We would appreciate your comment and suggestions as to Radio Matters you consider of general interest and importance.

The AEROVOX Research Worker

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AEROVOX ANNOUNCES A NEW PROFESSIONAL SERVICE

The development of fixed condensers and resistances constitutes one of the most interesting phases of radio—particularly so because of the tremendous importance of these units in everyday radio practice. The subject is one of tremendous scope, covering a large territory and because of the prevalent use of fixed condensers and resistances in every radio installation, technical details pertaining to these units cannot but be of interest.

The AEROVOX RESEARCH WORKER is dedicated to the disemenation of truthful technical details appertaining to the development of fixed condensers and resistances, including power equipment. It further will contain data covering the designs of new and efficinet receivers, amplifiers and transmitters. It will contain helpful suggestions which the experimenter and professional set builder will be able to use to good advantage in his laboratory.

The permanent mailing list of the AEROVOX "RESEARCH WORKER" will comprise the individuals who profess interest in this issue by mailing the enclosed card.

Fill in your name and address and return the card immediately in order that your name be on file for the next issue.

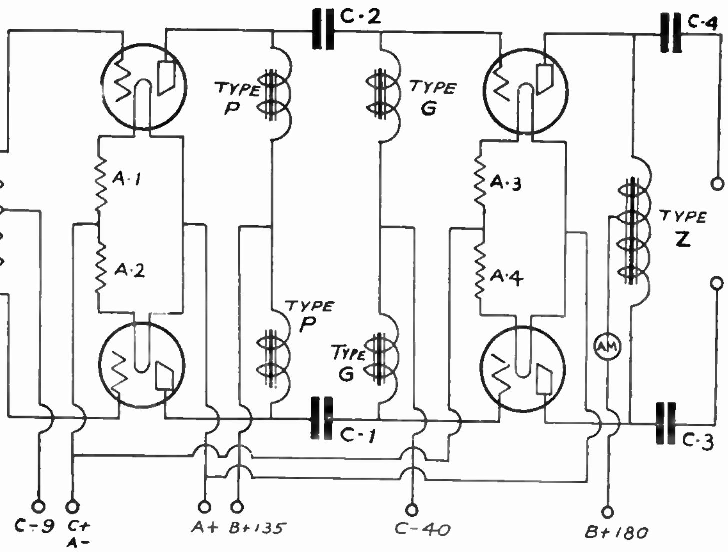
The purpose of the AEROVOX "RESEARCH WORKER" is to convey to the interested individuals technical information which he can utilize in his everyday work. The technical radio man is always interested in quantitative data for it guides him in his work. Some technicians are equipped with laboratories wherein they can carry on whatever experiments are necessary. Others however are not so fortunate. . . This pamphlet will cater to both. It will show the experimental work carried out in the AEROVOX laboratories and also the methods used.

We realize the important roles performed by power condensers in everyday radio practice; in electrified receivers, in A and B battery eliminators. Improvements have been effected since the advent of commercial broadcasting on that memorable December day in 1920. A comparison of power condensers of that day the units produced now, would show the tremendous strides of progress in this field. Can you forget the old grid leak-condenser combination! A paper condenser with a pencil mark for a grid leak. It functioned. . . but how much superior is the present day mica grid condenser. . . Can you recall the old wood pulp paper dielectric filter condenser. . . the haphazard rating. . . the fear and trepedition before the condenser was placed into service. One of the first developments in this field by the AEROVOX laboratories, was the selection of a 100% pure LINEN dielectric in place of the wood pulp paper.

The AEROVOX "RESEARCH WORKER" will be published bimonthly. It will contain information of experimental and design nature which is not available in present day text books. Hence a complete file should prove of exceptional aid. It is hoped that this medium will foster the growth of experimenting; that it will augment the radio knowledge prevalent throughout the land.

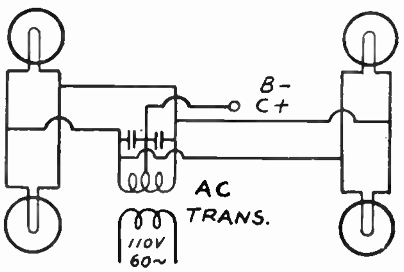
A SPECIAL AUDIO AMPLIFIER

By John F. Rider



This is a story about an audio amplifier.

It is difficult to please one's friends with a radio receiver installation. Fault-finding is easy; the comments are various. Sometimes the criticism is justified, at other times the adverse comment is wholly unjust. Be that as it may, someone will usually express an adverse opinion. But when the day arrives when all who listen to an amplifier speaker combination declare it to be excellent, then it is time to sit up and take notice. When all who listen to the amplifier used in conjunction with various types of receivers declare it to be beyond re-



proach, then one has attained one's goal. And when this group of listeners includes men and women well versed in music, familiar with speech enunciation, acoustics and radio, the complimentary reaction bears much significance.

The unit is an audio amplifier to be used in conjunction with any receiver and is fed from the first stage of audio amplification. The use of a single stage of audio amplification proceeding the amplifier is not a strict reservation. If so desired the amplifier unit can be coupled directly to the detector tube in the receiver. The use of the single stage unit, however, augments the utility of the amplifier in that it may be placed at some point distant from the receiver. The system of amplification is a combination of transformer coupled push-pull and impedance coupled push-pull with impedance coupled push-pull output. The input is transformer coupled and the other tubes are impedance coupled. The input tubes are of the 112 type and the output tubes of the 171 type, four tubes being used in all, each stage utilizing two tubes.

The selection of the combination of transformer coupled push-pull and impedance coupled push-pull was premediated. With an efficient and stable radio frequency amplifying system and a good speaker a push-pull amplifier of this nature possesses the characteristics essential for accurate reproduction.

So much has been written about low notes and the effects of the load impedance upon the energy transfer between the output circuit of the tube and the load that I am obliged to mention some specific figures along this line. The out-put impedance of the tubes recommended to feed the amplifier is approximately 5000 ohms at the specific plate voltage. The primary inductance of the input push-pull transformer fed from this type is approximately 32 henrys at 60 cycles and with direct current in the windings. The impedance of the winding is therefore approximately 12,032 ohms at 60 cycles. With this high value of load impedance at the low frequency the energy transfer between the tube and the transformer is of excellent proportion. Fear of burnout due to excessive plate current is eliminated since the primary winding will safely carry 60 milliamps, which figure is many times the maximum value encountered in actual practice.

A similar situation is found in the plate coupling impedances. The plate impedance of this tube is again 5000 ohms at the specified plate voltage. The inductance of the plate coupling in unit at 60 cycles and with D. C. in the windings is 175 henrys. This means an impedance of approximately 63,920 ohms at 60 cycles. The D. C. resistance of the plate impedance is 3,200 ohms and there is very little voltage drop in the impedance windings.

The coupling condenser in the impedance coupled stage designated as C1 and C2, are mica condensers molded in bakelite, thus precluding the possibility of distortion due to moisture absorption and consequent lowering of the insulation resistance. Under such circumstances some portion of the plate voltage applied to the plate of the preceding tube would find its way to the grid of the succeeding tube and even injure the tube. This is a very important detail The output coupling condensers C3 and C4 are filter condensers rated at 400 volts. They are non-inductively wound, have a low power factor and a high value of insulating resistance.

The designations marked upon the drawing are as mentioned in the following list of parts:

One Samson push-pull input transformer type X

Two Aerovox No. 400 filter condensers (400 volts), 4 mfd. C3 & C4

Two Aerovox No. 1450 .01 mfd. fixed condensers C1 and C2

Four Eby type 102 sockets (S1, 2, 3 and 4)

Two amperites type .5 ampere (A3 and A4)

Two amperites type 1A (A1 and A2)

Two Samson plate impedances type P

Two Samson grid impedances type G

One Samson output impedance type Z

One Westinghouse Micarta panel, black, 7x18x3-16 inch

One Jewell 0 to 50 D. C. milliameter type 53

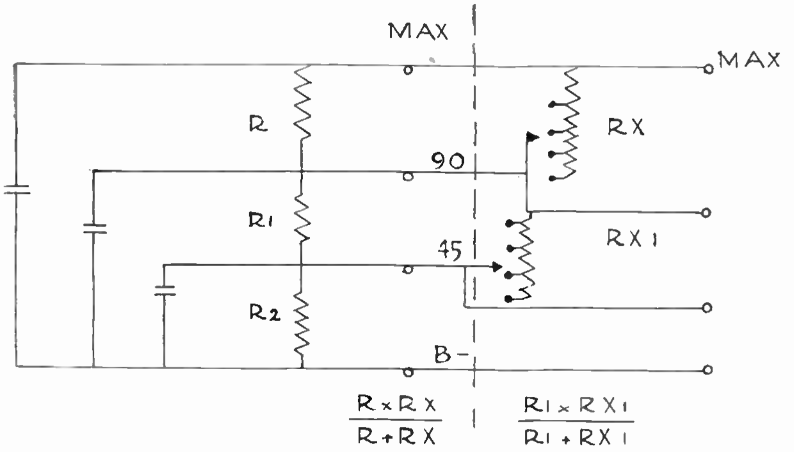
One Electrad battery switch

Two boxes of Acme celatsite wire

Ten binding posts Eby.

One baseboard 7x17.5x3¾ inch.

ADAPTING THE B ELIMINATOR



The adaptation of a B battery eliminator to a superheterodyne receiver is much more difficult than the adaptation of the same eliminator unit to a standard tuned radio frequency receiver. The reasons for this are numerous.

In the first place, the plate voltages applied to the oscillator, the two detectors and the intermediate amplifying stages are usually of such values that the voltage available from the eliminator is unsuited. And if the eliminator does not supply the required voltage tap the available current is insufficient to supply the current requirements of the receiver. For example, the plate voltage applied to the two detectors and the oscillator is usually 45 volts. And in many instances the intermediate amplifiers of which there are two or three, are also supplied with 45 volts. The result is a 45 volt drain at approximately 5 or 6 mils. The design of the average B battery eliminator does not permit of a 6 mil drain at the 45 volt tap, particularly so when the regular drain is being applied to the 90, 135 and the maximum output voltage terminals. With fixed resistance values and a fixed value of available voltage the voltage drop across the resistances in the B eliminator is increased as the current drain is increased and the final result is a low voltage output.

On the other hand, many fans desire an intermediate amplifier plate voltage value in excess of 45 volts, perhaps 67 volts or even 90 volts. Very few eliminators are equipped to supply a plate potential of 67 volts and very few are equipped to supply 90 volts to five or six tubes in a receiver, since it is necessary to add the audio tubes to the intermediate amplifier tubes. The eliminators which utilize voltage regulator tubes can be used to supply the additional current of 90 volts; but very few manufactured eliminators are equipped with voltage regulator tubes. The problem can be solved by using tapped voltage reducing resistances.

These resistances can be located external of the B battery eliminator, and are connected across the eliminator binding posts as shown in the drawing.

This arrangement results in a fixed resistance shunted with a tapped resistance. The variable resistance affords a control of the total resistance of the combination as shown by the formula. This variable resistance should be shunted across whatever terminal must supply the additional current and voltage. To increase the current supply, at a predetermined voltage, the value of the resistance within the eliminator must be lowered. This is accomplished by shunting the resistance with another variable resistance. R, R1, and R2, are the fixed resistance within the eliminator case. Rx and Rx1 are the tapped or variable resistances external of the eliminator. The max terminal still affords the maximum output voltage, but the previous 90 and 45 volt terminals can be adjusted to supply any voltage between 45 and maximum.

The above cut shows a tapped Pyrohm resistance. These units are available in all sizes, rated at 20, 40, 100 or 200 watts. The drawing illustrated above shows two external resistances. This is a suggestion or an example of how the resistances are applied.

WHAT TEMPERATURE COEFFICIENT MEANS

With the pronounced interest in wire wound resistances designed for use in battery eliminators and electrified receivers, frequent mention is made of the temperature coefficient of the resistor . . .What does temperature coefficient mean? . . .Many fans who have heard the term used or mentioned in print have wondered as to its significance.

Every substance, regardless of what it is, has a certain operating characteristic. In other words it will perform in a definite manner under certain conditions. Applied to resistance, the resistor will possess a certain value of ohms resistance when temperature of the resistance material is at a definite value. Some resistances possess the property of decreasing in resistance as the temperature rises. Other resistances possess the property of increasing in resistance value as the temperature increases. The term applied to this variation in resistance, as the temperature is varied, is temperature coefficient. If the ohmic value increases the temperature the resistor possesses a positive coefficient; for example, the Aerovox Pyrohm resistance is wound with wire which possesses a position temperature coefficient of .0002 between 20 and 100 degrees centigrade. If on the other hand, the ohmic value decreases the increase in temperature, the unit possesses negative coefficient.

When a resistance unit is inserted into any circuit such as a battery eliminator for the purpose of reducing the voltage to the required value, a certain amount of heat is generated in the resistance, this heat being the result of the energy dissipated in the resistance. Expresssed differently, the reduction of the voltage takes place in the form of generation of heat in the resistance. It therefore stands to reason, that if a certain voltage is required and the resistance inserted into the circuit is to obtain a definite value of voltage, that the temperature coefficient of the resistance be nil or at least positive. If it is negative, the action of the resistance will defeat its own purpose, since the more the heat generated in the resistance, the less the voltage drop in the resistance. Hence resistances with negative temperature coefficient are unsatisfactory for power work.

If however, the resistance possesses a positive temperature coefficient, it is satisfactory for power work and the lower the temperature coefficient, the more satisfactory is the unit.

PAPER DIELECTRIC CONDENSERS

TYPE 202 INVERTED

All Aerovox filter condensers are non-inductively wound, are manufactured from the best materials obtainable, and are made completely by us under the most modern methods. The dielectric used in all Aerovox condensers has an operating temperature of about 60 to 70 degrees Fahrenheit higher than ordinary paraffin usually used in paper condensers. This insures long life, especially when the condensers are used near transformers, or tubes which develop considerable heat. Individual coating of each section with a moisture proof wax pitch compound of high melting point, coupled with extreme care in manufacturing, results in a condenser of high insulation resistance.

TYPE 200 SHORT

D. C. WORKING VOLTAGES

Capacity	200 *Type* No. 200	200 *Type* No. 202	300 *Type* No. 302	400 *Type* No. 402	600 *Type* No. 602	1000 *Type* No. 1002
.05 Mfd.	$ .55	——				
.1 "	.60	——	$ .80	$1.00	$1.10	$1.50
.25 "	.70	——	1.00	1.10	1.35	2.00
.5 "	.75	——	1.20	1.40	1.85	3.00
1.0 "	.90	$1.25	1.60	1.85	2.75	4.75
2.0 "	1.75	2.00	2.60	3.00	5.00	9.00
4.0 "	——	3.25	4.70	5.25	9.50	17.50
6.0 "	——	4.25	6.75	7.25	13.50	25.50
8.0 "	——	5.75	8.75	9.50	17.50	——
10.0 "	——	6.75	10.25	11.75	21.50	——

BUFFER CONDENSERS

Buffer condensers are connected across the secondary windings of power transformers. They are made in three different types. The condensers consist of two non-inductively wound 0.1 Mfd. sections connected in series, with a center common tap.

Type No.	*D. C. Working Voltage*	*List Price*
446	400 Volts	$1.50
646	600 "	2.00
1046	1000 "	2.75

MOULDED MICA CONDENSERS

TYPE 1450

These condensers are moulded in genuine bakelite in our own plant. By a special process in the manufacture of the condenser element, the capacity is predetermined, and the finished product guaranteed within 10% of marked rating. The bakelite seals and protects the condenser against extreme temperature, moisture, or chemical action. The dielectric is of the finest grade India Ruby Mica, the plates are pure tin foil, and the condenser element is thoroughly impregnated. Compact in size, with special lugs, which allow for screw, eyelet, or soldering assembly. Soldering tabs have split, elongated slots for easy connection to solid or stranded wire.

TYPE 1745

TYPE 1450

Capacity	*List Price*	*Capacity*	*List Price*	*Capacity*	*List Price*
.00004 Mfd.	$ .35	.00037 Mfd.	$ .35	.005 Mfd.	$ .60
.00005 "	.35	.0005 "	.35	.006 "	.70
.00007 "	.35	.001 "	.40	.0075 "	.85
.0001 "	.35	.002 "	.40	.01 "	.90
.00015 "	.35	.0025 "	.45	.015 "	1.20
.0002 "	.35	.003 "	.50	.02 "	1.50
.00025 "	.35	.004 "	.50		

TYPE 1475

Capacity	*List Price*	*Capacity*	*List Price*
.0001 Mfd.	$ .40	.00025 Mfd.	$ .40
.00015 "	.40	.0005 "	.40