 900-ohm bias resistance. This is in the interest of low current drain from the B supply. It is not so much overbiased that the quality will suffer.

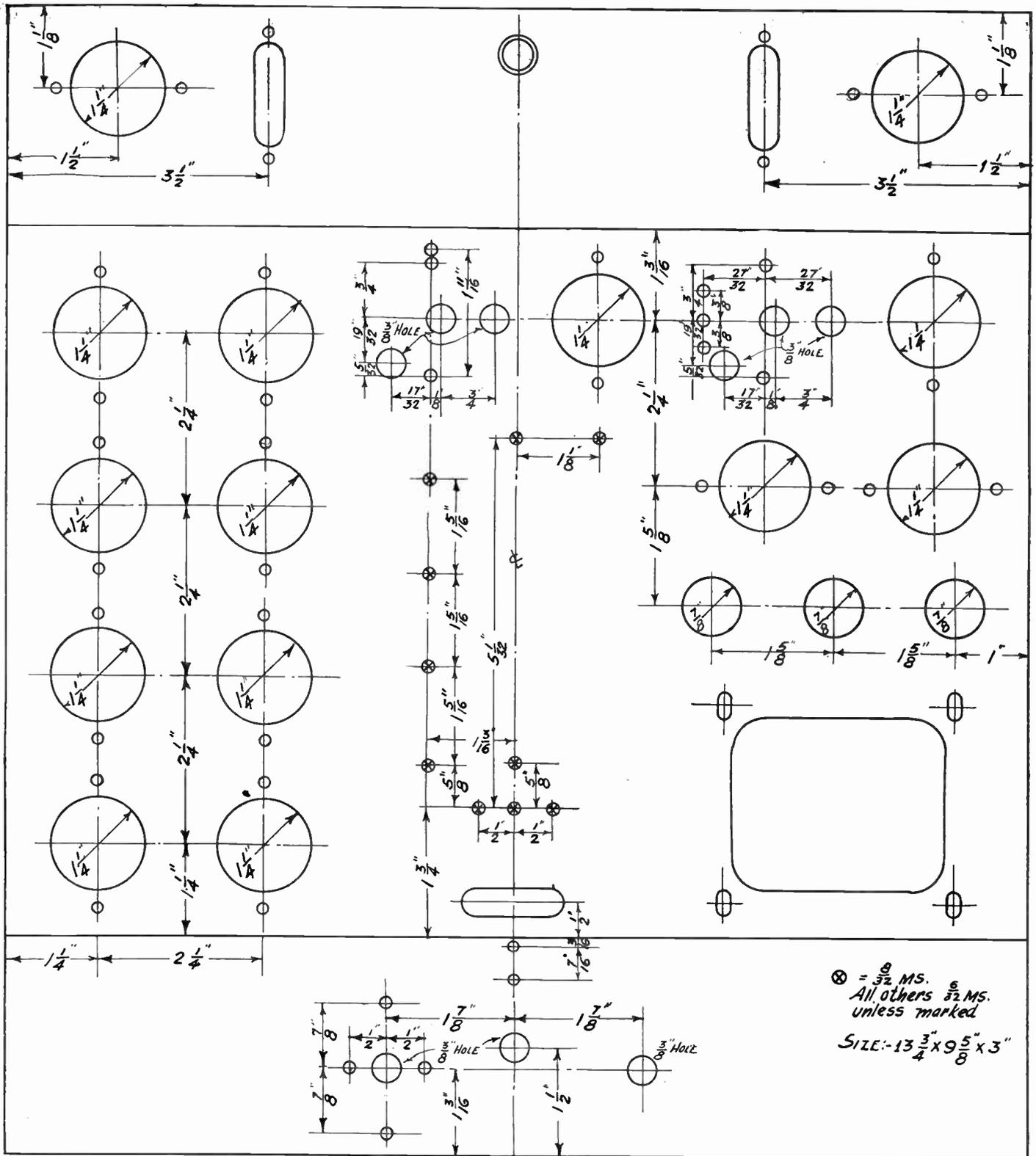
I-F Coils

Two intermediate frequency coils are required, and both should be doubly tuned. The second has a centertapped secondary to permit the use of full-wave detection in the diode circuit. The fact that full-wave detection is used makes the by-pass condenser across the load resistance particularly effective.

The intermediate coils are tuned to a frequency of 456 kc for several reasons. One has already been referred to, namely, the suppression of images by a single r-f tuner. Another reason for the choice is minimization of squealing due to harmonics of the intermediate frequency. There may be a squeal at 912 kc, but it will not be strong and it can be avoided by slight detuning whenever it interferes with the reception of 910 kc. That is the only channel with which interference could result due to the second harmonic. But there may be another squeal 1,397 kc. This will be still weaker and if it should interfere with the reception of 1,380 kc. it may be avoided by slight detuning. There will be no other chances for interference of this type for the next harmonic will be outside the tuning range. Had the frequency been much lower there would have been many other chances for interference.

A practical reason for the choice of this frequency is the availability of the coils. The frequency is coming into use and manufacturers are turning out the necessary coils.

(Continued on next page)



For the remarkable 8-tube receiver, which has as great sensitivity as the 12-tube Diamond but of course not as great power output, the above chassis is used. The size is $13\frac{3}{4} \times 9\frac{1}{2} \times 3$ inches.

(Continued from preceding page)

The modulator dial settings may be taken as correct, since they were based on inductance selected for the low-frequency end, and obviously the high frequency end was easily reached, allowing in the so-called broadcast band tuning also some police and amateur reception, although the capacity increase was very small at the high frequency end, and the attainment of 1,450 kc at 25 did not mean that any great excess would obtain beyond the highest frequency in the broadcast band.

Looking at the dial settings, it is obvious that at the lowest frequency tested the dial settings were fairly close, while at the next lowest test frequency they were a little farther apart, and as the frequency increased so did the difference. However, the oscillator required more

capacity at the lowest extreme, immediately required less capacity (next test frequency) and from then on much less capacity, with difference increasing with frequency, and always in the same direction.

Low-Frequency Adjustment

The place to read the answer is at the high frequency end, because the inductance is the predominating factor here, and since the oscillator dial numbers were too low by far, and would be increased if the inductance were reduced, it was a plain case of too high inductance. The padding condenser has very small effect on this part of the scale, so taking 1,450 kc, a common tie-down point for super-heterodyne padding, the oscillator was put at 25, instead of 13, to match the 25 setting of the r-f tuning, and turns taken

off, one at a time, until the station came in at the previously measured volume level. It was then assumed that the inductance was correct, and a check would result if the padding capacity were increased to accommodate the oscillator requirements at the usual 600 kc setting.

So a 100 mmfd. variable condenser was put across the 0.00035 mfd. fixed condenser in the pad, and adjusted for maximum response, whereupon a measurement was taken of the two circuits (r-f considered as one, oscillator as the other) and the tracking was found to be off not more than 5 kc at any point, which is negligible, and on the dot at the majority of points, taking 32 test frequencies. When these results were communicated to two curves, the 5 kc difference was never exceeded on paper and the absolute identity of dial settings was preserved as to the ma-

jority of the points on the curve, which points now registered more than 100. That is, the circuit tuned from 540 kc to higher than 1,540 kc.

The high frequency extreme will not always be exactly the same, due to slight differences in capacity arising from wiring, insertion of a short-wave switch, d-c voltage differences, tube differences, etc., but of two such receivers built, both exceeded 1,575 kc a trifle, on which frequency there is a police transmitter. Next the padding condenser was measured. It proved to be 390 mmfd.

Second Harmonic Elimination

With padding so nicely done it would be pleasant to report that without further to-do the circuit was tuned throughout the scale and not a squeal was heard. But this was not quite the case. There was one squeal that could not be corrected except by woeful mistuning of one or more circuits, and there was another small disappointment, the registration of reception of 710 kc where 1,420 kc should come in. It will be observed there was a station on 1,400 kc, and since there was a second harmonic somewhere, a check could be made for the 1,420 kc position on the dial. It was correct to a nicety, but of course it was a 710 kc station coming in as a second harmonic.

Some theoretical investigation of this condition was made at once. The r-f level of 710 kc should be blotted out by the tuner, and this was assumed accomplished. The frequency of the oscillator, to bring in 1,420 kc, was 1,885 kc, and no relationship of harmonics of oscillator and modulator seemed to account for the reception, although of course there was harmonic generation in the receiver.

It was then suspected that the 710 kc frequency was introduced into the modulator directly, because it was the frequency of the strongest local station, and that the second harmonic was present, 1,420 kc, due to some wrong bias or other cause, and the oscillator was generating it correct frequency, 1,885 kc, to yield 1,420 kc response.

Harmonics Eliminated

Therefore, the modulator was investigated, and it was found that a trial resistor of 20,000 ohms placed in series with the grid of the oscillator and the screen of the modulator was effectively in circuit, as a shorting strap that had been applied when this reduction of oscillator voltage to the modulator screen had been found bad practice had fallen off. The resistor and strap were removed and the connection made securely, when the 1,420 kc response from the 710 kc carrier was eliminated. The screen voltage on the modulator (which is exclusively oscillation voltage) had been too low.

Now no harmonic response from the receiver could be obtained. A test oscillator was set to beat with second harmonics of frequencies to which the receiver was tuned, test oscillator coupled to receiver, but there was no response. To work the oscillator its frequencies were determined from the receiver. Fundamentally, and harmonics of the test oscillator were heard at the fundamental positions in the receiver. This showed that the set generated no harmonics but that the test oscillator did.

There was a squeal at about 1,150 kc in the set, but it was found that this was not always present, and also a squeal would appear now and again at some higher frequencies. It was easy to determine that there was intermittent oscillation at the r-f level, and consequently the screen voltage was reduced a little, and the primaries, originally 15 turns wound over secondaries, were reduced to 12 turns. Then the trouble disappeared. Without primary reduction it disappeared also if a long aerial was used, but the trial aerial consisted of only six inches of wire, as the idea was to stabilize the circuit without the aid of the resistance of a long aerial, so that any who would use a short

aerial would not run into squeal trouble.

After those corrections—full oscillation voltage applied to the modulator screen, and smaller primaries and somewhat lower screen voltage on the r-f tubes—the troubles from squeals were no more. There was not a squeal at any setting, due to the receiver, although of course the faint squeals heard on any and all sets due to stations in foreign countries 5 kc removed from stations in this country were occasionally heard.

The smaller primaries also stabilize the operation on short waves, since there is a switch to bring in what is termed 70-200 meters, although actually the short-wave spectrum does not go up to 200 meters, nor need it, since the broadcast tuning dips below 200 meters. The two should just meet or slightly overlap.

The voltages and resistances have been selected on the same experimental basis as the coils. Of the pigtail high resistors in the circuit, the actual values in the model measured, as compared to the commercially rated values were:

Rated Value	Actual Value
3,500 ohms	3,000 ohms
25,000 ohms	21,000 ohms
60,000 ohms	54,000 ohms
4,200 ohms	3,800 ohms
250,000 ohms	221,000 ohms

These resistances do not have to be critically close to the specifications, and the rated values are close enough to the actual for purposes of full benefit of performance from the receiver.

The actual voltages for the B supply do not have to be as high as indicated, as a transformer was used that gave 770 volts a.c. across the high-voltage winding at 65 ma. This affords half the total ac input to the rectifier, or 365 volts a-c.

Voltages Measured

As to d-c values, from rectifier filament to ground, 450 volts were read; across the field of 2,500 ohms, 150 volts were read, and the output of the filter was the difference, or 300 volts. That the 3,500-ohm resistor (actually 3,000 ohms in the measured instance) dropped only 30 volts proved that five tubes and their bleeder resistors drew only 10 milliamperes, which is working the tubes at extra low drain. The total B current, bleeder and all, should run around 65 ma, depending largely on the current in the power tube, which in this circuit is shown as being plate-voltaged at 300 volts, with a negative bias of 20 volts, rather than 250-16.5 as the voltage combination, the reason being the slightly better suitability of 20 volts for the positive voltage on the 2B7 screen with 250,000 ohms as the plate load resistor of the pentode of the 2B7, with 300 volts on 2B7 also.

Some will use transformers affording lower voltage, but will not be too low, if there are 700 volts a-c across the high-voltage winding.

The whole circuit is exceedingly simple and follows standard practice in general, but the oscillator is special, as it is to have a rectifier component. Because of the unusual nature of this circuit it is

shown without rectifier being effective, in that grid is returned directly to ground without intervention of a bypassed resistor common to the grid and rectifier circuits. The reason is that it was deemed advisable to get the circuit working properly without the rectifier, and then make the slight addition.

The oscillator was measured for bias change with frequency change, and it was found that the bias was 21.5 volts at 530 kc and fell gradually to 20 volts at 1,200 kc, rising again, this time to 20.5 volts, at 1,500 kc. This in effect measures the relative change in the oscillation amplitude, being 1.5 volts at extremes of voltage, out of 21.5, or about 7 per cent. Why the bias should change in the direction stated is not definitely known, although the action at 1,200 kc was no doubt due to the effect of the mutual impedance of tickler and grid windings.

So the circuit was measured for grid current, with a 600,000-ohm resistor in series with the grid circuit, and deflections of from 17 microamperes at 530 kc to 60 mca at 1,500 kc were noted, with the direction of change interrupted at 1,200 kc. These values, assuming the resistor was always in the circuit, meant voltage changes of from 10.2 to 56 volts, these adding to the steady bias value of around 20 volts.

It is not desirable to have grid current, and it might be eliminated by using a higher value of series resistor in the heater circuit of the oscillator, but then the danger arises of the oscillator not being self-starting. It was found that 0.6 ohm preserved the self-starting feature, although it did not remove the operating point on the characteristic sufficiently to assure saturation on the negative portion thereof, otherwise there would have been no grid current. However, a grid suppressor helped, in that it diminished the intensity of the oscillation more at the high than at the low frequencies, and is shown as 5,000 ohms.

High Grid Impedance

This combination leaves to the rectifier the work of augmenting the bias sufficiently to overcome completely any and all grid current. The whole theory of the frequency-stabilized oscillator is that the grid impedance should be infinite, or, if that can not be attained, at least that the grid impedance be very large compared to the plate impedance. It can be sufficiently large without difficulty, as the grid current can be limited to 2 microamperes without rectifier, so with rectifier it can be practically eliminated, for the rectifier will provide additional bias proportional to the increase in amplitude, and therefore the oscillator circuit becomes self-leveling.

The values are not given for the rectifier adjunct of the oscillator, for the reason stated, that the circuit should first be built with oscillator unstabilized. Directions will be given in a subsequent issue for effectuating the stabilization. And when the oscillator is frequency-stabilized it will not change its frequency at any setting and will afford the same frequency at the same setting any and every time.

Coil Data for Circuit

R-F secondary inductance, 230 microhenries; 119 turns on No. 32 enamel wire, tapped at 22 turns from ground end.

R-F primary inductance, 7 microhenries; 12 turns of No. 32 or other similar wire wound over secondary, near bottom.

Separation between primary and secondary, 0.02 insulating fabric.

* * *

Oscillator secondary inductance, 124 microhenries; 75 turns No. 32 enamel wire, tapped at 19.5 turns.

Oscillator tickler, 10.5 microhenries inductance; 15 turns of No. 32 enamel or similar wire wound over secondary, near bottom.

Oscillator rectifier winding, 31.5 microhenries inductance; 30 turns No. 32 enamel or equivalent wound next to secondary, not over it.

Separation between secondary and tickler, 0.02 insulating fabric; between secondary and rectifier windings, 1/16 inch.

Form diameters are 1" outside, tuning condenser is 410 mmfd., padding condenser is 390 mmfd. Correct inductance values are given, but no allowance made of inductance drop due to shielding, as this differs with size and material of shields. Short-wave padding condenser, 0.0024 mfd.

TUBE TABULATION

For Operating 2B7, 6B7, 55, 77 and 85

6B7								
Plate Supply Volts	Grid Resistor Megohms	Bias Volts	Self-Biasing Resistor Ohms	Screen Supply Volts	Plate Load Megohms	Plate Current Ma.	Peak Out. Volts	Volt Amplif.
100	0.25	-2.00	5550	20	0.25	0.27	28-30	35
100	0.25	-2.50	12200	20	0.50	0.15	25-27	36
100	0.50	-2.15	9350	20	0.25	0.23	36-38	47
100	0.50	-2.60	19250	20	0.50	0.13	32-33	46
135	0.25	-1.80	3800	20	0.25	0.35	38-40	36
135	0.25	-2.25	8300	20	0.50	0.20	32-35	38
135	0.50	-1.95	4850	20	0.25	0.30	48-50	53
135	0.50	-2.40	10900	20	0.50	0.16	42-44	56
180	0.25	-2.10	3700	25	0.25	0.43	50-53	50
180	0.25	-2.60	7600	25	0.50	0.26	45-48	53
180	0.50	-2.10	3500	25	0.25	0.45	65-68	63
180	0.50	-2.60	7300	25	0.50	0.26	64-66	70
75								
100	0.25	-1.05	10500	-	0.25	0.10	11-16	30
100	0.25	-1.05	15400	-	0.50	0.07	10-14	29
100	0.50	-1.10	11550	-	0.25	0.09	15-19	36
100	0.50	-1.05	15000	-	0.50	0.07	14-19	37
135	0.25	-1.05	6200	-	0.25	0.17	17-23	42
135	0.25	-1.10	9150	-	0.50	0.12	17-21	38
135	0.50	-1.05	5850	-	0.25	0.18	20-30	50
135	0.50	-1.10	10000	-	0.50	0.11	18-27	48
180	0.25	-1.25	4900	-	0.25	0.25	26-33	48
180	0.25	-1.20	7100	-	0.50	0.17	24-30	46
180	0.50	-1.30	5450	-	0.25	0.24	32-40	56
180	0.50	-1.30	9000	-	0.50	0.14	30-38	55
77								
100	0.25	-1.10	3750	20	0.25	0.22	15-23	40
100	0.25	-1.25	6450	20	0.50	0.14	17-22	39
100	0.50	-1.05	3400	20	0.25	0.23	16-29	54
100	0.50	-1.25	7250	20	0.50	0.13	18-28	53
135	0.25	-1.20	3100	25	0.25	0.29	21-32	54
135	0.25	-1.37	5600	25	0.50	0.18	27-31	52
135	0.50	-1.27	3750	25	0.25	0.25	29-37	61
135	0.50	-1.42	6300	25	0.50	0.17	34-38	62
180	0.25	-1.25	2180	30	0.25	0.43	31-43	76
180	0.25	-1.50	4550	30	0.50	0.25	36-41	65
180	0.50	-1.30	2600	30	0.25	0.38	36-52	92
180	0.50	-1.55	4850	30	0.50	0.24	45-52	93
85								
100	0.25	-4.75	16800	-	0.25	0.28	24-26	6.15
100	0.25	-3.75	25800	-	0.50	0.14	17-22	6.05
100	0.50	-5.00	21200	-	0.25	0.23	27-29	6.60
100	0.50	-5.50	46000	-	0.50	0.12	26-27	6.20
135	0.25	-6.80	21200	-	0.25	0.32	34-36	6.15
135	0.25	-4.75	24300	-	0.50	0.19	27-30	6.10
135	0.50	-7.00	22000	-	0.25	0.31	38-42	6.50
135	0.50	-7.00	42500	-	0.50	0.16	36-40	6.35
180	0.25	-7.50	16300	-	0.25	0.46	38-40	6.45
180	0.25	-7.00	28000	-	0.50	0.25	36-38	6.40
180	0.50	-7.00	14900	-	0.25	0.47	40-44	6.75
180	0.50	-7.50	31200	-	0.50	0.24	40-45	6.50

THE following data were released by RCA Radiotron Co., Inc., and E. T. Cunningham, Inc.:

Application Note on the 2B7, 6B7, 55, 75, 77 & 85 as Resistance-coupled Audio-Frequency Amplifiers.

The data tabulated in this note are of particular interest to the engineer designing transformerless receivers of either the universal (a-c or d-c) or a-c type, and automobile-radio receivers.

Tabulated below are optimum operating conditions for the 6B7, 75, 77* and 85 as resistance-coupled audio-frequency amplifiers at each of three plate-supply vol-

*The data in this note for the 77 are not to be confused with those given in Note No. 1 for the 77 as a biased detector.

tages and with specified values of resistance in the grid circuit of the output tube. The 2B7 and the 55 are not included in the tabulation since the same conditions, excepting for heater voltage, obtain for these types as the 6B7 and the 85, respectively.

The 100-volt plate-supply conditions are of especial interest to engineers designing universal (a-c or d-c) receivers, because this is about the maximum plate-supply voltage available due to voltage drop in the rectifier and filter.

The 135-volt plate-supply conditions are of especial interest to engineers designing transformerless a-c receivers, using the 25Z5 in a voltage-doubler circuit. Although the 25Z5 will give approximately 220 volts output when used in a doubler circuit, the voltage drop in the filter and

in the electro-dynamic speaker field plus the regulation drop in the power supply circuit will reduce the voltage available for plate supply to about 135 volts.

The 180-volt plate-supply conditions are of especial interest to engineers designing automobile radio receivers, since this is approximately the voltage from most auto B eliminators or dynamotors.

In the tabulation of optimum operating conditions for each tube type, the column headings have the following meanings:

PLATE SUPPLY VOLTS—The voltage applied to the plate through the plate-load resistor.

GRID RESISTOR—The grid resistor for the succeeding tube. The value of this resistor must not exceed the maximum value specified in our published data for the tube used.

BIAS VOLTS—The bias voltage on the control grid of the amplifier tube.

SELF-BIASING RESISTOR—The value of self-biasing resistor required to give the bias voltage. In calculating this resistance for screen-grid tubes, the sum of the plate and screen current must be used.

SCREEN SUPPLY VOLTS—The supply voltage for the screen grid.

PLATE LOAD—The resistance in the plate circuit across which is developed the output voltage.

PLATE CURRENT—The plate current of the tube. In the case of duplex-diode types, this refers to the amplifying tube-unit.

PEAK OUT.—The peak output voltage developed across the plate-load resistor. The first figure gives the maximum undistorted output voltage obtainable, and the second figure gives the maximum obtainable with some distortion. The output voltage measured across the plate-load resistor alone would be somewhat higher, were it not for the shunting effect of the grid resistor of the succeeding tube.

VOLTAGE AMPLIFICATION—The voltage amplification obtainable with the tube under the conditions specified. It is to be noted that these data give the voltage amplification obtainable at the grid resistor of the succeeding tube; that is, the a-c load on the amplifier is the parallel combination of the plate-load resistor and the grid resistor of the succeeding tube.

Note: The coupling condenser between the plate-load resistor and the grid resistor of the succeeding tube should be of adequate capacity to insure good low-frequency response. A capacity of 0.1 mfd. is usually the maximum which will be required.

A THOUGHT FOR THE WEEK

ONE of the big air chains cudgelled its brains for a considerable period in an effort to decide what percentage of beer announcements it would permit over its channels every twenty-four hours. It decided to permit a ten per cent allowance for more or less wet and bibulous programs. Breweries did not form a line on the right in an effort to snatch time. Now the chain has about made up its mind to take 'em as they come—without many takers. Several beer barons are considering this new mass production of publicity and—the chain officials are holding their breath!

SUCCESS IN ONE EASY LESSON

How to Learn the Resistance Color Code and Stop Shorting High Voltages

By Cy N. Tiffic

SOME constructors of sets may believe that the so-called color standardization of resistance identification has worked a hardship on them, because formerly it was possible to get resistors that had the values written or printed on them, whereas now one gets resistors with confusing color codes instead. Now one has to ascertain what the resistance value is, or at least what it is supposed to be, and the work may have to be done by a gross approximation. For instance, one may have an ohmmeter that reads up to 10,000 ohms only, and therefore can test only small values, all high ones giving virtually no deflection, so that the difference between 50,000 and 50,000,000 ohms could not be told.

Of course the solution is to learn the standard resistor color code, and as it is based on a system, it is not hard to remember. One may have a chart or one of the moving disc indicators, and consult either, but suppose one doesn't have the chart at the time the mysteries are to be solved? Is there any more satisfactory method than to know the code by heart as you do the Declaration of Independence?

Two Are Enough

There are three indexes on the resistor, or in some instances of low resistors for which the code does not cover the last numeral, only two indexes.

If there are three, then the body color denotes the first significant figure, the end color denotes the second significant figure, and the dot represents the number of ciphers after the first two significant figures. As detailed values are not necessary, due to 10% tolerance in manufacture of resistors, two significant figures are sufficient.

What does this mean? It means that if we have a resistance of 250,000 ohms and classify the significant figures and ciphers according to the rule, we shall have 2 as the first significant figure (body color), 5 as the second significant figure (end color) and 4 as the figure representing the number of ciphers. However, as the numbers are given color designations, we express the resistance in the following manner:

Red body (color code for 2).

Green end color (color code for 5).

Yellow dot (color code for 4).

The fact that the dot is yellow shows that there are four ciphers following the second significant figure.

From the above we have learned three of the color designations for numbers: red, 2; green, 5; yellow, 4. As there are only ten all told, 0-9 inclusive, we have to learn only seven more. And since there is a system this memorization is simplified.

The numbers, naturally, run in consecutive order from 0 to 9, and black is the color for 0, while white is the color for 9. Therefore, if we remember that the beginning looks black but that the end looks brightest, we can always remember the numerical identities for black and white. Another point is that in the dark one can see nothing (0), while when things are bright we can see the most (9). So we have learned five of the ten colors by

Standard Resistor Code

For First or Second Significant Figure	Number of Ciphers After the Significant Figures
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

The color for the first or second significant figure follows this code: body color denotes first significant figure; end color denotes second significant figure; dot denotes number of ciphers after the first two significant figures.

their numerical equivalents and the job is half finished.

The Second Half

Since progression is toward lighter colors, the nearest color to black is brown, which is 1, and as brown is the nearest color to black in the list, so since black is 0, brown, its next-door neighbor, is 1.

Six out of ten have been learned, and only four more to go.

Now, with black and brown fixed in mind as to what numbers they signify, we need think only of the color that is nearest to brown, or that must be mixed with black to produce brown, and that is red. So red is 2, but since we have learned that, we merely put it in its systematic category as following 1.

The nearest color to red on the list is orange, and as orange follows red, and as red is 2, orange is 3. The two fruits that are grown often on the same plantations and are much associated in thought and distribution are the orange and the lemon. We are at liberty for the present purpose to denote the lemon as yellow. Then we have the number following 3, which many by this time must have divined is 4, represented by yellow.

Only three more to learn!

Green, we have learned, is 5, and is produced by mixing the color above it by the color below it on the list. The color above is yellow for 4, and the color below must be blue, representing 6. The closest color to blue on the list is violet, 7, while the closest color to white, the known last color, 8, is gray, the second from last color, 8.

Remembrance by Association

So we have our list and a memory association:

Black is the beginning, just as the world started in darkness according to the Bible 0
 Brown is the closest color to black 1
 Red is the closest color to brown and is 2
 Orange is the closest color to red and is 3

Yellow is the closest color to orange and is 4
 Green is for the most frequent number therefore is 5
 Blue, the next color, is closest to green, and is 6
 Violet is closest to blue and is 7
 Gray is next to last and closest to the final white, so is 8
 White is the end of the list, a contrast with the beginning, and is 9

The Ciphers

So there are the ten numbers, 0-9 inclusive, and the ten colors, and by the grace of necessity it is permissible to refer to such the whole ten as colors, although there are only six prismatic colors on the list: red, 2; orange, 3; yellow, 4; green, 5; blue, 6; violet, 7. The prismatic colors, with their initials used to form a word, constitute that word vibgyor: violet, indigo, blue, green, yellow, orange, red. Of course the prismatic colors would not be quite suitable. Imagine a service man, working in a poorly-lighted room in a customer's home, peering into a console to view the under side of a chassis, and attempting to tell the difference between blue and indigo!

The significant figures are covered by the entire list, but the number of ciphers after the second significant figure is limited to six. So the range is no ciphers (none) to six ciphers (000000), a total of seven selections. The mistake should not be made of reading no ciphers as 0, as 0 is one cipher.

Same Colors

The color coding therefore from 0 to 6, inclusive, a total of seven selections, is used for denoting the number of ciphers, and the fact that ciphers are intended is disclosed from the presence of this color in the dot. The colors for numbers of ciphers is the same as for individual digits in the significant figures.

Sometimes there are only two, instead of three color designations. This ordinarily would denote a low resistance. The standard code is departed from to the extent of omitting the third significant figure, as it would be inexpressible; that is, the full three indexes are not present, but the clarity is there just the same.

The code is not for adjustable resistors, and moreover it is not usually applied to resistors that are to dissipate any considerable power, for instance wire-wound resistors. The grid leak type resistor, with or without pigtailed, will be found color-coded in most instances, and the main advantage is that the designation is put on in a manner to make it stay on (often paint). When labels were gummed to resistors, or blue pencil or ink used on the porcelain cartridge types, the values written in, either the labels would come off or the pencil or ink marks would rub off, and finally the value of what had been inscribed become black.

From your knowledge of the color code you know now what black is.

AUTOMATIC SQUELCH

What It Does and How It Works

By Conrad Fredrics

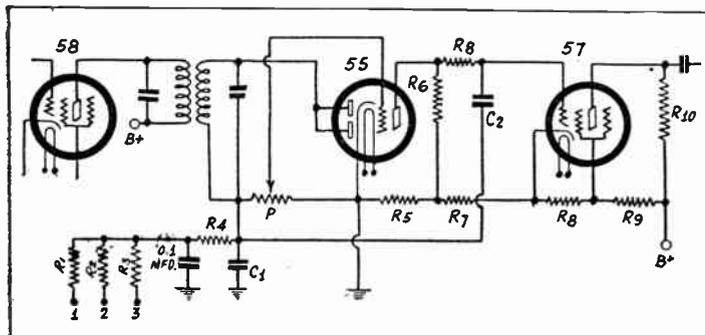


FIG. 1

A circuit showing how to hook up a noise suppresser in conjunction with an a.v.c. and varying the noise suppression.

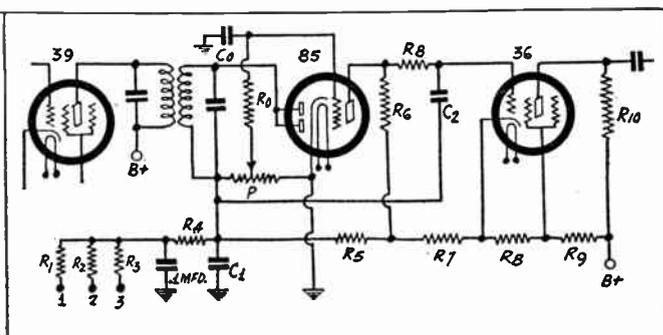


FIG. 2

This is the same circuit as that in Fig. 1 except that it is for the 85 and other consistent tubes.

ONE much-troubled apartment house dweller remarked when he heard of the squelcher that that was a God-send to all who desired peace after one o'clock in the morning. Its use should be made compulsory by law.

Of course, he misunderstood the function of this device, or, perhaps, he had a sense of humor that persisted through all his troubles with loud radio reproduction all about him when he desired to sleep.

If the function of the squelcher were what this man thought, or what he pretended to think, the device, no doubt, would be a boon to many. Perhaps it would be cleared of its notoriety. It is a fact that in some circles it is held deleterious rather than beneficial to good radio reception. With them the device is notorious. The squelcher may have gained this reputation because of faulty adjustment in no sense due to any defect in the system.

The Principle of Squelcher

The squelcher, or noise suppresser, is supposed to suppress inter-channel noise in receivers equipped with an automatic volume control. It is not supposed, as many have thought, to suppress the noise mixed in the signal, for any attempt to suppress such noises will result in the suppression of the signal also. It has long been the aim of much research to find a means of improving the signal to noise ratio, but the search has not been attended with much success, except with very elaborate equipment. It has been seen in the most general terms that improvement by simple tuning will not yield desired results.

The function, therefore, of the noise suppresser is to suppress noises in the speaker during the process of tuning from one station to another. It may be so adjusted that it also suppresses the signal when this is so weak that it would not be distinguishable from the noise if it were allowed to come through. In other words, the circuit can be arranged so that there is a threshold below which nothing comes through, whether noise or signal. Such an arrangement is desirable because it discourages attempts to receive signals that are so weak that they cannot make themselves heard above the general racket.

But the amount of noise in the atmosphere varies from hour to hour, from day

to day, and from season to season. Therefore when a threshold device is incorporated in the receiver equipped with both automatic volume control and noise suppresser, there should be a means for varying the threshold so that the operator of the set can, if he chooses, pick up distant and very weak signals when they have a chance to come through the noise fairly unblemished. This is easily possible, for just as it is a simple matter to cut in or out the automatic volume control, so it is easy to cut in or out the noise suppresser; or just as it is easy to vary the degree of automatic volume control, so it is easy to vary the degree of noise suppression control.

The variable feature has been introduced as a "delayed automatic bias." To vary the threshold it is only necessary to change the "delay." This delay has nothing to do with time, for it is only a matter of voltage. There is a handicap on the diode detector which must be overcome before a signal comes through. If the signal and noise voltage is less than the "delay" nothing comes through. The noise suppresser tube is a valve that must be opened by the signal.

The Valve

This valve is a combination of the triode of the detector tube and the first audio tube. The triode does the closing and opening when properly acted on by the signal and the first audio tube is closed or opened so as to let the signal through. The triode part of the rectifier tube is not a part of the detector or of the amplifier. It is a pure d-c amplifier. That is, it amplifies d-c voltage and in so doing varies the operating bias on the audio amplifier that follows it. The circuits used are shown in Figs. 1 and 2, one using a 55 and one an 85.

In either circuit P is the diode load resistor in which the bias to be amplified develops. The audio signal also develops in this resistor. R5 is a voltage drop resistor for the purpose of providing a low positive plate voltage on the triode of the 55 or 85. Since the triode has a positive plate voltage a current will flow in its plate circuit, and this will flow through resistance R6. The current that does flow will depend on the bias between the slider on the potentiometer and the cathode, and it is proportional to the signal strength.

Therefore, the drop in R6 will be proportional to the signal strength. Now, R6

is in the grid circuit of the 57 or the 36. If the current in R6 is very large, which it is when there is no signal, the drop in it will be large, and the bias on the following amplifier will be large. Indeed, it will be so large that the bias on that tube will be far beyond the cut-off bias. Hence, any signal that reaches the grid by the a-c route cannot be amplified. Since there is only noise when there is no signal, the noise cannot come through.

Opening the Valve

Now, suppose that a strong signal comes along. The voltage between the cathode and the slider on the potentiometer will increase, since it is proportional to the signal strength, and this will be amplified by the triode. But an increase in the bias on the triode causes a decrease in the drop in R6. When the bias on the triode is at the cut-off point there is no current at all in R6. Therefore, the bias on the amplifier grid is determined by the fixed bias, the drop in R7. This is adjusted so that the tube, either the 57 or the 36, operates best as a voltage amplifier. The amplifier is then wide open and the audio signal, which reaches it by the condenser C2, is amplified.

There will, naturally, be a transition region in which the cut-off is not complete. That is, the signal will not be strong enough to drive the bias on the amplifier to the optimum bias. Such signals will be distorted in the audio amplifier. It may be because of this fact that the noise suppresser has gained a bad reputation. The greatest chance for avoiding this difficulty occurs when the slider of the triode is at the left end of the load resistance, that is, so that the full voltage in the load is amplified by the triode.

In this circuit the potentiometer is not used for controlling the audio output of the set, but only to control the degree of the noise suppression. If the slider on the potentiometer is set at the cathode there is no chance for any signal, however strong, to open the audio amplifier. The threshold is then raised to the highest possible level. Naturally, it will never be set in that manner, although our troubled apartment dweller would like to see it done.

Neither would it be set at the other extreme unless the principal use for the receiver was to receive weak distant stations. Ordinarily it would be set at some midway point where a few selected locals would come in freely.

Improving Selectivity Methods Applicable to T-R-F Sets

By Edgar Bell Forrester

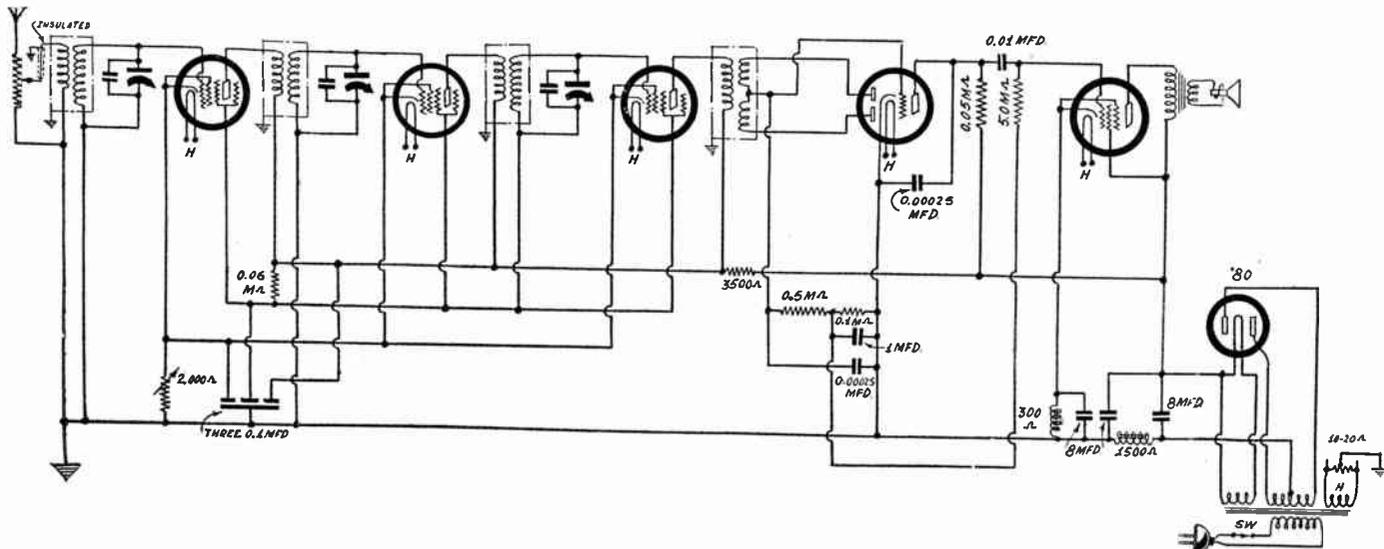


FIG. 1

The selectivity of a t-r-f receiver like this is not nearly so great as that of a superheterodyne, and frequently station heterodyning comes through.

TUNED radio frequency receivers are now out of date. Yet there are many who still prefer them. They are supposed to be easier to build. As far as the actual building is concerned there is little difference between a t-r-f receiver and a superheterodyne. There is a difference, however, in adjusting them. When the circuit is of the t-r-f type there are only two or three trimmer condensers to be adjusted, and only at the high frequency end of the dial. When the receiver is of the superheterodyne type adjustments must be made in the intermediate frequency amplifier, in the radio frequency amplifier, and particularly in the oscillator.

When the t-r-f receiver has been finished, it is likely to be very much less selective than the superheterodyne, even though the superheterodyne may be less pretentious. That is the penalty for avoiding a little work.

What Interference Results

In the t-r-f set interference will occur between adjacent channels. For example, WOR and WLW might interfere with each other for they are only 10 kc apart. These stations, and others of similar power and frequency separation, should be very far apart geographically, but it usually happens that they are not far enough apart. This is due to the high power of some of the stations, for one thing, and to the lack of selectivity, for another. A superheterodyne is usually able to separate these stations. It is true that the separation is accomplished at a loss of certain high frequencies in the audio band, but these are so high that they are not missed when they are absent but very much noticed when they result in station interference. The interference spoken of is particularly the carrier heterodyne, which has a frequency of 10,000 cycles, assuming that each of the two interfering stations maintains its frequency "right on the nose," as specified by the Federal Radio Commission, not allowing the frequency deviation allowed by the commission. However, even if both stations deviate by the maximum amount,

the heterodyne could not differ from 10,000 cycles by more than 100 cycles. So we might say that the heterodyne is exactly 10,000 cycles.

This frequency is quite audible to every normal individual, except possibly the very aged. When it is present in the signal, it is very annoying, and something must be done to cut it down to below audibility.

Cutting Down Heterodyne

The best way to get rid of the carrier is to make the circuit so selective that the side frequencies corresponding to a 10,000 cycle audio frequency will be blotted out. Doing this in the superheterodyne is easier than to avoid doing it. In the t-r-f set it is quite difficult. That is, it is difficult doing it with the tuner.

An increase in the selectivity, of course, will do it. But how can the selectivity be increased? Trimmers can be adjusted, but if they are they can be fully effective at only one frequency. And making the adjustment at some frequency in the lower part of the broadcast band is likely to render the set useless at the higher frequency end. Therefore, the best thing to do with the trimmers after they have been adjusted at a high frequency, say 1,450 kc, is to leave them alone.

The selectivity can be increased by increasing the number of tuned circuit, particularly if this is done without at the same time increasing the radio frequency amplification. But increasing the selectivity in this manner is usually out of the question. It does not look well to have a coil and a condenser on top of the radio set, or at any other place near it. The lady of the house usually rules such contraptions out.

It can also be increased by using a shorter antenna, in fact or in effect. If the weather is not congenial enough to invite the erection of a shorter and better outdoor antenna, an inside antenna might be substituted. Perhaps the lady of the house can be induced to accept it in the interest of receiving the crooners without interference from the sopranos. But even if the antenna cannot be shortened in this way, the outdoor antenna can be shorten-

ed in effect without leaving the house. All that is required is a small condenser in the antenna lead. This can be placed inside the set, where it will be entirely out of sight, or it may be placed at the binding post for the antenna, where it will only be in sight when dusting operations back of the set are performed. The smaller this condenser is the more effective it is in shortening the antenna.

Another way of increasing the selectivity, a way that is available to the engineer and the set builder but is not easily available to the layman, is to reduce the number of turns on the primaries of the radio frequency transformers.

Still another way, and one that can be applied by any one to his heart's desire, is to by-pass well in the audio frequency amplifier. This by-passing can begin at the detector plate, or at the load resistance of the diode rectifier. In the diagram above this method is employed, for the condenser across the load resistance is 0.00025 mfd. whereas one of 0.00005 would be ample if the high frequencies were not to be removed. Of course, the condenser can be increased to a still larger value.

Another place in the audio amplifier where a condenser can be put is in the plate circuit of the first amplifier. In the circuit above a 0.00025 mfd. condenser is connected between the plate and the cathode. A larger condenser would cut down the high notes still more, and if it is large enough it certainly will cut down the interference between the carriers of two stations operating on adjacent channels.

Output Tube By-passing

One place where a by-pass condenser is often used for the purpose of suppressing high frequency hiss is across the output of the last tube. At this point it is customary to put a condenser of 0.006 mfd. A larger condenser would be more effective. The question of how large the condenser should be depends on the tube, on the speaker, and on the degree to which the high frequencies must be cut down. It is a matter of trial.

THE "PRIZEWINNER" AC-D

By M. K.
Alan Radio

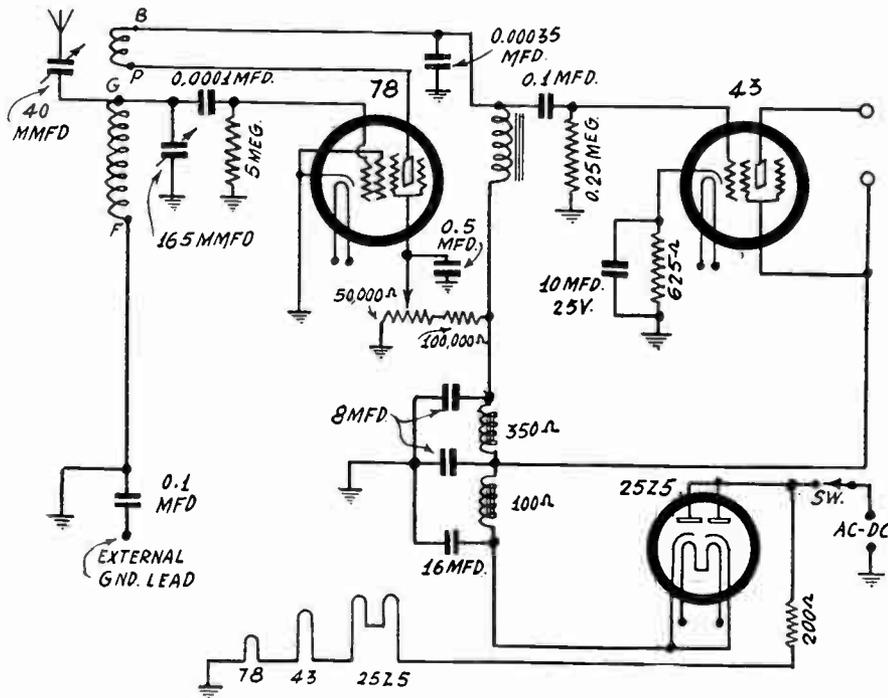


FIG. 1

This is the diagram of the "Prizewinner" three-tube universal short-wave receiver, which utilizes a 78, a 43 and a 25Z5.

FOR the short-wave enthusiast with a modest pocketbook, and one who desires sensitivity and volume together with a quiet, built-in power supply, the following description of just such a job will prove to be of more than passing interest, for herewith are presented the constructional data on a self-powered a-c and d-c short-wave receiver of more than ordinary sensitivity and volume, freedom from line pick-up, and numerous other valuable features, yet whose cost when assembled will be under \$11.

Though primarily intended for head-phone operation, this outfit will operate a magnetic or dynamic speaker on most local signals. This circuit, as described, utilizes an ultra-sensitive 78 grid leak detector, a 43 power amplifier, and a 25Z5 rectifier, a combination of tubes which adapts itself readily to both a-c and d-c line operation with practically identical performance.

Regenerative Detection

Aside from the use of the 78 tube, the detector circuit is a conventional regenerative grid leak arrangement (but what a difference the 78 makes!). The grid leak found most satisfactory was 5 megohms, and the grid condenser, .0001 mfd. Regeneration is smoothly controlled by means of a 50,000-ohm potentiometer of the carbon-element type (Centralab in this case) in the 78 screen lead, and bypassed with a .5 mfd. pigtail condenser. The tuning condenser used in the original outfit is one having a special short-wave capacity curve. It has a maximum capacity of 165 mmfd., or .000165 mfd., and about 9 mmfd. (00009 mfd.) minimum capacity. This, coupled to a 13-to-1 tuning dial, makes for easy tuning. The condenser insulation material has been especially selected for service in high frequency circuits.

COIL DATA

Coil Forms: 1¼-inch diameter, five prong type.
 'G' terminal of grid winding at top of form.
 'P' terminal of tickler winding at bottom of form.
 All windings close wound except 'A'. Spacing on 'A' equal to diameter of wire.
 All windings wound in same direction.
 Grid terminal of form not used.

Wavelength meters	Grid		Tickler		Separation
	Type of wire	Turns	Type of wire	Turns	
'A'— 14 to 35	No. 20 enam.	5	No. 28 SCC	3	5/32"
'B'— 34 to 63	No. 20 enam.	11	No. 28 SCC	4	5/32"
'C'— 62 to 112	No. 24 SCC	19	No. 28 SCC	5	1/8"
'D'—110 to 195	No. 26 SCC	48	No. 28 SCC	7	3/32"

LIST OF PARTS

Coils

- One set of four "Prizewinner" coils to cover 14 to 200 meters or as described in table
- One "Prizewinner" audioformer
- One "Prizewinner" 15-henry, 100-ohm filter choke
- One "Prizewinner" 25-henry, 350-ohm filter choke

Condensers

- One 0.00004 mfd. antenna trimmer condenser (Hammarlund)
- One 0.01 mfd. by-pass condenser (Aerovox)
- One 0.02 mfd. by-pass condenser (Aerovox)
- One "Prizewinner" 165 mmfd. short-wave condenser
- One 0.0001 mfd. mica by-pass condenser (Elmenco)
- One 0.00035 mfd. mica by-pass condenser (Elmenco)
- One 10 mfd., 25 volt, electrolytic by-pass condenser (Dubilier)
- One filter block consisting of two 8 mfd. and one 16 mfd., 200-volt, electrolytic condensers

Resistors

- One "Prizewinner" 5-megohm resistor
- One 600-ohm, one-watt, resistor (Elmenco)
- One 100,000-ohm, 1/2-watt, resistor (Elmenco)
- One 50,000-ohm potentiometer (Centralab)

Other Requirements

- One antenna and ground terminal strip
- One terminal strip for phones
- One 6-prong wafer socket marked 78
- One 6-prong wafer socket marked 25Z5
- One 6-prong wafer socket marked 43
- One 5-prong wafer socket marked coil
- One "Prizewinner" stamped chassis (all necessary holes punched out)
- One metal cabinet, crackle finish
- One 13-to-1 vernier dial
- One escutcheon plate for dial
- One tube shield
- One rotary on-off line switch
- Three one-inch bakelite knobs
- One line cord
- One pair headphones or magnetic speaker
- One type 78 tube
- One type 43 tube
- One type 25Z5 tube

Battery Converter Meets

Extreme practicability of a new universal battery converter, which operates from 6 volts, giving 110 volts a-c, is reported from the factory of the Universal Microphone Co., at Inglewood, Cal. The converter was given a thorough tryout during the recent Hawaiian maneuvers of the navy's aircraft carrier Lexington. The converter was used to operate a neon gas tube signalling device to direct pilots landing their craft on the deck of the Lexington. The warcraft has 880 feet of deck space on which to land the 100 machines that are carried in the hold.

Past experience has shown that other signal lights were not practical or effective when visibility was low. Neither was it desirable to use any appliance with a cumbersome cord dangling in the way.

C SHORT-WAVE RECEIVER

Baker
Company

In the antenna circuit, a small trimmer of 40 mmf. maximum capacity has been included for the elimination of dead spots.

Development of Circuit

During the development of this receiver, various makes of coils, both expensive and moderately priced types, were tried, but none proved quite satisfactory. As a result, the plug-in coils described in the accompanying coil table were evolved. A word here in regard to the adjustment of the coils will not be amiss. The position of the tickler in respect to the grid coil is very important. A small variation will make a considerable amount of difference. In general, the tickler should be kept as far away from the grid coil as possible without dropping out of oscillation. In most instances, the separation distance given in the coil table will be correct.

Impedance coupling to the 43 power amplifier tube proved extremely efficient. The secondary winding of the average audio transformer will do the trick here, but for best results an audio impedance transformer will be necessary. The coupling condenser used is a .1 mfd. pigtail type, and the 43 grid resistor is a 1/4 megohm, 1/2 watt, of the same type. The 43 tube is self-biased by means of a 625-ohm cathode resistor, which is bypassed by a 10 mfd., 25-volt electrolytic condenser.

Quiet Power Supply

In order to insure a quiet power supply, a two-section filter system is used, consisting of one 100-ohm, 15-henry choke, one 350-ohm, 25-henry choke, one 16 mfd., 160-volt electrolytic condenser, and two 8 mfd. electrolytic condensers. This was found to give a vanishingly low hum level even with highest regeneration.

The 25Z5 rectifier tube is operated very conservatively, since the total "B" drain is about 25 milliamperes, resulting in life of the rectifier tube.

The heaters of all the tubes are connected in series, and as all are .3-ampere tubes, only a 200-ohm, 25-watt, wire-wound resistor is needed to complete the series circuit, which is placed directly across the 115-volt line.

Test on 'Plane Carrier

The universal converter and neon tube carried correct and visible signals during night-time flying, dense fog and other poor weather conditions.

This made it possible to quickly run from one spot to another with necessary signals and make the entire landing in a short space of time.

Signals were in code formation and the equipment, with six volt battery, makes a compact, light weight and serviceable aid, according to Universal officials who were informed of the fine record made by their products in this new and novel field.

The battery converter was passed by the naval engineering board and is now in use at the North Island naval base in San Diego.

Assembly of Parts

The parts are assembled on a cadmium plated steel chassis. A shielding compartment is provided for the 78 tube. This also shields the coil from the rest of the apparatus. The sockets used, including the coil socket, are of the wafer type. Six-prong sockets for the type 78 grid leak detector, the 43 power amplifier, and the 25Z5 rectifier, and a five-prong socket for the coil. The cabinet is of rustproof metal and is finished in black crackle, which combine to give this receiver an exceptionally fine appearance.

If care is exercised in the construction of this receiver, together with the proper installation consisting of a correctly erected antenna of not over 60 ft. including the lead-ins, and if a good ground connection is used, the constructor should have little difficulty in receiving stations several thousands of miles distant.

Noiseless Lead-ins

It may be well to add that when the receiver is to be used in districts where there is much electrical noise, especially in congested city districts with tall buildings where electrical noises abound, a lead-in provided with transposition blocks, or some equivalent, will greatly improve reception. The theory of these devices is that the real pick-up takes place high above the noises and that the lead-in is immune to them because the two wires of the lead-in change relative positions at close intervals. In many instances where noises make distant reception almost impossible during the very hours when the chance of receiving is greatest, these devices have so improved the signals that the listener forgot about the noise.

Layout of Chassis

Much thought was given to the layout of the parts in the original model of this receiver. Much thought and more practical trials of a large number of possible combinations. The objects sought were a minimum of uncontrolled regeneration and a minimum of hum. Tests for regeneration had to do with the placement of the radio frequency coil and the tuning condensers. Tests for hum had to do with the placement of the audio frequency coupling coil and the filter chokes. It was found that certain combinations gave a great deal while others gave no appreciable hum. The hum in some cases resulted from mutual coupling between the audio coupling choke and the filter chokes. When the fields of the two were effectively at right angles, there was no hum, and, naturally, one of these combinations that was consistent with the rest of the layout was retained.

The Antenna Circuit

The small condenser in the antenna circuit is adjustable to accommodate antennas of different frequencies. It is accessible from the rear of the set where it is mounted very close to the radio frequency coil. When properly used it can be employed to vary the sensitivity, for the smaller it is the less effect will the antenna resistance have on the tuned circuit.

Provision is made for an external ground in a manner that eliminates all danger of short circuit of the line. A

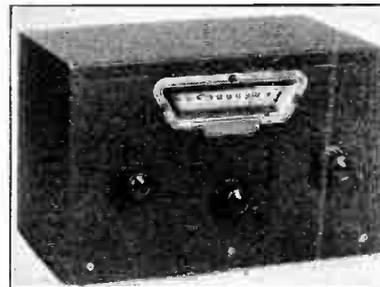


FIG. 2
Front view of the cabinet of the "Prizewinner" short-wave receiver.

condenser of 0.1 mfd. is connected between the ground binding post and the circuit.

The Heater Circuit

The heater circuit has been designed on the supposition that the line voltage is 115 volts, for that voltage is more common than the nominal 110 volts.

It makes no difference whether the line voltage is alternating or direct as far as the heaters are concerned because all the tubes are of the heater type and all will operate on either current. There is a difference, however, in respect to the rectifier elements, but only in the connection. It is necessary to observe polarity, for the rectifier will not work unless the anodes are positive. Therefore the grounded side of the circuit should be the negative. Nothing happens in this circuit if the connection is made wrong the first time, that is, no signals will come through and nothing will be damaged. Therefore if the set does not begin to show life after a minute or so, reverse the line plug and the circuit should work immediately.

Warning

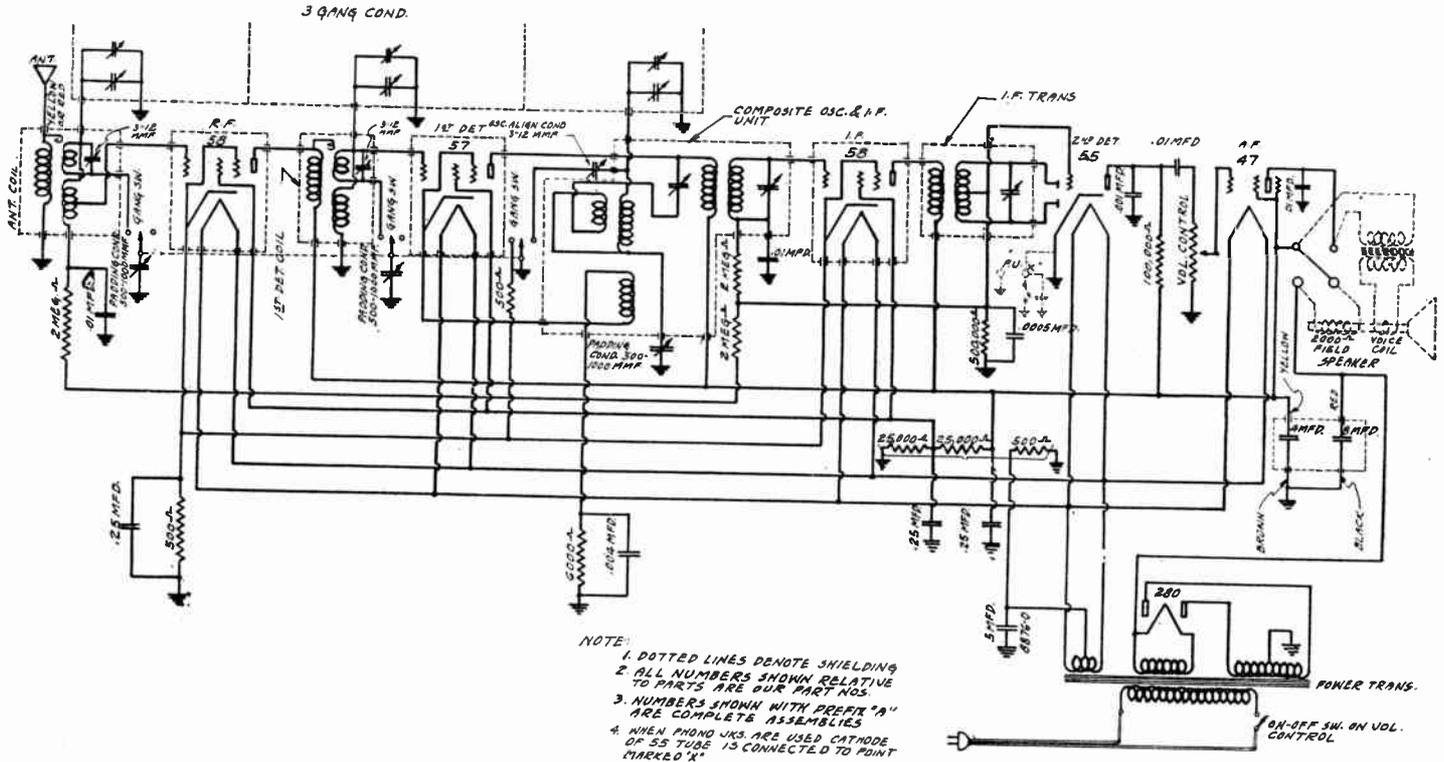
A warning will not be amiss just the same. There are several ground symbols on the diagram. They do not mean ground in the usual sense, but only the chassis. If the real ground is connected to the chassis there will be danger of shorts in some instances. It is for that reason that the insulating condenser has been provided between the binding post for the real ground and the chassis.

In some instances on d-c lines the chassis will actually be ground, but that will only be in those rare cases where the negative side of the d-c line is grounded. In most cases the positive side is grounded and when it is the chassis will differ from ground by 115 volts, the chassis, of course, being negative by that amount. For that reason it is well to insulate the chassis from anything that might cause a short.

Results with this circuit have been quite satisfactory. Many foreign stations have been received in the day time and the early evening. As the Summer approaches it is expected that reception will be still better on the short waves which this receiver covers. It should be kept in mind by those operating the set that the best chance of receiving signals from Europe is in the late afternoon and early evening, for it is then that the Europeans send out their signals.

Oscillator's Harmonics Used for Short-Wave Results

Service Data on a Commercial Dual-Range Set



A COMMERCIAL receiver, using six tubes, manufactured for private brand sale, and thus having several trade names, uses oscillator harmonics for short-wave reception. Preliminary data were printed last week, issue of April 15th. Service information on the six-tube set is given herewith. The circuit diagram is printed above, the chassis view on the next page, on which also appear the voltage data for this set and for a similar five-tube set concerning which other information was given last week.

How Oscillator Works

OSCILLATOR: The fundamental of the oscillator is used to produce the beat frequency when operating on the broadcast band and the harmonic of the oscillator is shifted in frequency by padding condensers to produce the beat frequency when operating on the short wave band, and the antenna and R.F. stage padding condensers are used to bring these stages into resonance with the oscillator stage.

AUTOMATIC VOLUME CONTROL: The automatic volume control action tends to maintain the volume of all stations received at a constant level, determined by the position of the manual volume control, and will aid in minimizing station fading. However, when the station signal falls below the optimum volume in the antenna the receiver will be unable to bring this weak signal up to the desired volume. On some stations, therefore, because of this, the station's signal may decrease to an inaudible volume. This is not due to defect either in the receiver or its accessories, but is due to the phenomenon of fading. Extreme station fading will be indicated by the rising and falling of background and static noises, also the tone quality will become "tinny". Because of the functioning of the automatic volume, which tends to keep the volume, (determined by the position of the manual volume control) always at maximum, the receiver may appear to tune broadly. This, however, is only ap-

parent—the selectivity actually being very good. Improper automatic volume control action will in practically all cases be rectified by replacing the No. 55 tube.

ANTENNA: To obtain best results a proper antenna installation is imperative. On most installations outside antennas, not exceeding 35 feet including lead-in, will prove most satisfactory and in all except buildings which are constructed with a large amount of steel, an inside aerial of this length will give good results. In steel constructed buildings only an outside antenna should be used. The higher the antenna and the further away it is from surrounding objects the more efficient it will be particularly on short wave reception. A good ground is as essential as an efficient antenna. Ground should be attached, by means of an approved ground clamp, to a cold water pipe which has been carefully cleaned either by sand papering or filing. Generally a steam radiator makes a satisfactory ground, but occasionally, due to poor connections in the pipes, may be inefficient. Therefore, as a general rule, water pipes are preferable.

TUBES: The receiver uses the following tubes: One (1) No. 258 as a tuned radio frequency amplifier tube. One (1) No. 257 as a composite oscillator and modulator tube. One (1) No. 258 intermediate frequency amplifier tube. One (1) No. 255 duplex diode and triode tube (Detector, AVC, first audio). One (1) No. 247 output tube. One (1) No. 280 rectifier tube.

Checking Voltages

VOLTAGE TABLE: Never check voltages until all tubes are fully warmed up to proper operating condition. The voltage table given below is taken at 115 volts line. It must be remembered that the voltage readings vary directly as the line voltage and also with the accuracy of the meters used. A variation of 10% plus or minus is permissible.

ALIGNMENT: Only when an intermediate coil has become defective, due to an

open or burned out winding should it be necessary to re-adjust the intermediate trimmers. Should this occur, it is necessary that an oscillator be used with some type of output measuring device. To align the intermediate stage, connect the high side of the oscillator output to the control grid of the modulator tube, leaving the grid cap disconnected from the tube.

The ground side of the test oscillator should be connected to either the ground lead of the set or to the chassis. Set oscillator at 175 kilocycles (this must be accurate) and adjust the output of the oscillator so that a convenient reading is obtained on the output meter. If during the alignment, the meter goes off scale reduce the output of the oscillator or adjust the receiver volume control.

Align the first intermediate transformer by turning the I. F. trimmer screw up and down until maximum reading is obtained on the output meter. The first intermediate transformer has two screws which are accessible through the top of the transformer shield can. The second I. F. trimmer should also be aligned in this manner. This trimmer is also mounted on top of the shield can. It is always best to re-check the adjustment after the first alignment to be sure that the alignment of the secondary has not been changed by the adjustment of the primary trimmer.

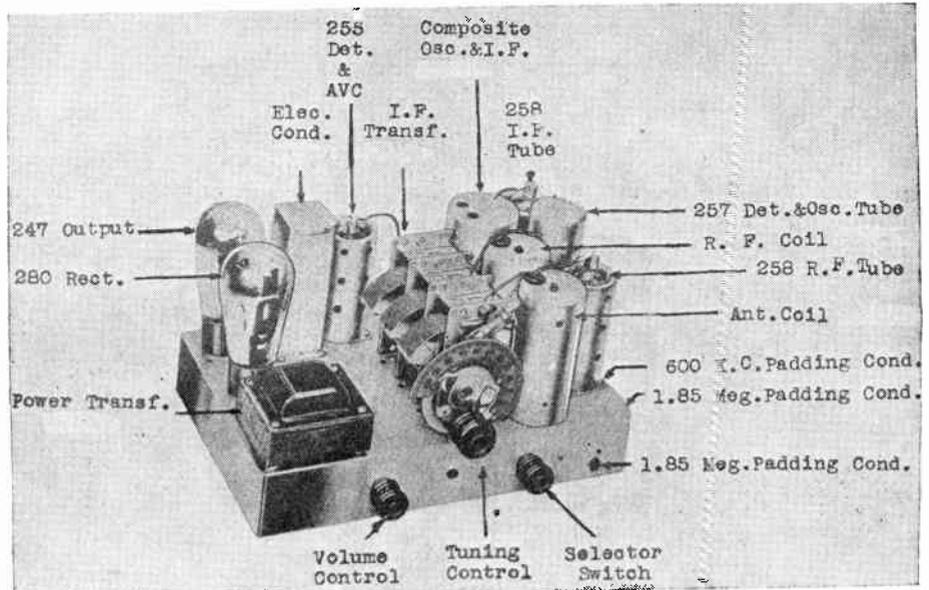
After both intermediate coils have been properly peaked the tuning of the intermediate stage is complete and the trimmers should not be further disturbed. If an antenna R. F. or oscillator coil requires replacement it will be necessary to realign the variable condensers. To do this proceed as follows: Place the band selector switch for operation on the broadcast band, connect the high output side of the oscillator to the antenna lead of the receiver and the ground side of the oscillator to the chassis or ground lead of the set. Then tune the receiver and set the oscillator frequency at 1400 KC and back off the oscillator variable condenser trimmer screw (this trimmer is mounted on

Type of tube	Position of tube	TUBE VOLTAGES			Normal plate M.A.	Screen volts
		Filament volts	Plate volts	C volts		
258	Radio frequency	2.3	225	2.5*	8	92
257	Composite oscillator and modulator.....	2.3	225	5.	3.5	92
258	Intermediate frequency	2.3	225	2.5*	8	92
255	Detector and audio	2.3	30*			
247	Output	2.3	215	5**	32.5	225
280	Rectifier	4.9	27.5 M.A. ea. plate			

* These readings are only comparative and are not true voltages applied. The voltmeter, when readings are taken at these points, is in series with a very high resistance.
 ** To read 247 bias, read between 247 control grid and 500 ohm section of load resistor. (This point is by-passed with the 5 MFD Dry Elec. Cond.)

top of the variable condenser and is the third section reading from front to back, looking at front of receiver) to minimum capacity. Turn set up on end and adjust the oscillator trimmer (located on the under side of the chassis and mounted on the composite oscillator I. F. coil lug and wave selector switch) to obtain maximum output reading. Next peak the antenna and R. F. stages by adjusting the antenna and R. F. variable condenser trimmers (mounted on top of the variable condenser) to resonance. Next tune the receiver to approximately 600 KC and set the oscillator to this frequency. Then the 600 KC padding condenser, (the one nearest the rear of the chassis on the right hand side and accessible through the hole in chassis) should be peaked for maximum reading on the output meter. Note: It may be necessary to rock the condenser back and forth to peak correctly.

Next throw the band selector switch to the high frequency band and tune receiver and set oscillator frequency to 3.7 meg. at which point the antenna and R.F. trimmers mounted on top of the antenna and R. F. coils and accessible through the hole in the shield cans should be peaked in this manner. After this adjustment is correctly made, tune the set to 1.85 megacycles and set oscillator at same frequency. The two padding condensers, one mounted in front of the chassis and the other one on the right hand side toward the front of chassis is then tracked for maximum output reading. If the oscillator frequency does not go below 1500 KC it will be necessary to use harmonics of the oscillator for alignment of the high frequency band. The second harmonic of 925 KC will be 1.85 meg. The fourth harmonic will be 3.7 meg. It must be remembered that the output of the oscillator decreases with increase of harmonics. That is the fourth harmonic of 925 KC (3.7 meg.) will not give as large a reading on the output meter as the second harmonic (1.85 meg.). Some oscillators may not have sufficient fourth harmonic output to permit aligning on 3.75 meg. It would therefore be advisable to check the output of the oscillator at this frequency by using a set that is known to be perfectly aligned and noting whether or not the fourth harmonic can be picked up by the receiver.



THE VOLTAGE TABLE AT TOP OF THIS PAGE APPLIES TO THE SIX-TUBE SET DIAGRAMED ON THE PRECEDING PAGE. THE VOLTAGE TABLE BELOW CONCERNS THE FIVE-TUBE MODEL DIAGRAMED AND DISCUSSED LAST WEEK, ISSUE OF APRIL 15TH.

Type of Tube	Position of tube	TUBE VOLTAGES				
		Filament volts	Plate volts	C volts	Normal Plate-M.A.	Screen volts
257	Composite oscillator and modulator	2.4	240	6	3.5	85
258	Intermediate frequency..	2.4	240	3	7	85
255	Detector and audio....	2.4	30*			
247	Output	2.4	220	5**	32.5	240
280	Rectifier	4.9	30 M.A. each plate			

* These readings are only comparative and are not true voltages applied. The voltmeter, when readings are taken at these points, is in series with a very high resistance.
 ** To read 247 bias, read between 247 control grid and ground.

Reducing Loss in Transmitting Aerial

By Walter C. Evans

Manager, Radio Department, Westinghouse Electric & Mfg. Co.

It is well known that the broadcast frequencies of radiation travel without loss from the boundary of the earth until they encounter the effects of the Heaviside layer, where they are partly absorbed and bent back to earth again. The return path to earth being without loss, it often happens that the waves travel for hundreds of miles and return to earth with fair intensities.

Height May Solve Problem

If these waves were not mixed up in their passage into and out of the Heaviside layer, it would appear that it would be worth while to concentrate all the radiation energy into the vertical and let it be returned to earth after having travelled a long distance with very little loss. However, this has been attempted and abandoned due to the interfering effects of the

variously polarized and phased waves which returned to earth.

However, the problem might be solved if the antenna were placed high enough above the earth, so that radiations might be permitted to travel directly from the antenna to the ground. There should be no loss in signal strength until it arrives at the earth's surface, where it will be reduced in strength to a degree determined by conditions immediately surrounding the receiving point.

In short, if the transmitting antenna be high enough off the ground so that it is in a direct line of sight with the receiving antenna, it may be possible to produce transmission with only negligible loss.

Computing the curvature of the earth for various distances, we find how high in

the air the radiating antenna must be held, if it is to completely "see" the receiver. For the first 30 miles, the antenna elevation is relatively low, while from 30 to 100 miles, it increases rapidly.

Start Blimp Tests

For example at 30 miles, the antenna elevation is 450 feet, while at 80 miles it is 4,200 feet and at 100 miles it is 6,700 feet. The problems involved in maintaining an antenna at elevations from 1,000 to 10,000 feet are, to say the least, numerous.

We have, therefore, begun experiments with a baby blimp and, if they are promising, we probably will obtain a larger balloon to send our trial antenna higher into the air.

Radio University

A QUESTION and Answer Department. Only questions from Radio University members are answered. Such membership is obtained by sending subscription order direct to RADIO WORLD for one year (62 issues) at \$6, without any other premium.

RADIO WORLD, 145 WEST 45th STREET, NEW YORK, N. Y.

Quality Good, Sensitivity Poor

THE quality of our receiver is excellent and is the best that we have heard. However, the set is not selective enough as local stations as far as 50 kc apart come in at the same time. Can anything be done to eliminate the interference? If there is a simple device for doing it please suggest it.—W. E. B., Erie, Pa.

Another tuner between the antenna and the set will improve the selectivity. But if the selectivity is increased greatly the quality will suffer. It may be that you can increase the selectivity sufficiently without noticing any change in the quality. A small condenser in the antenna circuit will help some, and so will a shorter antenna. Possibly a tunable wave trap would do, one that could be tuned to the interfering station each time.

Economical D-C Tubes

In A universal receiver having five tubes, of which one is a 25Z5, what tubes should be used so that most of the available voltage will be used advantageously?—R. E. B., New York, N. Y.

One should be a 43 which is a 25-volt power tube. The remaining tubes should be of the 6.3-volt type. The total voltage drop in the heater circuit will then be 68.9 volts. Hence out of the 115 volts of the line 46.1 volts should be dropped in the ballast resistor.

Speaker for Quality

WHAT speaker would you recommend for use with a high power receiver in which quality has been the first consideration? The output tubes are two 2A3s in push-pull.—T. H. S., Harrisburg, Pa.

We cannot recommend any particular speaker. However, a receiver with output tubes like that should be terminated by a very large dynamic speaker, one that will stand the great output of which the tubes are capable. Moreover, the speaker should be baffled with a large board con-

structed so that it will not vibrate mechanically and also so that it will not absorb a great deal of the sound energy.

Using the 75

IN EXPERIMENTING with the 75 in place of the 85 I have found that when the tube functions as a detector and amplifier the automatic volume control does not work, and when the volume control works, the tube does not function as an amplifier. Will you kindly explain the reason for this?—W. R. L., Marion, Ohio.

This is bound up with the required bias on the tube. A certain signal strength is needed to operate the automatic volume control satisfactorily. When the signal is strong enough for this it is too strong for the amplifier. This is especially the case when the tube is operated with diode bias, but it also holds when the grid bias is fixed, for then the signal voltage greatly exceeds the bias. There are two things that can be done in cases like that. One is to control more tubes automatically so that not as great a bias is needed to cut down the amplification. The other is to use the two diodes independently, one for the a. v. c. and the other for the detector. Probably the second method will yield better results in general. If the 75 triode is diode biased with a potentiometer for load resistance the grid could be moved in any case so that the triode will not be overloaded either with signal or with bias.

Capacity of Electrolytics

IT IS usually recommended that electrolytic condensers be not used for by-passing radio frequency currents. A report from a radio laboratory showed that a condenser rated at 30 mfd. at audio frequencies measured 5 mfd. at radio frequencies. Is it not better to have 5 mfd. than 0.1 or 0.25 mfd., values usually recommended for radio frequency by-passing? Will you kindly explain why an electrolytic condenser is not as effective

at radio frequencies as at audio?—W. N. P., Stamford, Conn.

The difference between 30 and 5 mfd. in a condenser used for by-passing radio frequency currents would not mean a thing if that were the only reason for a difference. Although the electrolytic may measure 5 mfd. at radio frequencies it is not necessarily as good as a 0.1 mfd. The thing that counts is the effective series resistance of the condenser at radio frequencies. An electrolytic condenser of 30 mfd. has a very high radio frequency resistance and it is that which causes the trouble. A paper condenser of 0.1 mfd. has a negligible resistance at radio frequencies, although at audio frequencies its resistance may be very high. The high resistance at radio frequencies of electrolytic condensers is due to impurities in the chemicals and the electrodes, especially the aluminum. There are miniature conducting areas on the electrodes where the insulating layer does not form.

Noise Suppressor

IS THERE a simpler way of suppressing the noises in a radio receiver equipped with automatic volume control than by the use of a separate suppresser tube? If there is, will you kindly explain it?—F. W. R., Indianapolis, Ind.

A diode bias tube is a noise suppresser, as has been explained in Radio World. This is particularly true of tubes like the 75 and the 2B7. Neither will amplify if the bias is positive. If the fixed bias is adjusted so that it is positive when no signal is coming in it will not amplify the noise. A signal would change the bias to the point where it would amplify. There is no difference in principle between this and the usual noise suppresser except that in the regular suppresser the signal is cut off in the negative direction and in the one propose it is cut off in the positive direction. If this method is used there strength. Signals of intensity less than this would not be able to get through at all, and that in itself might be an advantage. In fact special circuits have been devised for doing this very thing.

Class B in Auto Sets

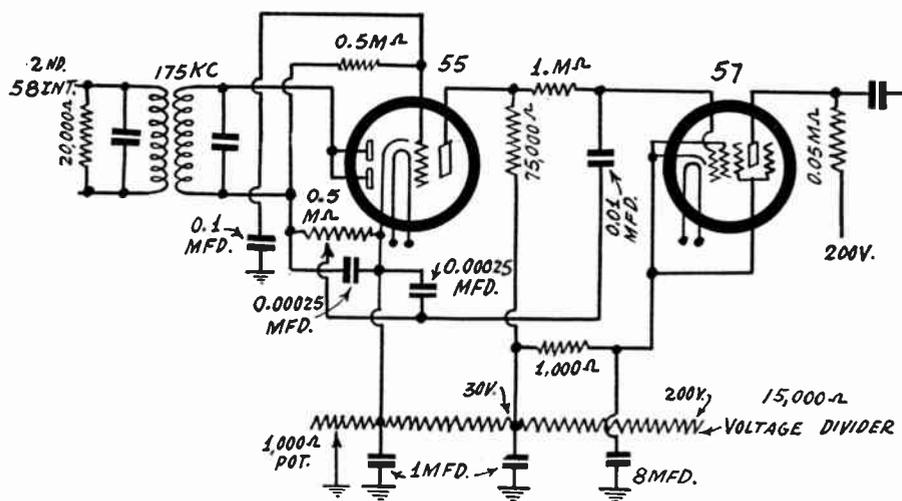
WOULD you recommend the use of a 79 tube in a Class B amplifier for an auto set? If not, why not? It seems to me that this would be advantageous in view of the fact that a single tube can be used in the output stage.—F. R. G., Rockford, Ill.

We have not been recommending this tube in auto sets for two reasons; first, because a Class B amplifier distorts on weak signals, and tolerable signals in a car will be weak, second, because the voltage supply available for the plates usually does not have adequate regulation. The second objection can be overcome by using dry cell batteries with large condensers across them or by using a motor generator, also with large condensers. Even with the vibrating type supplies condensers might make Class B practical. The main reason is the distortion on weak signals. If the amplifier were to be used as a transportable public address system there might be a good reason for using Class B.

Squelcher Circuit

WILL you kindly publish a circuit showing the proper connections of a noise suppresser tube. I wish to use a 55 as detector.—F. G. W., Denver, Colo.

You will find the circuit on this page. The 55 is used as detector and bias amplifier and the 57 as first audio. It is this tube that is controlled so that it can amplify signals only and not noise. This does not mean that noises in the signal will not be amplified. It may be required to give the screen of the 57 a higher voltage than that indicated. Try connecting the screen to various points on the voltage divider.



The connections of a 55 and a 57 in a circuit for diode detection, automatic volume control, and noise suppression.

D-C Power Tubes

WHAT TUBES are the most suitable for push-pull output in a d-c operated receiver? I know that the 48 has been designed for this purpose but I would prefer a tube that is less expensive, and one that will fit speakers designed for 171A tubes and the like. If there is such a tube please name it.—F. R. T., Erie, Pa.

The 43 ought to fit the case. It is a tube with a 25-volt heater drawing 0.3 ampere. Its use would simplify the receiver a good deal. It would dispense with the shunt resistance necessary to compensate for the 0.1 ampere difference in current requirements. Moreover, it can be used with speakers designed for 171A, 245, 250, other tubes with about the same load impedance.

Diode-Triode in Noise Suppressor

IS THE triode of a 55 an audio amplifier when used to control the bias on the next tube in the circuit? If it is, will you kindly explain why a very large condenser may be connected between the control grid and ground? Is the next tube an audio amplifier or a detector? I am very much "at sea" about this matter.—F. G. J., Stamford, Conn.

The triode part of the 55 is then a d-c amplifier and that alone. That is why a large condenser can be connected between the grid and ground. It amplifies the bias on the tube that follows. This tube may be called the noise suppresser but it is the 55 triode that makes it suppress. The noise suppresser tube is an audio amplifier when there is any signal to amplify. It is a shut valve when there is nothing but noise to amplify, unless the radio frequency noise is so severe that it is able to open the valve.

One of the first Americans to see the treasures of King Tut's tomb was Jimmy Kemper, who is starred over an NBC network. Jimmy was the house guest of Thomas Shafto, famous far-eastern theatre impresario, at the time and was in Shafto's party which visited the Egyptian museum in Cairo when the first treasures were being unpacked there.

Interference in Receivers

WHEN A receiver is unable to separate high frequency stations but is all right at the low frequencies, is the fault in the receiver or does it lie in the stations? That is, do the frequencies of the stations vary?—W. H. C., N. Y.

The cause is not likely to be variation in the frequencies of the transmitting stations, because if the stations allowed their frequencies to vary sufficiently to account for the trouble, they would not be allowed to continue transmitting. Yet the receiver may not be at fault either. On the high-frequency channels there are many stations and two or more stations may be using the same wave at the same time. When that is the case it is impossible to make the selectivity so high that the receiver could separate them. However, the trouble is likely to lie with the receiver first, because a higher selectivity is needed at those high frequencies, and second, many receivers are considerably less selective at those frequencies. If the trouble occurs when the receiver is a well-adjusted superheterodyne the trouble is most likely to be that several broadcast stations are operating on the same wave simultaneously.

Oscillator Tube Heats Up

THE OSCILLATOR tube in my superheterodyne heats up to the point where the plate is red. How can this be prevented and what is the reason?—H. P., New York, N. Y.

The plate current in the tube is too high and there is no way in which the power can be carried away to some other place

to be dissipated. Reduce the plate voltage or put a resistance in the plate circuit to limit the plate current.

Power Tube in Resistance Amplifier

CAN an output power tube like the 59 be used as a voltage amplifier in a resistance-coupled circuit to deliver a very strong signal to a still larger tube? If so, what should the load resistance and the screen voltage be? Should the grid bias be the same as when the tube is used as a power amplifier and is it permissible to use a grid bias resistor?—W. R. C., Mineola, L. I.

Yes, it can be used for that purpose. The load resistance might be of the order of 50,000 ohms. The grid bias should be the same as when the tube is used as a power amplifier. The grid bias resistance should be considerably higher since the plate current will be lower. With 50,000 ohms in the plate circuit the proper bias resistance should be around 5,000 ohms. This value, however, should not be depended on but the value should be varied until the proper bias is obtained. The screen voltage should probably be much lower than when the tube is used as a power amplifier. Certainly, the voltage should be so low that the effective plate voltage is higher than the screen voltage. A resistor of suitable value in the screen lead might be the best way in which to insure that the plate voltage will remain greater than the screen voltage.

Voltage Doubler

I HAVE built a voltage doubler rectifier and I find that the voltage falls rapidly as I increase the current drawn from it. What is the reason and how can it be remedied?—H. P., New York, N. Y.

The condensers in the filter are not high enough. If the regulation is to be good, it is essential that the condensers be large. If you already have large condensers, you either draw too much current or the rectifier does not supply enough current. This may be due to excessive resistance in the rectifier or in the transformer supplying the a-c. In a voltage doubler of this type using radio frequencies it was found the lack of capacity was due to insufficient coupling between the high frequency oscillator and the rectifier.

Output of Diode

IS THE output of a duplex diode triode great enough to load up a power tube or

is an intermediate audio amplifier necessary?—F. C. E., San Diego, Calif.

The output of a duplex diode, or any other diode, is high enough to load up any of the available power tubes used in receiving sets. But, of course, it will not be high enough for any tube if the signal put into it is not high enough.

Amplitude Controlled Oscillator

DOES an oscillator in which the grid bias is amplitude controlled really stabilize the frequency? If so, how?—W. E. N., Chicago, Ill.

Apparently it does not because only the bias is proportional to the amplitude, the oscillator merely becomes more efficient the higher the amplitude. The bias has no control over the instantaneous grid voltage. If the rectifier load resistance is in the grid circuit so that the resistance acts as a leak, there is a control of the instantaneous grid voltage, just the same as any grid leak controls it.

Grid Current in Amplifiers

WHY IS IT that with modern tubes recommended grid leak resistances are nearly always relatively low? Is it because there is a grid current even when the bias is negative?—T. R., Rochester, N. Y.

The recommendation is an acknowledgment of the fact that grid current does flow and that its effect must be prevented by using a low resistance. It appears that some of the modern tubes have more grid current than some of the older ones. Many of the latest tubes have high amplification factors, requiring a low bias. Therefore there is more chance of entering into the positive grid bias region on strong signals. Even when the bias is negative but of low value there is grid current in most tubes.

Separate Mixer Tubes

IS IT BETTER to have a combination mixer tube or separate oscillator and modulator? If separation is preferable, why is the 2A7 brought out?—K. V. S., San Antonio, Tex.

Good results are obtainable from a combination or autodyne tube, better results from separate oscillator and separate modulator. The 2A7 is two separate tubes, a triode oscillator and a pentode modulator, though both are in one envelope. Electron coupling is used.

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WORLD'S FAIR TO EXTOL SPAN OF ELECTRICITY

The wizardry of electricity that has transformed the world's communication in the past hundred years, provided power for factories, light for homes, necessities and recreational features undreamed of a century ago will be unfolded to the millions of visitors to Chicago's 1933 World's Fair—A Century of Progress Exposition.

Dramatic exhibits of the amazing progress of the electrical industry will be shown in the Electrical Building and the Communications Building which rise on Northerly Island fringing a beautiful lagoon.

A striking example of the miracle of modern electricity was presented when the Electrical Building and the Communications Building were formally dedicated last fall.

When the ceremony opened the great semi-circular hall of the Electrical Building was almost dark, save for the wavering light of candles.

Grid Glow Tube Used

On the speaker's stand a man approached a table on which was mounted a mechanism that looked like a storage battery with over-sized radio tubes on its top, one twice as large as the other.

The man paused for a moment before this device and then passed his right hand over the larger tube. Then as if by a miracle performed by Aladdin the hall burst into the brilliant radiance of high powered electric lights.

The man was W. O. Batchelder, president of the Electric Association of Chicago. The device was a grid-glow tube. Electricity from the body of a person approaching a grid-glow tube closes a circuit which may cause illumination to be turned on, or other services to be performed by electrical power.

The Electrical Building and the Communications Hall are located across the lagoon from the Hall of Science on the mainland. Joining the Communications Hall on the north is the Social Science Building, connected by a bridge with the Hall of Science. Raymond Hood of New York is the architect.

"Miracles" Listed

A preliminary announcement of exhibit plans by one of the electric companies listed a few of the modern miracles of electricity that will be on display, including:

1. The thyratron organ—size of a piano but combining the range, volume and musical quality of pipe organ and calliope;
2. The fever machine—wonder device for increasing temperatures at will in fighting disease;
3. Communication of sound, light beams;
4. The sodium lamp.

Scores of other marvels, some of which have never before left the research laboratory, will receive their premiere at the 1933 World's Fair.

Modern uses of electrical current will be portrayed in an exhibit by the Electric Central Committee, representing ten major public utility groups.

Eight main sections will be included in this exhibit, each representing some different use of electricity. These will be residential, commercial, industrial, science of seeing, electricity on the farm, school room, lamp lighting and spectacular display.

NBC-KPO Chain Ends Its Career

Oakland, Calif.

The NBC-KPO network has ceased to exist.

Don E. Gilman, vice-president in charge of the Pacific Division of the National Broadcasting Company, announced the reasons for the discontinuance of program service from NBC to member stations of the KPO network, which includes KGA, Spokane; KJR, Seattle; KEX, Portland, and KECA, Los Angeles.

Mr. Gilman said these stations will build their own programs, while KPO operates its new 50,000-watt transmitter near Belmont, on the San Francisco peninsula, offering the same service to listeners as in the past.

The NBC-KGO network, which includes in addition to KGO, the key station in San Francisco, KFI, Los Angeles; KGW, Portland; KOMO, Seattle; and KHQ, Spokane, will be operated as usual, with programs from San Francisco, New York, Chicago, Washington and all former points of origin. The same program service will be available to KPO only.

An economic saving without sacrifice of service to listeners was the motive of the Pacific Division's change in network policy, according to the NBC's western head.

FLIERS' BEAM DEFIES CLOUDS

How planes can be guided down over cloud-obscured airports by means of a new directional radio apparatus that sends up a well-defined path of signals from the airports to pilots flying above the clouds as far away as fifteen miles, has been revealed by United Air Lines' engineers after completing satisfactory tests of the new equipment on its New York-Chicago-Pacific Coast mail, passenger and express airway.

Known as the "airport localizer beam," the radio signals are broadcast in loops over a directional antenna that can be aimed to shoot the signals toward a pilot in flight at any point within a fifteen mile radius of the airport.

The localizer is coordinated with the Department of Commerce directive radio beacon established along mail-passenger airways to identify by code signals the course of the air routes from city to city. However, when a pilot, flying above clouds that obscure the ground below, reaches the city of his destination, finding the airport is another problem that has been solved by the localizer beam.

As the pilot nears the city, he communicates with the United Air Lines airport dispatcher by radio telephone and advises his position. The dispatcher immediately locates the position on his map, turns the movable antenna of the localizer beam in the proper direction and switches on the transmitter, which shoots a steady stream of signals at the pilot. As soon as the pilot hears the localizer beam in his earphones, he follows it until he emerges from the clouds directly over the airport. If he strays from the course, the signals immediately change to warn him of his deviation.

Dispatchers can also talk with pilots on the United localizer transmitter, to advise whether or not the field is clear for landing. Thus the new development also improves airport traffic control.

TEST FOR OSCILLATION

While the "touch-grid" test will locate undesired oscillator, a better way is to measure plate current, which is much higher during oscillation.

BLIMP IS USED IN SEARCH OF FADING CURE

Radio engineers of the Westinghouse Electric and Manufacturing Company have bought a baby blimp, which, if experiments are successful, will add considerable to broadcast efficiency.

Walter C. Evans, manager of radio broadcasting for Westinghouse, announces that the blimp, which flew to East Pittsburgh from the Goodyear Company at Akron, O., will be floating high above KDKA, near Saxonburg, trailing an experimental antenna.

"We are conducting extensive research aimed at the reduction of fading," states Mr. Evans, "and the use of a blimp is another of the steps we are taking in that direction.

500-Foot Aerial Trailer

"We expect to have the blimp installed within a few weeks and then will conduct extensive research into its use as a support for antenna.

"Our blimp, of the type often used for advertising purposes, will be 25 feet long and about 10 feet in diameter. A combination guy and feed wire will hold it in the air about 1500 feet over the station. Trailing from it will be a 500-foot antenna, of course, connected to the feed-in wire. A system of winches will be installed on the ground to raise and lower the bag when necessary.

"The first blimp we have ordered is a small one and will be used only for experimental work. It can only lift a fairly light weight, so the aluminum wires of our new system, will weigh about 14 pounds.

Larger Blimp Considered

"Experiments will be conducted under the direction of R. N. Harmon for a period of some months. If they are as successful as his preliminary calculations indicate we will then obtain a much larger blimp and install extensive equipment for further studies.

"Our experiments are for the purpose of extending the present range of broadcasting stations and, at the same time, expanding the area in which no fading occurs."

In any event, those listening to KDKA, will, on occasions, hear broadcast programs actually coming from the air and high in the air, at that.

Former Operator Boss of Westinghouse Radio

Walter C. Evans, long associated with broadcasting activities of the company, was appointed manager of the radio department of the Westinghouse Electric & Manufacturing Company. He will retain his former duties as manager of radio broadcasting and, in addition, will have entire charge of the sale, engineering and manufacture of Westinghouse radio apparatus.

It is a long climb from the post of radio operator of a Great Lakes vessel, the job he had when only 15 years old, to his present executive duties but Mr. Evans belongs to that group of youthful leaders who have made America's radio history. He spent two years on the lakes then became radio operator on a United Fruit ship.

PERSONALITIES

The Easy Aces program originates in Columbia's Chicago studios, but its theme song is "Manhattan Serenade"...Edwin C. Hill's faultless and vividly colorful speech has brought him radio fame, but he has never made a platform talk in his life and steadfastly refuses to do so...Morton Downey, the Irish tenor, likes to sing "Eli, Eli," the sacred song of the Hebrews... Jane Froman, ex-journalism student, who once wanted to be a sob-sister, now says she runs away from newspaper folk who would interview her as a radio star... Kate Smith collects hundreds of unusual perfumes in all sorts of containers, but never uses any herself...David Ross, shortest in stature of all radio announcers, has the deepest and most resonant voice... Fred Waring sings and conducts his vocalists in college glee specialties over the air, yet as a student at Penn State he failed to make the glee club...William O'Neal is Columbia's tallest singer and Jeannie Lang the shortest, but they sing duets together on the Pontiac programs.

Muriel Wilson, the Mary Lou of Captain Henry's Show Boat, once was called upon to substitute anonymously on another program for a soprano who was unable to sing. The sick soprano got lots of fan mail telling her she was in fine voice that night.

Tom Howard says he has been having some trouble with his eyes. But he thinks he would have more trouble without them.

Jeannie Lang: "Are you sure those were good matches you sent to Mrs. Crumplefuss this morning?"

Tom Howard: "Of course! I tried them all before I sent them, and every single one of them worked fine."

Scrappy Lambert, leader of the Singing Clerks, wrote "The Boys From I. O. U." that his boys sang the other night. Incidentally, that beer ballad, "The Old Quartet," that they sang last Friday night is a brand new tune, and it was broadcast from "The Musical Grocery Store" for its first public appearance. The boys picked the right night to introduce it, too.

Norman Anthony, "Ballyhoo" editor, is writing some of the gags for Tom Howard's "Musical Grocery Store" these days.

Herb Polesie: "What do you think of the moratorium?"

Tom Howard: "It's one of the best boats."

To Max Reinhardt, the German dramatist, who put Jessica Dragonette in "The Miracle" in the only solo part, the National Broadcasting Company star was "Gentle Julia" because she was always so polite. The Reinhardt spectacle was Miss Dragonette's first professional engagement. Her next opportunity came in "The Student Prince" as Kathie and she was next the ingenue in the Neighborhood Play House Follies. She made her first radio appearance in 1926.

Among his souvenirs, Phillips H. Lord can list the following unusual gifts from listeners: Apples, tropical fish, fish worms, clams, antiques of all sorts, busts, pastels, butterflies, paintings, baskets, bulbs, potatoes and hundreds of other odd items.

BORRAH MINEVITCH practices the harmonica early in the morning with all the lights out...JIMMY MELTON started his musical career as a saxophonist...FRANK MUNN'S aversions are cucumbers and ferry boats...PHILLIPS LORD owns a 220-foot schooner...ALLYN JOSLYN, NBC actor, is a bachelor...FRANCES LANGFORD'S greatest thrill

was meeting Al Smith and having her picture taken with him.

It's often really difficult for Peter de Rose, member of the team of Breen & de Rose and a well-known composer, to tune himself off the air. When Peter installed a radio in his automobile the first three numbers that came over his set were his own compositions.

The Pickens Sisters, NBC singing trio from Georgia, soon will be able to open a dress shop of their own. Every time they appear on a program the three sisters buy similar gowns, only different sizes. They will soon have enough gowns, Patti confided, to open a small store, for "there's three of everything to pick from."

Mary Livingston distinguished herself as an imitator of Mae West during the Chevrolet program recently. Miss Livingston mastered Miss West's dulcet speech of "She Done Him Wrong" during a single sitting at the performance of the popular talkie.

That mail carrier who spent his day off accompanying another mailman on his route must have been a relative of Lee Sims and Ilomay Bailey, the NBC stars. The couple (Ilomay is Mrs. Sims) have seven radios at home—one in each room.

President Roosevelt's inaugural address was heard twice in this country—the second time several hours after it was delivered. An NBC control engineer at home tuned in GSA, one of the new, beam short-wave stations used by England. On 49 meters they were sending to Canada, and the engineer tuned in the edge of the band, to hear President Roosevelt's voice coming from across the Atlantic. The NBC transmission of the address as the President spoke had been clear enough to make recording possible in London, and his words later came back to this country with all the original clarity and force.

Norman Cordon's most prized possession is a pair of riding boots, ten years old, which he has worn in many fox hunts. Norman is the basso heard with the Ambassadors quartet.

Olga Albani, NBC's mezzo soprano who in private life is Olga. Countess Albani, is an ardent sportswoman. One of her favorite sports is fencing.

THURSTON HALL, who plays DETECTIVE JIM HANVEY in the Townsend Murder Mystery dramas, has played thirty years on the legitimate stage and in vaudeville, musical comedy, the silent screens and the talkies...If VICTOR HALL, member of the ROLLICKERS QUARTET, were presented a million dollars tomorrow, he says he wouldn't quit radio!...ANNETTE HANSHAW'S favorite dish is chocolate pudding with whipped cream...GEORGE HICKS, announcer, is prouder of having been an ordinary seaman than attending college!...HARRY HORLICK was born in Tiflis, Russia, the son of a composer and writer...ARTHUR BILLINGS HUNT, who weighs 230 pounds and is six feet tall, likes to have "a light in the house" when he returns home at night.

Harold Stokes, orchestra director, is saving "musical mongrels." Thus far he has kept the hobby a secret. Musical numbers which are written, published, plugged, and then dropped because the public does not like them or does not take to them, are called "dogs" in the publishing world. Stokes has gathered a large collection of these which have never been touched by the purchasing public.

News of the Manufacturers' Association

Broadcast problems, especially the "hum" of certain transmitters, are being studied by engineering committees of the National Association of Broadcasters and the RMA. The committees of the two organizations held their initial meeting, Virgil M. Graham, of Rochester, New York, being chairman of the RMA group, and Joseph Chambers, of WLW, Cincinnati, chairman of the broadcasters. Audio frequency hum of some transmitters, mostly old equipment of a few small stations, and heterodyne frequency producing hum between stations affecting operation of receiving sets, were subjects before the joint conference.

The radio industry is sharing in the improved banking and business conditions, according to a survey by Radio Manufacturers Association's Board of Directors.

Outstanding broadcast features in March, such as the Roosevelt inaugural and the President's dramatic banking broadcast, contributed not only to actual radio sales, but to trade stimulation. While the banking moratorium struck the radio industry like others, there has followed an upturn in radio sales, especially of automotive receiving sets.

Several projects for future development, such as cooperative institutional broadcasting, possible development or improvement of receiving set design and new technical developments now in the laboratories but capable of commercial promotion, were initiated by the RMA directorate.

W. S. Symington, president of the Colonial Radio Company of Buffalo and New York City, and LeRoi J. Williams, newly-elected executive vice president and general manager of the Grigsby-Grunow Company of Chicago, are new directors of the RMA.

Try-Mo Enjoys Success With 'Beginner's Twin'

The Try-Mo Radio Co., Inc., reports great interest in its new short-wave receiver, "The Beginner's Twin." Highly enthusiastic letters have been received from various points throughout the country regarding its unusually fine operation. One amateur writes:

"I received GSSW and 12RO regularly, as well as numerous other short-wave stations. At present I cannot read the code but have commenced practicing and expect soon to copy amateur and commercial stations all over the world."

Judging from the letters received so far this outfit bids fair to be one of the most popular kits on the market at the present time, said Morris Lager, of the Try-Mo Co.

Many amateurs have reported that they didn't believe it possible to put out such a kit at so reasonable a price. One writes: "Yours is by far the best short-wave kit I have purchased. You use Hammarlund condensers throughout while others are selling inefficient tuning condensers and other apparatus. No wonder the "Twin" performs. I was delighted to find that the coils furnished were absolutely correct and covered the wavelength range specified with smooth regeneration control. No alterations were required. I do not hesitate to recommend this kit to my friends."

STATION SPARKS

By Alice Remsen

Indian Lament The Lone Wolf Tribe

(WABC, Mondays, Wednesdays and Fridays, 5:45 p.m.)

Gone forever are the council fires
Which lit the land of our brave sires.
No more, when wooded hills we roam,
Will their warm light lead us back home.

We were the children of this earth,
But we have signed away our birth,
For promise to protect our young,
Forgotten when it left the tongue.

The hunting ground is laid in corn;
From us our resting place is torn;
You squaws and braves—our honored
dead,

Above your graves the plow is led!

And gone the spirit of our race,
As once we were there is no trace.
As a splendid nation we have passed—
Soon the Great Spirit calls our last.

—Otto Johnson.

* * *

The poem is contributed by Otto Johnson, a well-known authority on the American Indian. Mr. Johnson is also an ardent radio fan and writes that the Lone Wolf Tribe program is one of the most interesting of its kind on the air; he recommends it for children and grown-ups alike. So listen in and enjoy these American Indian episodes.

* * *

The Radio Rialto

MOSTLY A MATTER OF HEALTH

Well, my word! Here I am back in the Big City, after five months of philandering in Cincinnati. Everything looks just about the same as it did when I left, although I've not yet had time to look around thoroughly; have not even had time to draw a long breath and relax. As soon as I arrived, down I had to sit at the old typewriter and bat this out for you to read—so if I'm short and to the point this week, please forgive me. . . . I left a friend in Cincinnati, Margaret Maloney, Editor of Radio Dial, sick with scarlet fever. I return to New York to find another friend, Elsie Hitz, of "Evening in Paris Mysteries" and "The Magic Voice" fame, sick with the same illness. Margaret acquired hers through drinking water during the flood; Elsie gained hers from a little niece whom she visited. It was only recently that understudies had been found for Elsie, and so, for the next few weeks you will hear Lucille Wall speaking Elsie's role in "The Octopus," and Thelma Marsh doing the same thing in "The Magic Voice" . . . Not so fortunate were the Mills Brothers, for when brother John, with the boom-boom voice, was stricken with a serious illness, no substitute could be found and so Stoopnagle and Budd pinch-hit for the dusky quartet. . . . Which only goes to prove that understudies are as necessary to radio as they used to be in the legitimate drama.

HOW FANNIE BRICE ARRIVED

It is always interesting to know the how, why and wherefore of an artist's career. Some were born into the profession, some drifted, and some were actually pushed. Fannie Brice, radio's newest comedy sensation, was actually pushed into the show world—literally and violently, and here's how it happened: At the age of fourteen Fannie went to a Brooklyn theatre to see two newsboy friends perform in an amateur contest. She stole through the stage

door by convincing the old doorman that she was one of the performers. While she stood in the wings watching the amateurs go through their acts, the manager seized her and shoved her on, shouting: "It's your turn next! Go out and knock 'em cold!" Fannie was frightened to death, but with the courage of youth and no time to think, she just blinked her eyes in the unaccustomed glare of the footlights, opened her mouth and started to sing. The song was "When You Know You're Not Forgotten by the Girl You Can't Forget." Instead of throwing a shower of assorted vegetables, the audience deluged Fannie with coins and on top of that she won first prize in that amateur performance and ran all the way home with the money. After that first success nothing could keep her off the stage. Fannie Brice really did start right from the bottom and worked her way up in successive stages to the very topmost pinnacle. . . . Would you be interested in knowing that Georgia Backus, heard in the Eno Crime Club Clues broadcast over NBC, declares that her most prized possession is her dog "Shadow"?

Are you aware that John Tucker Battle served in the war as bugler in the U. S. Marine Corps? . . . that Jack Benny might have been a concert violinist instead of one of radio's funniest men, because he studied with two famous violinists? . . . that Al Bernard was once an office boy at three dollars a week? . . . that Don Bestor does most of his composing just before dawn? . . . that "Corky" was Ford Bond's college nickname, because a football injury made him limp through one entire semester? . . . and that Guy Bonham was born on Thanksgiving Day?

RADIO SERVES!

Radio is again proving itself a wonderful help to mankind in the search for possible survivors of the Akron disaster. While the planes and ships sweep the waters, messages are being sent from them to Naval headquarters telling a chronological story of their efforts and discoveries. . . . During the floods through Ohio, radio, especially via WLW, played a great part in aiding those who were in charge of flood relief, keeping them informed of the rise in the river and giving out orders to marines, police, firemen and citizen helpers in the flood area. . . . Encouraging news comes from the Chevrolet Motor Company; in March, despite the unsettled banking situation, its production came within three hundred units of equaling March of last year. During the first quarter of this year it manufactured 148,336 new cars and trucks against 133,363 a year ago. Retail deliveries of Studebaker and Rockne automobiles, in ten days ending March 31st, exceeded all previous records for the same time since June, 1932. A total of 1,758 cars was delivered in that period. . . . Sales of Buick cars also registered an upward trend with 1,636 new cars, a gain of 734. So if the automobile industry can show gains, it stands to reason that every other industry will follow suit in due course, and radio is bound to benefit accordingly. . . .

A MILE-A-MINUTE TALKER

There is a fast-talking young man now on the air with a mile-a-minute speed. He is Billy Repaid, the man who talks like a typewriter. The "Globe Trotter" and "The Radio Reporter," morning and evening news commentator of Station WJR, in Detroit, for the last two and a half years, Billy now is rushed East on an express train each week to keep pace with the

fast-moving tempo of B. A. Rolfe's music on his Saturday Night Dancing Party. Repaid likes to talk. A Detroit business man, he entered radio when the manager of WJR heard him address a sales meeting and decided there was a place on the air for Billy's fast-wagging tongue. The next week "The Radio Reporter" made his bow, and ever since he has been giving Detroit a breathless account of what's happening in the world. Repaid still gives his news casts in Detroit each Monday, Tuesday, Wednesday and Thursday. Friday he catches a train for New York and the Dancing Party. Sunday finds him on his way back to Detroit. . . . Gene and Glenn had a funny experience during their present personal appearance tour. They continued their broadcasts for the Sohio Company in whichever town they happened to be in via WLW and WTAM. When they arrived in Bellefontaine, Ohio, they found that the only grand piano in town was owned by Sid Lawrence, the local theatre manager, and the boys needed that grand for their radio act. So what? Well, a line was run into Sid's front parlor from WLW in Cincinnati, and WTAM in Cleveland, and the show went on as scheduled, using the parlor as a studio, and the grand piano nobly withstood its first, and probably last radio experiment very successfully.

* * *

Biographical Brevities

About Walter Damrosch

Dr. Walter Damrosch, dean of American conductors and music counsel of the National Broadcasting Company, recently observed his seventy-first birthday, but refused to allow any fuss or ceremony. He's too full of life and vigor to think seventy-one worth celebrating. He first set foot on American soil in 1870, when he was nine years old, just after he had seen the great Richard Wagner conduct at Bayreuth. His father, Dr. Leopold Damrosch, was a noted conductor in Breslau, where Walter was born.

When the family came to the United States on the invitation of the Arion Society, New York's largest German choral organization, Walter and his brother Frank were injected into the turmoil of Public School No. 40, on East 23rd Street. In 1873 the elder Damrosch founded the New York Oratorio Society, and Walter, then eleven, sang in the chorus. Four years later Leopold founded the Symphony Society and in 1883 he was invited to conduct German opera at the Metropolitan. In the meantime young Walter was getting on; yes, indeed. At the age of 18 we find him engaged as the conductor of the Newark Harmonic Society and sort of unofficial assistant at the Metropolitan. After his great father's death, the youthful impresario, not quite 23 years old, took the Metropolitan Company on tour. Less than a month later Walter conducted his first performance of the New York Symphony and made such an impression that he was immediately elected to permanent possession of that post. Hard on the heels of this success came his appointment to fill his father's old place as conductor of the Oratorio Society, and on top of this he was made assistant director at the Metropolitan. From then on each year in Dr. Damrosch's life saw some new and outstanding accomplishment in the world of music. In 1896 he finished writing a grand opera, "The Scarlet Letter," and in 1898 he wrote a "Manila Te Deum," inspired by Dewey's spectacular victory over the Spanish fleet. But, in spite of his remarkable accomplishments in the past, it is the future which interests this marvelous old man, and that is why he is in radio, because he really believes that the future of music lies that way—in the education of the young of this land to the beauties of great masters in music; and perhaps he is right.

TRADIOGRAMS

By J. Murray Barron

A very efficient and compact 3-tube ac-dc short-wave receiver is being marketed by Alan Radio Corp., 83 Cortlandt Street, N. Y. City. While a new number to the line of short-wave receivers, already there are some remarkable records from owners of this set.

* * *

Geo. E. Deming, executive vice-president, Philco Radio and Television Corporation of Philadelphia, reports sales well ahead of last year both for February and March. One week in April, 1933, produced greater sales than the entire month of April, 1932.

* * *

Henderson Publications, Inc., publishers of "Musical Merchandise" and "Radio & Electrical Appliance Journal," have leased space on the 17th floor of the 31-story RKO Building in Rockefeller Center, N. Y. City. This radio publication is one of the oldest trade journals in the field and the organization was established by Glad. W. Henderson, president, in 1916.

* * *

Blan, the Radio Man, 177 Greenwich Street, N. Y. City, a great believer in unique and out-of-ordinary window display, has exceeded his work of the past with a mystifying and clever peek-hole exhibit of "The Fan's Dream," a vest-pocket radio. A large crowd stands in line awaiting a turn to view the creation.

* * *

Now that the Winter is over it's time the fan and experimenter paid some attention to his aerial equipment. As March, with the high winds, has passed, perhaps the old aerial went with it or at least has been shaken loose. However, as a suggestion, when looking over the aerial, if its wire is of the stranded type, why not also erect a solid-wire aerial of large gauge to aid in short-wave reception? It's worth while. Of course, do not forget to have a good ground. If you have not gone in for the thrill of shorter waves, even a small few-tube earphone receiver will give you many pleasant and instructive hours. There are many who are preparing to bring along some small outfits to the shore and mountains this year, so that their leisure time may be more enjoyably spent. With the time, and with the quiet of the out-of-town resort, one can do considerable experimenting and make contact with many outposts of the world.

* * *

There has been in recent week considerable inquiry regarding portable or small public address systems. Some are for use in automobiles. There should be even a greater demand. That there are large prospective sales in the communities can not be doubted. The outlets are numerous.

* * *

There are increasing indications that the automobile receivers are to be even more popular than earlier indicated. While under some circumstances the midget sets are used, and occasionally with very excellent results, it will not mean that all type universal as-dc sets made for battery and eliminator will perform satisfactorily in a car. Only a few such sets will give satisfaction and one has to be very careful. A regular standard receiver designed for automobile operation will nearly always satisfy, provided it is put out by a reliable manufacturer. One should be extremely careful in this respect if headaches and disappointments are to be avoided. Nevertheless the popularity is on the increase and there is a large assortment of satisfactory receivers for this purpose.

* * *

The makers of Philco Radio recently announced a 3-purpose antenna system which would eliminate the noises of so-called man-made static, give better recep-

tion on distant stations, and permit the operation of two to four sets from one antenna. Within a few days of the initial announcement—made by Boake Carter in one of Philco's regular 15-minute broadcasts—Carter's fan-mail picked up in quantity and queries about the new antenna system came in every mail. Wherever the new antenna system has been tried results have been convincing. Any Philco dealer is prepared to demonstrate and explain the technical features of the new system, which can be installed complete in less than 2 hours.

* * *

Notwithstanding the bank holiday which held up business in all parts of the country for at least four days, the Lynch Manufacturing Co. has shown a constant improvement in sales from the first of the year, according to statement just issued by the company's president, Arthur H. Lynch. Mr. Lynch will be remembered as the former editor of "Radio Broadcast" and "Radio News." Recently he has relinquished many of his other trade connections in order to devote most of his time to the company bearing his name. Sales for January were 5% better than for January of last year. Sales for February were 8% better than 1932 and sales for March were 95% better than they were the previous March. Mr. Lynch is a firm believer in the fact that list prices should not be lowered and that discounts should not be increased. If these two tendencies in radio merchandising continue it is going to become increasingly difficult for the manufacturer to make any real progress, he believes.

* * *

A small, inexpensive slide-wire rheostat for radio experimenters, service men and manufacturers of electrical equipment is announced by G-M Laboratories, Inc., 1735 Belmont Ave., Chicago, in its type R rheostat. Wound on a one-piece porcelain form, with adjustable contact for varying the resistance, this unit is designed for maximum service and convenience. It will dissipate 75 watts continuously. These rheostats are wound with wire having low temperature coefficient of resistance, in 12 ratings, from 5,000 ohms, 0.12 amperes, to 4.8 ohms, 4 amperes. Binding screws at each end of the winding permit the use of any type R rheostat as a potentiometer. Considerable overloading for brief intervals will not permanently damage the rheostat. The formed metal mounting bracket seven inches long provides rigidity and a convenient means for mounting on metal, bakelite or wood.

CORPORATE ACTIVITIES

CORPORATION REPORTS

Sparks-Withington Company. Net loss for six months ending Dec. 31, after deduction of depreciation, taxes and other charges, \$200,996. The net loss for the same period of 1931 was \$472,657.

Weston Electrical Instrument Corp. Net loss for the year 1932, after deduction of depreciation, taxes and other charges, \$143,353. For the year 1931 there was a net profit of \$122,264, equivalent after Class A payments, to 32 cents a share on \$164,000 no par common shares.

McGraw Electric Company and subsidiaries. Net loss for 1932, after adjustments, depreciation, inventory, taxes and other charges, \$269,124. For the year 1931 there was a net profit of \$188,932, equivalent to 75 cents a share on 250,000 no par capital shares.

Canadian Westinghouse Company—For year 1932, net income after depreciation, taxes and other charges, \$706,330, amounting to \$1.31 a share on \$540,000 no-par common shares, as against \$1,842,740, or \$3.41 a share, in 1931. In 1932 the deficit after dividends was \$373,670, compared with a surplus of \$222,740 in 1931.

BANKRUPTCY PROCEEDINGS

Petition Granted

James R. O'Kelly, radio engineer, 147-15 Willets Point Blvd., Flushing, N. Y., assets \$6,325.50; liabilities, \$7,832.66.

Petitions Filed By

Century Radio Service, 45-8th Ave., New York City (Alfred J. Pratt and Gerald S. Murphy). Assets, \$873; liabilities, \$3,072.

Western Electric Lists Its Tubes in Catalogue

A want long-felt among amateurs in radio telephony is filled by a catalogue just issued by the Western Electric Company. The catalogue covers types of vacuum tubes produced by this manufacturer for use by licensed amateurs in radio telephone transmitting equipments.

In all, 27 tubes are described, running from the smallest or so-called "peanut" tube to the 276A which has a maximum plate dissipation of 100 watts.

Two pages in the catalogue are devoted to the information on each tube. The information consists of a statement of the uses of the tubes, a table of electrical characteristics; a line drawing showing the shape of the tube, its internal structure and its outside dimensions; a diagram indicating where the various leads appear in the base prongs or other connections and the code numbers of the sockets with which the tube may be used. In short, all data required by the amateur for designing his circuits in a radio telephone transmitting equipment is presented.

Copies of the catalogues may be obtained by licensed amateurs at the offices of the Graybar Electric Company, which are located in 75 principal cities of the United States.

Wynn's Chain Rents Two Entire Floors

Amalgamated Broadcasting System, Inc. and Amalgamated Artists Bureau, Inc., Ed Wynn, president, Ota Gygi, vice-president, have leased two entire floors in 501 Madison Avenue, the thirty-story building at the northeast corner of 52nd Street. The gross area taken approximates 10,000 square feet of space, and the tenants have an option on an additional 27,000 square feet. The structure is to be named the Amalgamated Broadcasting Building after Mr. Wynn's new company, and this name, in large bronze letters is now being affixed to the front of the building.

The lease was signed on Mr. Wynn's birthday, his 30th anniversary in the theatre, and also the third birthday of the building into which he is moving.

The tenant is assembling the so-called third network which, when completed, will include 100 broadcasting stations. Amalgamated promises a new type of entertainment and plans to make the advertising phase of the entire situation subservient to the program itself.

Literature Wanted

Readers desiring radio literature from manufacturers and jobbers should send a request for publication of their name and address. Address Literature Editor, RADIO WORLD, 145 West 45th Street, New York, N. Y.

T. O. Leid, Radio Hospital, 346 W. 14th St., New York City.

James J. Merriman, 5706 S. Carpenter St., Chicago, Ill.

Joseph Franklyn, 1877 Sterling Place, Brooklyn, N. Y.

Peter Buckland, 140 Shepard Street, Rochester, N. Y.

M. Mickelson (short-wave and receivers only for re-sale), Paramount, 3448-19th Avenue, South, Minneapolis, Minn.

R. T. Guernsey, 2638 Emmet St., Chicago, Ill.

G. W. Elam, Jr., Box 345, Willis, Texas.

Speed Rossi, Box 45, Dunbar, Pa.

Perry J. Sherman, No. 1112 Mesquite St., Corpus Christi, Tex.

L. T. Patterson, 555 B St., Idaho Falls, Idaho.

H. B. Van Natta, 1056 Bond St., Elizabeth, N. J.

Clifford Wiseman, Stoy, Ill.

Leo Korpinen, Box 33, North Lake, Ishpeming, Mich.

F. M. Wilcox, Prop., Auto Electric Service, Omak, Wash.

RCA Building Nearly Completed; 1,400 Are At Work on Structure

Work on the 70-story RCA Building in Rockefeller Center has entered the final stages. Approximately a month before the arrival of the first tenants, the towering edifice is nearly completed, according to an announcement made by Rockefeller Center, Inc.

Of the 2,100 workmen now rapidly pushing forward the construction of the Rockefeller Center Development, about 1,400 are concentrated in the RCA Building.

It is estimated that this structure is now approximately 90 per cent completed.

Most of Activity Inside

Most of the activity is being carried on inside the sweeping granite walls of the building. Electricians, mechanics and engineers are installing and testing the mass of mechanical equipment that will provide light, heat and power for the building's estimated daily "resident" and transient population of more than 50,000 persons. Plasterers, painters, carpenters and artisans are putting the last polish and sparkle to the luxurious inner finishings.

Many of the upper floors are completed. The general plastering has been completed, with the exception of a few floors which have been held up due to tenant requirements for special layouts. The white, or final, coat of plaster is now being applied to the walls and ceilings of the basement and shopping basement levels.

Terrazzo flooring in the main, mezzanine and shopping basement floors has

been poured. The mezzanine floor already has been polished and workmen are now polishing the floors in the main and shopping basement areas.

Glazing is completed throughout the building except for the show windows on the main, mezzanine and basement floors.

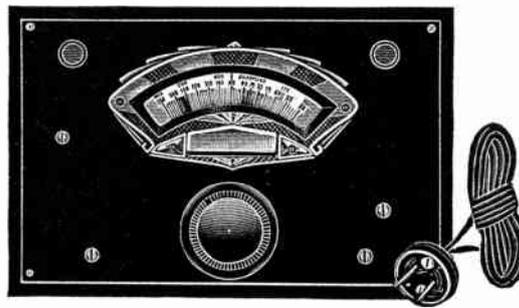
Most of the interior marble has been set. Workmen are now polishing and jointing the marble. All interior tile is in place and it is now being cleaned and pointed. Wales brown tile is being set in the floor of the observation tower at the top and on the roof terrace at the 65th floor.

Engineers report that the elevators in the building are 98 per cent finished. One car in each elevator bank is now in operation, and there remains to be done only final work in tuning and adjusting the signal control apparatus, and the installation of signal fixtures and cab accessories.

The six escalators which operate between the shopping basement and the mezzanine floor levels of the building are in place and the bronze handrails are being installed.

The extensive ornamentation of the RCA Building is also being pushed rapidly to completion.

All-Frequency Service from a Test Oscillator



The test oscillator has a frequency-calibrated dial, registering 50 to 150 kc, while above this tier of frequencies are registered all the popular commercial intermediate frequencies. So just consult the dial scale.

A COMPLETELY self-operated a-c test oscillator, fundamental frequencies from 50 to 150 kc, with the line frequency, 60-cycle hum, used as modulation but not heard except at resonance, affords all-frequency service, from 50 kc up. This is true because the fundamental may be used as registered on the exclusively frequency-calibrated dial, and harmonics may be used for any higher frequencies, almost without limit. All oscillators are tested up to the 28th harmonic, but response of sufficient intensity may be obtained even beyond the 50th harmonic, and there are proven cases of good results up to the 150th harmonic.

Therefore when fundamental frequencies are low, as here, you may set down the lowest, 50 kc, as one extreme, while the harmonic orders give almost unlimited service to line up short-wave receivers, converters and broadcast receivers that respond to police frequencies.

Average Accuracy 1% or Better

The a-c test oscillator, 105-120 v., 50-60 c., uses a 56 tube, a frequency-stabilized grid circuit, Hartley oscillator and a-c on the plate. Special pains have been taken to assure accuracy, and the test oscillator is guaranteed to be accurate to within 2 per cent. However, at some settings the accuracy is almost perfect, while the average accuracy is 1 per cent. or better. The 2 per cent. rating is the extreme deviation, present in only a few instances.

Therefore in possessing one of these oscillators one knows that he has an instrument of a degree of accuracy more than sufficient for the purposes to which the oscillator will be put, i.e., lining up intermediate amplifiers and padding, in superheterodynes, or lining up condenser gangs in t-r-f systems.

The oscillator will yield sharp zero beats with carriers, and the accuracy may thus be checked at any time against broadcast carriers, using the tenth harmonic (500 to 1,500 kc). This harmonic is used for all broadcast frequencies.

If any particular frequency setting that is a multiple of 50 is ascertained for a receiver or other tested device, frequencies separated therefrom in steps of 50 kc may be registered by setting the test oscillator at 50 kc and tuning the tested device. This is particularly handy in frequency calibration, and for finding frequency extremes in receivers that cover some of the police frequencies.

Get One of These Test Oscillators Free!

The oscillator is self-powered as an a-c device, but may be obtained also in battery model. The circuits used are simplifications of the Hartley oscillator and the construction of all oscillators is under the supervision of graduates of the Massachusetts Institute of Technology, who test each oscillator to verify its accuracy.

The a-c model is constantly modulated and yields zero beats at all times. The battery model has a switch at left for modulated-unmodulated service, and yields zero beats on unmodulated but not on modulated service.

The a-c test oscillator parts may be obtained free with a one-year subscription for *RADIO WORLD*, \$2 issues, one each week, at \$6.00, the regular subscription price, while the cost is \$1.50 extra for wiring and calibrating. The \$1.50 is turned over by us to an outside laboratory. Order Cat. PRE-ACOW and remit \$7.50 with order. The 56 tube is 72c extra.

The battery model requires a 230 tube, a 22.5-volt small B battery, and a 1.5-volt dry cell. Order Cat. PRE-BATOW and remit \$7.50 with order. The 230 tube is 78c extra. Batteries not supplied.

The main scale of the frequency-calibrated dial reads from 50 to 150. The bars are 1 kc apart from 50 to 80 kc and 2 kc apart from 80 to 150 kc. Thus for broadcast work, using the 10th harmonic, the separation as registered by the bars is 10 kc from 500 to 800 kc and 20 kc from 800 to 1,500 kc. On an upper tier the intermediate frequencies are printed: 175, 300, 400 and 450 kc, with a bar to the left of 175, representing 177.5, and a bar to the right of 175, representing 172.5. These, with 150 on the fundamental, represent all the popular commercial intermediate frequencies. Any other intermediate frequency may be obtained either directly from the fundamental, or by dividing a higher desired frequency by the nearest whole number to yield a frequency represented on the fundamental.

SHIELDED OSCILLATORS, \$1 EXTRA

DIRECTIONS FOR USE

Remove the four corner screws and the cover, insert the 56 tube in its socket, restore the cover and screws, connect the a-c attachment plug to the wall socket, and the a-c test oscillator is ready for service at broadcast frequencies. No other coupling is necessary, as radiation is strong enough. Mentally set a pointer to the registered frequencies on the lower tier (so is read as 500, and 150 as 1,500), and set the dial for any desired frequency. At resonance the hum will be heard. Off resonance it will not be heard. For testing intermediate frequencies, connect the bared end of a wire to the output post of the test oscillator, other bared end of this wire to plate of the first detector socket. The first detector tube may be removed and bared wire pushed into the plate spring. The intermediates then are tuned for strongest hum response. If an output meter is used, tune for greatest needle deflection.

The battery model is connected to voltage source as marked on oscillator outleads and is used the same way, except that output lead may have to be wrapped around the aerial near set for a few turns to effectuate coupling at broadcast frequencies. The modulation is a high-pitched note, instead of hum.

Quick-Action Classified Advertisements

7c a Word—\$1.00 Minimum
Cash With Order

URUGUAY STAMPS—100 different stamps, \$1.00. 200 different stamps, \$3.50. Stamps will be shipped direct from Uruguay. Heriberto Meyer, care Radio World, 145 West 45th St., New York City.

PICTORIAL WIRING DIAGRAM made from any schematic. Send number of tubes for estimate. Super Engineering Lab., 1313 40th Street, Brooklyn, N. Y.

1-WATT PIGTAIL RESISTORS @ 5c EACH in following ohmages: 350; 800; 1,200; 20,000; 50,000; 100,000; 250,000; 2,000,000; 5,000,000. Direct Radio Co., 145 W. 45 St., N. Y. City

"DYKE'S AUTOMOBILE AND GASOLINE ENGINE ENCYCLOPEDIA," by A. L. Dyke. New 16th Edition, covering all the latest developments. A complete training in every part of automotive work, and for easy study is divided into a series of 85 simple instructions, 1,339 pages, 4.40 illustrations and diagrams. 6½ x 9¾. Includes chapters on Free Wheeling and Radio Receiving Equipment for Autos. Cloth, \$6.00. Flexible, \$7.50. Radio World, 145 W. 45th St., New York City.

BARGAINS IN FINEST PARTS! — Highest grade, new parts, few of each on hand. National dial, flat type, modernistic escutcheon, type G, clockwise, \$2.19; Pilot drum dial No. 1283 @ \$1.89; a-c toggle switch, 19c; triple pole, four-throw Beat switch, insulated shaft, \$1.62; double pole, four throw, \$1.08. Direct Radio Co., 145 West 45th St., N. Y. City

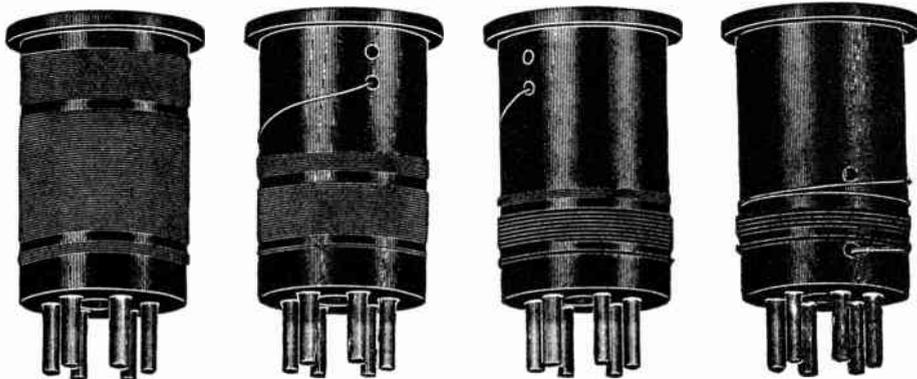
"THE FORD V-EIGHT—'B'-FOUR—'BB'-TRUCK," by C. B. Manly. A New and Practical Book for Everyone Interested in the Construction, Adjustment, Upkeep and Repair of The New Fords. Over 250 pages, 125 illustrations. Complete cross index. Pocket size, flexible leatherette cover. Price \$2.00. Radio World, 145 W. 45th St., New York, N. Y.

NEW RADIO AMATEUR'S HANDBOOK, 180,000 words, 207 illustrations, 218 pages (10th edition, issued 1933). Price, \$1.00 per copy. Radio World, 145 West 45th Street, New York, N. Y.

RADIO WORLD, 145 West 45th Street, New York, N. Y.
ALL SHIPMENTS MADE EXPRESS COLLECT.

SHORT WAVES

14
to
200
Meters



Use
0.00014
Mfd.
Capacity

SIX-PRONG PLUG-IN COILS FOR DETECTOR STAGE

P LUG-IN COILS with six-prong bases that fit into six-pin tube sockets (used as coil receptacles) provide three separate windings: primary, secondary and tickler. The three-circuit coil is most efficient in detector sockets.

Either of the two following uses applies:

(1)—As detector input from a tuned radio frequency stage, with primary in the plate circuit of a screen grid tube;

(2)—As detector alone, where there is no r-f amplification ahead of the detector, primary in the antenna-ground circuit.

See coil connections illustrated below.

The form diameter is 1.25 inch, with gripping flange.

T H E S E coils have proved their effectiveness in many circuits and lend themselves to all types of circuits save those with moving-coil ticklers.

The coils are designed for use with 0.00014 mfd. tuning capacity to tune from 200 meters to below 14 meters. The higher frequency coils have secondaries wound with very thick wire.

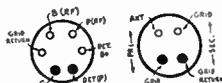
The bakelite coil forms are seasoned so that the inductance will not be affected by moisture-content of the forms.

The base pins are strong and durable and the coils will last for several years.

Four coils sent free with 6 months subscription (26 weeks) @ \$3.00. Order Cat. PRE-SWBP.

FOUR-PRONG PLUG-IN COILS FOR ANTENNA STAGE

When a short-wave tuned radio frequency set is built with a stage of t-r-f, the antenna coil should be of the four-pin, two-winding type. Centers of cores should be 6 inches apart or more to prevent back-coupling. No shielding should be used in either case. Coupling between coils makes a circuit tricky to tune. Shields reduce sensitivity too much in t-r-f short-wave circuits. The four-pin coils are wound with secondaries for 0.00014 mfd. and these match the secondaries of the six-pin coils.



The diagram at left shows connections to make to the sockets of both the UX (four-pin) and six-pin coils. The bottom views of socket connections are shown. The primary of the UX coil connects to Ant. and ground (Grnd.). Follow these connections carefully. If oscillation fails when desired, reverse connections of the secondary (transpose grid and grid return.)

Four UX wound coils sent free with 6 mos. subscription @ \$3. Order Cat. PRE-SWAP.

COIL FORMS



Those who desire to wind their own plug-in coils may use the same forms that prevail in the factory-wound coils detailed above. These coil forms are obtainable in three types. A set of coils of any type consists of four forms.

Any set of four coil forms (not wound) will be sent free for an eight-weeks trial subscription at the regular price, \$1.00.

UX forms (four) order Cat. PRE-CFUX.

UY forms (four) order Cat. PRE-CFUY.

Six-pin (four) order Cat. PRE-CFSX.

TUNING METER

Some short-wave enthusiasts like to tune in stations by the meter method. Thereby they can watch the meter needle for greatest deflection to ascertain resonance. A sensitive milliammeter serves the purpose. One of 5 ma full-scale deflection may be connected in series with the plate feed to an r-f, or intermediate tube, or in the common screen lead of several tuner tubes, or in any other circuit where the steady value of current does not exceed 2 or 3 milliamperes. In all tuner amplifier stages the needle will show higher readings at higher signal levels (modulation is upward) and therefore if only a few milliamperes flow in such circuits the meter may be used. The meter may be used for any d-c current measurement in its range.

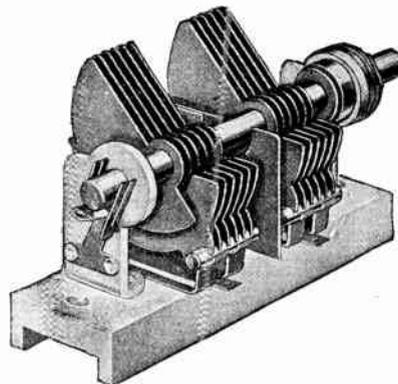
The 0.5 milliammeter is of the panel-mount type and is sent free with a six-months subscription (26 weeks) at the regular price of \$3. Order Cat. PRE-TUM.

MICROPHONE



A general utility microphone for home use, that enables you to use the audio amplifier in your receiver and "broadcast" in your home. This microphone is of the high-resistance single-button type, and is useful not only for serious work but also for playing pranks. No battery required. With the microphone are supplied socket templates and directions for connections to detector tubes of various types of receivers. Good results are enjoyably obtained. The microphone will be sent free on receipt of \$2.00 for sixteen-weeks subscription (16 issues), the regular price. Order Cat. PRE-MK.

CONDENSERS



The Hammarlund junior midline short-wave condensers, 0.00014 mfd., work exceedingly well with the coils offered above, but also may be used to advantage in any short-wave set, with any other coils intended for that capacity. These condensers have Isolantite bases, thus enhancing the low-loss construction that prevails throughout.

The condensers illustrated are the single 0.00014 mfd. and the dual 0.00014 mfd. The shafts are 1/8 inch. A vernier dial should be used. See vernier dial offers, for a-c and battery sets, on another page. Single condenser sent free with three months subscription (13 weeks) at regular price of \$1.50. Order Cat. PRE-H14. PRE-S-14.

Double condenser sent free with six months subscription (26 weeks) at regular price of \$3.00. Order Cat. PRE-DU-14.

Manual trimmer (10 mmfd.), free with trial subscription, 8 weeks, \$1.00. Order Cat. PRE-MNT.

RADIO WORLD, 145 West 45th Street, New York, N. Y.
(WE PAY POSTAGE ON ALL PRODUCTS LISTED ON THIS PAGE)

BLUEPRINT

627. Five-tube tuned radio frequency, A-C operated; covers 200 to 550 meters (broadcast band), with optional additional coverage from 80 to 204 meters, for police calls, television, airplane, amateurs, etc. Variable mu and pentode tubes. Order BP-627 @25c

RADIO WORLD

145 WEST 45th ST., NEW YORK, N. Y.

12-TUBE DIAMOND blueprint in preparation, ready about May 8th; full scale; price, 80c.

ANDERSON - BERNARD 8-tube blueprint in preparation, ready about May 8th, 70c.

RADIO WORLD, 145 W. 45th St., N. Y. City

ANDERSON'S AUTO SET

Designed by J. E. ANDERSON

FOREIGN RECEPTION ON 6-INCH AERIAL

This new auto set is the most sensitive car receiver we have ever come across. Mexican and Canadian stations were tuned in from New York City on a 6-inch aerial. The circuit, an 8-tube superheterodyne, with automatic volume control. The complete parts, including set chassis and set shield, battery box, remote control, battery cable, all condensers, resistors and coils, speaker with shielded cable; and a kit of RCA tubes (two 259, two 236, two 237, one 89, and one 85) are supplied less serial. Cat. 898-K @\$34.60
Wired model, licensed by RCA, with complete equipment, less serial, but including RCA tubes. Cat. 898-W @\$37.40

DIRECT RADIO CO.

143 West 45th St. N. Y. City

SHORT-WAVE COILS and FORMS



Precision short-wave plug-in coils, wound on 1/4" diameter. Form has gripping flange. Four coils to a set for each tuned circuit. Approximate frequencies with 0.00014 mfd. are 1400-3000 kc, 3000-6000 kc, 6000-13500, 13500-30000 kc.
Two-winding coils, UX base. Cat. SWA (four coils)\$1.20
Three-winding coils, 6-pin base (tickler interwound with part of secondary) Cat. SWB @\$1.40
UX sockets for use as coil receptacles, Cat. 52, @ 10c each. Forms four for 80c, either UX or 4-pin.
Six-spring sockets, Cat. 82, @11c each.

SCREEN GRID COIL CO., 143 W. 45th Street, New York City

and "RADIO NEWS" RADIO WORLD

BOTH FOR ONE Year **\$7.00** Canadian and Foreign \$150 extra

You can obtain the two leading radio technical magazines that cater to experimenters, service men and students, the first and only national radio weekly and the leading monthly for one year each, at a saving of \$1.50. The regular mail subscription rate for Radio World for one year, a new and fascinating copy each week for 52 weeks is \$6.00. Send in \$1.00 extra, get "Radio News" also for a year—a new issue each month for twelve months. Total, 64 issues for \$7.00.
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SOLDERING IRON FREE!

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

145 West 45th St. N. Y. City

PADDING CONDENSERS



Either capacity, 50c

A HIGH-CLASS padding condenser is required for a superheterodyne's oscillator, one that will hold its capacity setting and will not introduce losses in the circuit, for losses create frequency instability. The Hammarlund padding condensers are of single-condenser construction on Isolantite base, with set-screw easily accessible, and non-stripping thread. For 175 kc. intermediate frequency use the 850-1350 mmfd. model. For i.-f. from 460 to 365 kc., use the 350-450 mmfd.

0.0005 HAMMARLUND S. F. L. at 98c.

A sturdy, precision straight frequency line condenser, no end stops. The removable shaft protrudes front and rear and permits ganging with coupling device, also use of clockwise or anti-clockwise dials, or two either side of drum dial. Front panel and chassis-top mounting facilities. True straight line. This rugged condenser has Hammarlund's high quality workmanship and is suitable for precision work. It is a most excellent condenser for calibrated radio frequency test oscillators, any frequency region, 100 to 60,000 kc., short-wave converters and adapters and TRF or Superheterodyne broadcast receivers. Lowest loss construction, rigidity; Hammarlund's perfection throughout.

Order Cat. HOS @98c net

Guaranty Radio Goods Co., 143 West 45th Street, New York, N. Y.

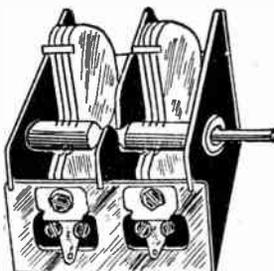
Matched Combination of Dial, Condenser, Coil



Dial obtainable with either of two numerically divided scales or with frequency scale.

Travelling light dial, bulb, escutcheon, 6-to-1 vernier, smooth action. Hub is for 7/8-inch shaft but 1/4-inch reducing bushing is supplied. This dial is obtainable with either type numerical scale (100-0 is illustrated) or with frequency-calibrated scale, marked 500 to 150. The frequency scale requires 0.00037 mfd. condenser and 250 microhenries inductance for the broadcast band or 0.00037 mfd. condenser and 20 millihenries inductance for actual 500 to 150 kc. fundamentals.
Cat. DJAD—0-100 for condensers that increase in capacity when turned to 75c the right. Scale, 0-100.....
Cat. DJAD—100-0 for condensers that increase in capacity when turned to 75c the left. Scale 100-0.....
Cat. DJADF—Frequency cali- 94c brated
Cat. RFCH—(TH)—Honeycomb coil of 20 millihenries inductance. Two extreme taps for total winding. Con- 45c ter lug is tag.....
Cat. TRF-250—Radio frequency transformer 2 1/2-inch diameter shield; primary and tapped secondary. Top may be used for oscillation in cathode lug of 45c heater tube
Cat. DJA-14-D—Two gang 0.00014 mfd. short-wave condenser with com- \$1.96 pensators
Cat. DJA-37—Single tuning condenser, compensator built in; 0.00037 98c mfd.

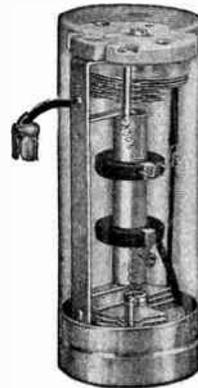
Short-Wave Condenser



Two-gang condenser for short-waves. Low minimum. Sturdy construction. Built near at front and back of Shaft. Compensators built in at side. Shaft is 1/4-inch Aluminium plates. Useful with all standard make short-wave coils. 3/4-inch bushing supplied.

DIRECT RADIO CO., 143 West 45th Street, NEW YORK, N. Y.

NEW \$2.65 INTERMEDIATES



465 kc. model is used in 11-Tube Push-Pull Diamond

Highest grade intermediate transformers, 465 kc or 175 kc, with or without secondary center tap, just released by Hammarlund, use air-core condensers for tuning.

The transformer is of the tuned primary-tuned secondary type, with both plate and grid coils being tuned by air-dielectric variable condensers of special design. These condensers are mounted on an Isolantite panel 1 1/2-16 inches in diameter. The rotor is carried in a single bearing in the Isolantite panel and consists of two circular and three semi-circular brass plates of 3/4 inch radius riveted to the rotor shaft.

The stator, also of brass, consists of two circular and two semi-circular plates soldered to stator support rods which in turn are soldered in the bushings in the Isolantite panel. Contact is made to the rotor plates by phosphor bronze spring under considerable tension. No locking device is necessary, as the tension of the contact spring is sufficient to maintain the setting of the rotor even where extreme vibration is present. A screwdriver slot is provided in the end of the rotor shaft to facilitate tuning.

The use of these air variables practically eliminates the variations in gain and selectivity inherent in intermediate transformers in which the coils are tuned by means of adjustable condensers of the compression type using mica as dielectric. The transformers are pre-tuned to the desired frequency. List price, \$4.50; net, \$2.65 each.

Guaranty Radio Goods Co.

143 West 45th Street



0.0005 mfd. Scovill tuning condenser, brass plates, shaft at both ends so condenser takes 0-100 or 100-0 dials and two can be used with drum dial; sectional shields built in, trimmers affixed; total enclosed in additional shield as illustrated. Access to trimmers with screwdriver. Side holes for bringing out leads to caps of screen grid tubes. Cat. SCSHC @.....\$1.95
Same as above, with ghost type dial (travelling light). Cat. SCSHC-DL @.....\$2.85
DIRECT RADIO CO., 143 W. 45 St., New York City

TROUBLE SHOOTER'S MANUAL, Nos. I and II

Having assembled 2,000 diagrams of commercial receivers, power amplifiers, converters, etc., in 1,200 pages of Volume No. 1 of his Perpetual Trouble Shooter's Manual, John F. Rider, noted radio engineer, has prepared Volume No. 2 on an even more detailed scale, covering all the latest receivers. Volume No. 2 does not duplicate diagrams in Volume No. 1, but contains only new, additional diagrams, and a new all-inclusive information on the circuits covered.
Volume No. 2—Perpetual Trouble Shooter's Manual, by John F. Rider, Shipping weight 6 lbs. Order Cat. RM-VT @\$3.00
Volume No. 1 (8 lbs.). Order Cat. RM-VO @ \$5.00
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