6-TUBE AUTO RECEIVER

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

TONE CONTROL
MB-30 SENSITIVITY

Need of Thorough By-passing Circuits

Amateurs Form Part of New 'SOS Reserve'

THIRD BIG CHAIN LOOMS
SUES RCA FOR $30,000,000
Electric Clock, $7.15

SOLDERING IRON FREE!

BROADWAY-HOLLYWOOD

MB-30 Price

Write or wire!

Horn Unit, $2.25

Subscribers! Important!

FILL OUT AND MAIL NOW

RADIO WORLD

RADIO WORLD

Telephone, $7.15

KEY TUBES

Quality First

The following constitute the thirteen most popular tubes used in radio today. Prices levied are low prices. The Key tub33 are first of the very first class. The tubes are manufactured under licenses granted by the RCA and its affiliated companies.

All prices are net and represent extreme discount already included.

GUARANTY RADIO GOODS CO.
145 West 45th St., New York City.

Enrollee please find $, for which this at

324 AC screen grid

328 AC amplifier

724A power tube

201A battery tube

40 A11 tube

30 power tube

30 AC rectifier

301 AC rectifier

This clock is for use in并无轻微的不慎行为，从正常是的情况看，它比较准确的年号。表是装饰手表，有镀金的表盘及标准尺寸的形状。表盘尺寸为1.5 x 2.5厘米。$2.25

Fidelity Unit, Cat. FDU, price $2.25

Guaranty Radio Goods Co.
145 West 45th St., New York City.

Name

Address

City...State...

GARANTY RADIO GOODS CO.
145 West 45th St., New York City.

This clock is for use in any abnormal correct only. A synthesizer, radio, built in, is when the thickness of the hours and minutes are.

324 AC screen grid

328 AC amplifier

724A power tube

201A battery tube

40 A11 tube

30 power tube

30 AC rectifier

301 AC rectifier

This clock is for use in any abnormal correct only. A synthesizer, radio, built in, is when the thickness of the hours and minutes are.

324 AC screen grid

328 AC amplifier

724A power tube

201A battery tube

40 A11 tube

30 power tube

30 AC rectifier

301 AC rectifier

This clock is for use in any abnormal correct only. A synthesizer, radio, built in, is when the thickness of the hours and minutes are.

324 AC screen grid

328 AC amplifier

724A power tube

201A battery tube

40 A11 tube

30 power tube

30 AC rectifier

301 AC rectifier

This clock is for use in any abnormal correct only. A synthesizer, radio, built in, is when the thickness of the hours and minutes are.

324 AC screen grid

328 AC amplifier

724A power tube

201A battery tube

40 A11 tube

30 power tube

30 AC rectifier

301 AC rectifier

This clock is for use in any abnormal correct only. A synthesizer, radio, built in, is when the thickness of the hours and minutes are.

324 AC screen grid

328 AC amplifier

724A power tube

201A battery tube

40 A11 tube

30 power tube

30 AC rectifier

301 AC rectifier

This clock is for use in any abnormal correct only. A synthesizer, radio, built in, is when the thickness of the hours and minutes are.

324 AC screen grid

328 AC amplifier

724A power tube

201A battery tube

40 A11 tube

30 power tube

30 AC rectifier

301 AC rectifier

This clock is for use in any abnormal correct only. A synthesizer, radio, built in, is when the thickness of the hours and minutes are.

324 AC screen grid

328 AC amplifier

724A power tube

201A battery tube

40 A11 tube

30 power tube

30 AC rectifier

301 AC rectifier

This clock is for use in any abnormal correct only. A synthesizer, radio, built in, is when the thickness of the hours and minutes are.

324 AC screen grid

328 AC amplifier

724A power tube

201A battery tube

40 A11 tube

30 power tube

30 AC rectifier

301 AC rectifier

This clock is for use in any abnormal correct only. A synthesizer, radio, built in, is when the thickness of the hours and minutes are.

324 AC screen grid

328 AC amplifier

724A power tube

201A battery tube

40 A11 tube

30 power tube

30 AC rectifier

301 AC rectifier

This clock is for use in any abnormal correct only. A synthesizer, radio, built in, is when the thickness of the hours and minutes are.

324 AC screen grid

328 AC amplifier

724A power tube

201A battery tube

40 A11 tube

30 power tube

30 AC rectifier

301 AC rectifier

This clock is for use in any abnormal correct only. A synthesizer, radio, built in, is when the thickness of the hours and minutes are.

324 AC screen grid

328 AC amplifier

724A power tube

201A battery tube

40 A11 tube

30 power tube

30 AC rectifier

301 AC rectifier

This clock is for use in any abnormal correct only. A synthesizer, radio, built in, is when the thickness of the hours and minutes are.
Accurate Tuning Condensors and Accessories

**EQUALIZER**

SINGLE .0035

**THREE-GANG SCOVILL .0005 MFD.**

**RIGID AND FLEXIBLE LINKS**

For coupling two 1/4 inch diameter shafts, use cast iron coupling and condenser of condensers, or two condenses of equal length. The two shafts may be of the right type, all metal, where the links are not required to be insulated. The short link, Cat. RL-3, may be used to engage each shaft, and is particularly serviceable where it is desired to use the capacities. The links may be used, but the returns then need not be insulated.

**EXTENSION SHAFTS, TWO SIZES**

Here is a handy aid in selecting condensers and shafts that have 1/4 inch diameter shafts for your purpose. Fits one 1/4 inch shaft, and provides 9/16 inch extension at will. However, the extension shaft and the boring or opening are 3/8 inch diameter. Order Cat. XR-4.

For condensers with 3/8 inch diameter shaft to accommodate in shaft that takes 1/4 inch shaft, order Cat. XR-8.

**.0035 TWO-GANG**

A two-gang condenser, like the single type, EXTENDED to connect on one frame, is Cat. KHD-1, also made by Scovill. The same mounting facilities are provided. There is a short shield between the respective sections. The tuning characteristic is modified to suit the frequency line. Order Cat. KHD-3 at $1.70.

**.0035 MFD. WITH TRIMMERS BUILT IN**

Four-gang .0035 mfd. with trimmers built in. Shaft and rotor blades renewable. Steel frame and shafts. Dimensions as at right. Overall length, 11 inches. Length, 3 1/4 inch. Weight, 3 lb. Properly wound for ganging with the condenser, or for use alone, with any other condenser. Order Cat. SPL-6-3.

**SHORT WAVES**

Tuning condenser for short waves. Particularly suitable for mixer circuits and short-wave adaptors. These condensers are .0005 mfd. (50 micro-microfarads) in capacity. They are suitable for use with any pilot in cath. Order Cat. BW-8-150 at $1.50. To provide regeneration from plate to grid return. For filters See 1931 book, page 392. Order Cat. BW-8-250 at $1.50.

A four-gang condenser of good, sturdy construction and reliable performance fits into the most popular tuning requirement of the day. It serves its purpose well with the most popular screen grid styles, which call for four tuned stages. Including the decoupler units.

Ordinarily a good condenser of this type costs, at the best discount, two or three dollars. For prices as low as this is considered for the fine illustrated and ever since the tuning condensers are not included. The capacity of such condensers has often been sacrificed to meet a price. As a reply, read the complete specifications or advantage. The first consideration was to build quality into the condenser. The accuracy is 99.6%.

**GUARANTEE**

Radiotron, Inc. 443 West 45th St., New York, N. Y.

All Prices Are Net.

(Just East of Broadway.)

Enrolled and $8.00 for each additional pair.

QUICK-ADJUSTABLE SHORT WAYS.

Price, $5.00. Consists of 30 sections, 10 each of 10 sections. Each section contains 10 crystals. Strength of each section is adjustable for any strain. Each crystal is mounted on a single bolt that can be readily removed. The crystal shaft is of steel and is accurately ground to correct dimensions. Each crystal has a sharp point that can be readily removed. Each crystal is mounted on a single bolt that can be readily removed. Each crystal has a sharp point that can be readily removed. Each crystal is mounted on a single bolt that can be readily removed.
Balkite Push-Pull Receiver

The Balkite A-3 Superheterodyne, one of the most sensitive commercial receivers ever developed, is tubed, including 360-valve semi-tube all. It operates, 150-230 v. AC or any, in a table model chassis. The receiver is made of all one-pi and the wire is done with extreme attention, by Gillett. The power supply is economically fine. It is being worked at 16% less than the usual capacity of the power transformer and chokes, assuring long life. There is no noise, as Balkite is exceptionally good.

The illuminated dial, at center, reads 0-100 in both, and at left is a blank space in which is written call letters. The little knob at left is the volume control, and the one at right is the AC switch. Each BF stage is filtered and bypassed independently, and the BF coils, tuning condenser, plate condenser, and chassis are separately shielded. The lead from antennas binding post at antenna window of the front cell is of shielded wire that is grounded in the receiver as a whole is totally shielded, with metal chassis and metal undercarriage, and thus provides an exceptionally shielded unit. Exceptionally high selectivity.

The Grooves to the moulded bakelite....-insulated lead-in wire are shielded and the lead-in wire indoors perfectly shielded. The maximum voltage leading to the moulded bakelite....

Silver-Plated Coils

Wound with non-insulated wire plated with genuine silver, on grooved forms, these coils afford high efficiency because of the low resistance to the current frequencies. The grooves on the insulated wire and the insulation provide a space in which the current frequencies may pass, reducing the direct current resistance of the tuning condenser. There is thus a greater number of turns and separation constant. Hence the secondary reactances are identified and ideal for good tuning.

The radio frequency transformer may be pumped out into a resonant cavity, or horn-powered, and has tuned lines for that purpose. It has a center-tapped primary, so that it may be used as an antenna coil with half or all the primaries in place, for any high resistance. This innovation produces a high grid plate current, more half the primary for any given plate voltage, as the parallel condenser is increased. The three-circuit tuner has a center-tapped primary. This tuner is of the usual type, but may be used on a chassis if preferred to using the screened tubes. These coils are available for all tap and half order. G RF SCT.

No 7A solid wire, surrounded by a solid rubber insulation cover, and above that a covering of braided copper mesh wire, which braids is to be grounded, to prevent static build up. This wire is specifically intended for antenna leads-in, to avoid pick-up of man-made static, such as from electrical machines. It is available in the regular lead-in wire, and also in the regular lead-in wire.

Silver-Plated Coils

New Multi-Tap Voltage Divider

The Mult-Tap Voltage Divider is used in all circuits, including push-pull and single ended ones, in which the current rating of 100 milliamperes is not severely exceeded and the maximum voltage is not more than 5 volts. Higher voltages may be used as lower drop.

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

The Mult-Tap Voltage Divider is placed across the filtered output of a B battery, which across a receiver, the voltages are in proportion to the current flowing through the various resistances. By making connection of grid resistors to various taps, the voltage may be read by using connections specified in the new 8-page instruction sheet. Each meter may be used independently. The box test leads, one red, the other black, which jack terminals, enable quick connections in any layout.

With this model you can shuffle directly to receivers and test circuits using the following tubes: 2101, 2106, 2116, 2120, 2125, 2145, 2150, 2245, 2250, 2275, and 2295.

When the R-245 is plugged into the receiver, the leads are connected to the receiver's output, and you can answer these questions. What is the grid bias voltage? What is the zero plate voltage? What is the plate current drawn by the plate? In these and other similar questions, a receiver's output is connected to the grid bias voltage.

Silver-Plated Coils

Shielded Lead-in Wire

Order Cat. MICON. $0.00 at prices stated.

No 7A solid wire, surrounded by a solid rubber insulation cover, and above that a covering of braided copper mesh wire, which braids is to be grounded, to prevent static build up. This wire is specifically intended for antenna leads-in, to avoid pick-up of man-made static, such as from electrical machines. It is available in the regular lead-in wire, and also in the regular lead-in wire.

Silver-Plated Coils

Fixed Condensers

High-Voltage Meters

Doublier Micron fixed condensers, type 642, are available at following capacities and prices:

<table>
<thead>
<tr>
<th>Value (mfd.)</th>
<th>Price 2.50c net price.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 micro</td>
<td>9...</td>
</tr>
<tr>
<td>20 micro</td>
<td>9...</td>
</tr>
<tr>
<td>30 micro</td>
<td>9...</td>
</tr>
<tr>
<td>40 micro</td>
<td>9...</td>
</tr>
<tr>
<td>50 micro</td>
<td>9...</td>
</tr>
<tr>
<td>60 micro</td>
<td>9...</td>
</tr>
<tr>
<td>70 micro</td>
<td>9...</td>
</tr>
<tr>
<td>80 micro</td>
<td>9...</td>
</tr>
<tr>
<td>90 micro</td>
<td>9...</td>
</tr>
<tr>
<td>100 micro</td>
<td>9...</td>
</tr>
<tr>
<td>150 micro</td>
<td>9...</td>
</tr>
<tr>
<td>200 micro</td>
<td>9...</td>
</tr>
<tr>
<td>250 micro</td>
<td>9...</td>
</tr>
<tr>
<td>300 micro</td>
<td>9...</td>
</tr>
<tr>
<td>350 micro</td>
<td>9...</td>
</tr>
<tr>
<td>400 micro</td>
<td>9...</td>
</tr>
<tr>
<td>450 micro</td>
<td>9...</td>
</tr>
<tr>
<td>500 micro</td>
<td>9...</td>
</tr>
<tr>
<td>550 micro</td>
<td>9...</td>
</tr>
<tr>
<td>600 micro</td>
<td>9...</td>
</tr>
<tr>
<td>650 micro</td>
<td>9...</td>
</tr>
<tr>
<td>700 micro</td>
<td>9...</td>
</tr>
<tr>
<td>750 micro</td>
<td>9...</td>
</tr>
<tr>
<td>800 micro</td>
<td>9...</td>
</tr>
<tr>
<td>850 micro</td>
<td>9...</td>
</tr>
<tr>
<td>900 micro</td>
<td>9...</td>
</tr>
<tr>
<td>950 micro</td>
<td>9...</td>
</tr>
<tr>
<td>1000 micro</td>
<td>9...</td>
</tr>
</tbody>
</table>

Order Cat. MICON. $0.00 at prices stated.

0-300 v., 200 micro per volt. Cat. F-300 @ $1.25 1. 250 v., 200 micro per volt. Cat. F-200 @ $1.00 1. 250 v., AC and DC frame meter reads. 300 ohms, 9... price. Order Cat. M-300 @ $0.95

Double Drum Dial

Excellent in design, the phasor double drum dial or in radio-RF choke, is the truest of radio-RF choke.

An efficient radio transmitter or in radio-RF choke, is the truest of radio-RF choke.

Shielded RF Choke

An efficient radio transmitter or in radio-RF choke, is the truest of radio-RF choke.

Hammarlund double drum dial, each section individually tunable.

Order Cat. B-DDC. List price $7.00 net price 

Shields RF Choke

An efficient radio transmitter or in radio-RF choke, is the truest of radio-RF choke.
A 6-Tube Car Set

By John C. Carver

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

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

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

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

Provision of Grid Bias

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

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

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

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

Suitable for Automobile Set

The circuit shown in Fig. 1 is suitable for an automobile receiver because it is capable of high sensitivity and can be put into a compact unit that may be shielded well. Ordinarily one would expect a six tube receiver to be bulky, but the receiver represented by Fig. 1 is not bulky for it is enclosed in a steel box 6.5 x 6.9 x 9.5 inches. This casing does not include the filament switch, the volume control, or the dial, for these are mounted in front of the box on a device to be mounted on the instrument panel. The main casing and the control panel are connected electrically by a flexible cable and mechanically by
The three trimmers had to make an explanation adjacent to the outside of about 7 inches to allow for indifferences in cars.

Shielding Is Well Done

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

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

Selectivity Secured

The selectivity of the receiver is secured by three tuned circuits controlled by a single knob on the panel. A trimmer condenser, C, is connected across each tuning section, and each of the three trimmers is accessible from the outside at a cost of $10,000, as has been put in place. Thus the final trimming is after all other changes in distributed capacity have been made. The holes through which the trimmer condensers are accessible are so small that no impairment of shielding results from them.

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

Controlling the Volume

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

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

KFI IS HEARD ON 50 KW PLEA

Washington.

When he tunes in WLW, Cincinnati, and KDKA, Pittsburgh, from his home in West Virginia, he finds that these two 50,000-watt stations take up ten divisions apiece on his receiver, said Federal Radio Commissioner Ira E. Robinson, at a hearing on the application of KFI, Los Angeles, for permission to use 50,000 watts. "Is there any assurance," inquired the Commissioner, who was chairman of the Commission and strongly opposed superpower, "that KFI, if using 50,000 watts, would not blanket other stations on adjacent channels?"

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

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

The station now feels the need of 50,000 watts, instead of the $3000 watts used, because it would be better able to serve the listeners Los Angeles and environs, explained Mr. Kale. The station has a clear channel assignment on 640 kc, and he felt it was thus entitled to 50,000 watts.

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

In the early years losses were heavy, and in one particular year, he remembered with remorse, the deficit was $80,000. Finally the tide turned. Last year, for instance, the station made a profit of $19,000, he reported, while the expected profit for 1930 is put at $20,000.

Contrasted to this situation was the general average of losses prior to 1929 of $50,000 a year.

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

BOARD ACCEPTS BUFFALO PEACE

Washington.

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

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

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

The appeal of WMAK for a clear channel, denied by the Board, was withdrawn as part of the pact.
Sensitivity of the MB-30

By Neal Fitzalan

FIG. 1
Gain curves of the MB-30 tuner and amplifier.
The top curve is the characteristic of the standard R. F. transformer.

FIG. 2
A simplified drawing of the untuned radio frequency transformer showing the tube capacity Ce which tunes the primary.

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

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

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

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

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

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

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

Getting Overall Characteristic
Now there are three types of couplers having three different types of characteristics. One of which is unsatisfactory if we are striving for uniform sensitivity over the entire broadcast band. The characteristic of the band-pass filters comes nearest to what is desired, but it fails too much at both ends. If we now use one untuned stage having a characteristic like that in the third graph, the sensitivity is brought up at the low frequencies, and if we use a standard transformer with a characteristic like that in the first graph, the sensitivity is brought up on the high frequencies. To get a satisfactory overall characteristic it is only necessary to use a suitable number of each of the three different couplers.

The overall characteristic shown in the fourth graph is the result of using two band-pass filters, one untuned transformer, and two standard tuned radio frequency transformers, and this curve is considered satisfactory because the slight deviation from uniformity is entirely negligible.

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

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

By Roger

This AC operated receiver is complete in every respect except the loudspeaker is missing. The three tuned circuits insure selectivity, the two screen grid tubes, sensitivity, and the resistance coupled audio amplifier, good tone quality.

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

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

There is one condenser in the filter that should be limited, and that is \( C_8 \), the one across the plate coupling resistor in the plate circuit of the detector. When the coupling is by transformer this condenser might be as large as .0003 mfd, but when the coupling is by resistance it should be no larger than .0002 mfd. The reason for this is that a condenser is much more effective as a by-pass when it is connected across a high impedance or resistance than when connected across a low impedance or resistance. The object of limiting this condenser, of course, is to prevent high audio note suppression, and the main object for using it is to make the detector more efficient.

It is also well to limit the capacities of isolating condensers \( C_4 \) and \( C_5 \). While the low note reproduction will be better the larger these condensers are, leakage through the condensers enters to mar the performance. The larger the capacity of a condenser the greater is the leakage through it, and the more leakage the more difficult it is to maintain the grids at the proper negative potential. A large value stopping condenser often leads to a drift in the plate current of the tube following,

(Continued from preceding page)

Sensitivity of

It is really connected across \( L_1 \) and \( C_1 \) in series but \( C_1 \) is so large in comparison with \( C_e \) that its effect on the position of the resonance may be neglected. In effect, therefore, \( C_e \) is directly across \( L_1 \). In Fig. 3 we have a simplified diagram of one of the band-pass filters, drawn so as to show clearly how condenser \( C_8 \) couples the two tuned circuits. The resistance \( R_7 \) across the

Fig. 3

A simplified diagram of the band-pass filter.
Aquate By-passing

Redmond


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

No Drift in Transformer Circuit

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

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

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

Husky Equipment Needed

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

The need of a husky power transformer for the AC receiver on page eight cannot be overemphasized because many receivers otherwise well designed are unsatisfactory because the regulation of the power supply is poor. The plate voltage particularly varies over wide limits as the load on the device is altered, and this variation shows up in the form of hum in many instances. The choke coils Ch1 and Ch2 should also be of substantial construction because if they are not they will not be very effective in reducing hum. Small-core chokes will saturate quickly, when they are of little use as chokes.

Preferred Volume Controls

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

In the battery circuit the volume is controlled by means of a rheostat Rh in the filament circuit of the first tube. No more satisfactory volume control has been found for this type of tube. It is effective and quick acting.
A QUICK glance at the diagram, Fig. 1, might give the impression that some manufacturer of fixed condensers, overstocked with 1 mfd. capacities, had got his engineer busy on the design of a circuit intended to sweep the stock off the shelves, at a price. A closer view might augment these suspicions and suggest even a conspiracy among coil, variable condenser, fixed condenser and resistor manufacturers, with a constructive sales suggestion by the licensed tube group, for there are plenty of these parts and accessories required if the circuit is to be built.

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

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

Relative Levelling

It has been customary to use as a volume control an adjustable resistor in the screen grid circuit. A potentiometer connected from ground (8 minutes) to a suitable positive voltage, with moving arm to the screen grids, has been shown time and again. Hence variation of the screen grid voltage to alter volume is standard practice.

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

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

Principle of Operation

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

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

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

Difference in Current Behavior

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

Right or Wrong

QUESTIONS

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

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

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

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

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

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

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

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

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

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

ANSWERS

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

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

3.—Wrong. There is no special difficulty in arranging an audio amplifier so that its characteristic is complementary to that of the tuner. The audio amplifier might be arranged so that there is regeneration at 10,000 cycles, for example, and the
but the opposite is true of leak-condenser detectors, and of RF and AF stages. The inclusion of an automatic volume control suggests the necessity for a meter as a resonance indicator. If only the ear is relied on to disclose resonance by maximum volume you will be fooled. It implies greater volume at resonance, and automatic volume control tends to level the volume. A little off resonance the volume is as great as at resonance. The meter used has a range of 0-10 milliamperes, because then the resistor RV flow the plate current of the automatic volume control tube and also the screen grid currents of the four radio frequency amplifying tubes. The total will read about 5 milliamperes. Resonance is determined by the needle being as far to the right as it can go by tuning.

Establishes Fixed Maximum

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

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

Different Roads to Same Goal

The automatic volume control will tend to keep the volume from exceeding this standard. But you may desire a certain value of volume as standard and also a lower value, so it is necessary to provide some ready means of making the adjustment. This is not a control in the strict sense, but merely a standardizer. Once this standardizer, which is not on the front panel, is set, it is not disturbed. The control is shown as a 30,000-ohm potentiometer used as a rheostat in the biasing circuit of the volume control tube. Another possible method would be by making the biasing resistor fixed, at 20,000 ohms, and making RV adjustable from 0 to 10,000 ohms, or the standard of volume may be established by using greater or lesser values of fixed resistance for RV, with the biasing resistor 20,000 ohms. These directions apply to tube 6.

One care which must be exercised is to keep the voltage through RF free from the radio frequency itself, otherwise satisfactory operation would not ensue. However, a bypass condenser of 4 mf. sidetracks the RF, because of extremely low impedance to RF. So, if 20,000 ohms for RV and 1 mf. are used, the time constant is 0.08 second, equivalent to 12½ cycles; hence there is no cut-off of any of the low frequencies of modulation. Nothing below 24 cycles is transmitted by stations.

What It Does Not Do

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

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

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

Tone Control

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

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

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

Herman Bernard
Types of Tone Controls

By J. E. Techni

Fig. 1

A Stage of Standard Resistance-Coupled Amplifier. The High Notes May Be Suppressed by Decreasing C1 because This Is in Shunt with the Line.

Fig. 2

A Choke Ch1 in Series with the Line May Be Used to Suppress the High Notes. A Resonant Shunt LCR May Be Used to Suppress Any Frequency.

1.32

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

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

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

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

Effect of RF Choke

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

In Fig. 3 we have a practical method of controlling the low frequency output of an amplifier. In many circuits it is customary to connect the loudspeaker in series with a condenser and supplying the plate current through a high inductance choke coil. In this figure the choke coil is a condenser, and the condenser is any one of the six condensers of different values that may be picked up with the switch S5. When the switch is set so that the 5 mfd. condenser is in series with the speaker, the low notes come through with practically no attenuation. When the next condenser is picked up there is some suppression of the low notes, but still the quality seems to be quite good. Then as smaller and smaller condensers are picked up the suppression of the low notes increases so that when the smallest, the 0.1 mfd. condenser, is in series with the speaker, the tone is quite thin.

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

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

Anderson

TIES

ain Editor

Connection

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

Shunts Across Speaker

If it is desired to cut out the high frequencies, this may be done by a set of condensers, any one of which may be connected in shunt with the speaker. This method is illustrated in Fig. 4. In this figure a shunt variable. One of the series condensers in Fig. 3. By means of the switch Sw in Fig. 4, any one of the six condensers ranging in values from 0.01 to 5 mfd. can be connected across the speaker, thus permitting almost any degree of high frequency suppression. When the 5 mfd. condenser is shunted across, practically nothing but the lowest bass notes get through.

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

The values of shunts in Fig. 4 are merely illustrative. In practice it may be well to start with a value no higher than 5 mfd. and then go down to values considerably smaller than 0.01 mfd. The choice of values is a matter for each individual to decide upon, since the whole object of tone control is to enable each one to select the tone values he desires.

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

Peak Suppression

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

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

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

Position of Resonant Shunt

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

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

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

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

Cutting Out Two or More Peaks

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

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

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

Two Parallel Amplifiers

This arrangement suggests the possibility of accomplishing the same thing with two different amplifiers and one speaker. One amplifier could be designed so that the low notes were amplified strong and the other so that the high notes were amplified most. A suggested arrangement is shown in Fig. 6. The transformer T might be the first audio transformer in the circuit directly after the detector. The potentiometer P should have a very high resistance, say, of the order of one megohm. Since the upper amplifier is to be effective on the high notes, C1 should have a very high inductance and C1 should have a high capacity. And since the lower amplifier is to be effective on the high notes, C2 and C3 should both have small values.

The signal voltages are impressed on the two amplifiers in opposite phase. It is not desired that the two amplifiers deliver the signals to the speaker in the same manner. Therefore the amplifiers should be arranged so that the phase is reversed. This is easily effected if the amplifiers are transformer coupled throughout. It would only be necessary to reverse a pair of transformer leads. If the two are resistance or impedance coupled, one of the amplifiers would have to have one more stage than the other.
**A Question and Answer Department conducted by Radio World's Technical Staff. Only Questions sent in by University Club Members are answered. The reply is mailed to the member. Join now!**

![Diagram of radio circuits]

**RADIO UNIVERSITY**

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

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

---

**This Illustrates Different Methods of Obtaining Grid Bias. The Two Diagrams Below Show How This May Be Obtained for AC Tubes by a Drop in a Resistor Through Which the Plate Current Flows.**

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

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

**Where Earth's Magnetism is in Reverse**

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

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

**Short-Wave Receiver Exceeds Converter**

In your opinion, which is better, a short-wave receiver, or a complete short-wave receiver? - F. R. C.

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

**Antenna Directionality**

Does an antenna receive signals equally from all directions or is there any directional effects that favor stations from certain directions more than those from other directions? - H. R. R.

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

**Variation of Inductance**

What is the reason the inductance of a coil increases with frequency? It cannot be due to a change in the dimensions of the coil, since they remain constant. - B. K.

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

**Non-Uniformity of Selectivity Change**

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

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

**Test to Make a Super Work**

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

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

**Reflection of Waves Analogous**

Can you give an analogy illustrating "skip distance" of radio waves? It is very difficult to understand why waves should skip over certain regions and why this should depend on wavelength. - L. K.

Take a glass vessel nearly full of water. Arrange a beam of light so that it strikes the surface of the water from underneath, and you will find that the angle between the upper surface of the water and the beam of light can be varied. Observe the reflected beam. In certain positions the beam will be reflected back into the water. In other positions the beam will not be reflected downward but will come through the surface. The hydraulic positioning of the beam is supposed to be such a reflecting layer at that water surface. Some waves will strike the layer and come down at some other place, thus skipping a certain distance on the surface of the earth. The angle at which the light beam ceases to be reflected and emerges on the upper side depends on the color of the light, that is, on the wavelength. Likewise the angle at which radio waves cease to be reflected by the Heaviside layer and begin to emerge on the upper side depends on the wavelength. Those waves that get through can-
not again come back to earth, just as the light beam that gets through the water surface cannot get back into the water. The radio case is much more complex than the optical case because the Heaviside layer is not so clearly defined as the water surface. Moreover, the light waves cover only one octave whereas the radio waves cover many octaves.

**Speaker's “Tuning” Characteristic**

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

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

**Electrical versus Motional Values**

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

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

**Condenser for Audio Oscillator**

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

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

**Range of Hearing**

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

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

**Measurement of Reverberation**

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

The reverberation period might be defined in several ways, but one definition is the time it takes for the intensity of a sound to become 360 of its original intensity. The higher the period the worse is the auditorium because echoes will last longer. All hard reflecting surfaces and open doors and windows reduce it. Carpets, clothes, upholstery and porous walls also shorten the period.

**Alternating Sound Pressure**

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

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

---

**KDKA Short-Wave Schedule**

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

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Time</th>
<th>Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>15,210 a.m.</td>
<td>6 p.m.</td>
<td>KDKA</td>
</tr>
<tr>
<td>15,190</td>
<td>7 p.m.</td>
<td>KDKA</td>
</tr>
<tr>
<td>15,200</td>
<td>8 a.m.</td>
<td>KDKA</td>
</tr>
<tr>
<td>15,090</td>
<td>9 a.m.</td>
<td>KDKA</td>
</tr>
<tr>
<td>15,180</td>
<td>10 a.m.</td>
<td>KDKA</td>
</tr>
<tr>
<td>15,170</td>
<td>11 a.m.</td>
<td>KDKA</td>
</tr>
<tr>
<td>15,160</td>
<td>12 noon</td>
<td>KDKA</td>
</tr>
<tr>
<td>15,150</td>
<td>1 p.m.</td>
<td>KDKA</td>
</tr>
<tr>
<td>15,140</td>
<td>2 p.m.</td>
<td>KDKA</td>
</tr>
<tr>
<td>15,130</td>
<td>3 p.m.</td>
<td>KDKA</td>
</tr>
<tr>
<td>15,120</td>
<td>4 p.m.</td>
<td>KDKA</td>
</tr>
<tr>
<td>15,110</td>
<td>5 p.m.</td>
<td>KDKA</td>
</tr>
<tr>
<td>15,100</td>
<td>6 p.m.</td>
<td>KDKA</td>
</tr>
<tr>
<td>15,090</td>
<td>7 p.m.</td>
<td>KDKA</td>
</tr>
</tbody>
</table>

**Join Radio World's UNIVERSITY CLUB**

And Get Free Question and Answer Service for the Coming 52 Weeks. This Service for University Subscribers Only

Subscribe for RADIO WORLD for one year (52 numbers). Use the coupon below. Your name will be entered on our subscription and University Club lists by special number. When sending questions, put this number on the outside of the forwarding envelope (not the enclosed return envelope) and also put it at the head of your queries. If already a subscriber, send us $6 for renewal from close of present subscription and your name will be entered in Radio University.

NO OTHER PREMIUM GIVEN WITH THIS OFFER

[In sending in your queries to the University Department please paragraph and number them. Write on one side of sheet only. Always give your University Club Number.]

RADIO WORLD, 145 West 45th Street, New York City.

Enclosed find $6.00 for RADIO WORLD for one year (52 nos.) and also enter my name on the list of members of RADIO WORLD'S UNIVERSITY CLUB, which gives me free answers to radio queries for 52 ensuing weeks, and send me my number indicating membership.

Name

Street

City and State
SOS RESERVE FORMED, WITH AMATEURS’ AID

Washington.

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

The organization and its scope are country-wide, and the SOS signal is not to be that of only ships in distress, but all the territory of Continental United States is involved. Hence, in the event of a flood, earthquake or a blizzard, the assistance of the League members as reporters and as message purveyors will be given. There are now 2,800 members of the League.

Rule for Messages

The Navy Department announced that the League members will render assistance principally as individuals, and will have a standard method of reporting. The League members will be part of the SOS Reserve, and as such reservists will flash messages through the local area of disaster to Red Cross branch headquarters or to the Red Cross local chapter. There are 3,400 such chapters in the United States. The standard message will be in two parts. The first part will report the type of disaster, the location and preliminary details of the catastrophe. It is assumed there will be a lapse of time between this and the second part of the message, so that the desired information can be exchanged. The information deal, said the Navy Department, with the number of injured, homeless and dead, houses destroyed or damaged and families affected.

Additional Messages

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

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

Disasters Grouped

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

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

Sets On Half of Farms in Iowa

Des Moines, Iowa.

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

The tabulation was made following a survey which was the outcome of the radio question in the Federal census. There are still quite a few crystal sets used on the farms, and that number is decreasing rapidly. This is further attested by the fact that the percentage of sets in the more thickly populated areas has increased as the percentage of sets on more remote farms, where only tube receivers would bring in signals.

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

SLOW PAYMENT MARKS TRADE

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

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

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

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

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

“We make radio parts and some other instruments. The radio parts are sold to set manufacturers and to jobbers for final outlet to custom-set builders and home experimenters. Most of the radio parts are made for very large concerns, none of which has a capitalization of less than $50,000,000. All classes of customers are failing to discount and most are taking sixty days net, which is a 30-day overdue. The very large concerns mentioned are paying their bills in about 60 days, after much talking on our part. These big companies never say they haven’t the money, but always offer some reason associated with auditing the books, or disturbance by inventory, or other dignified excuse.”

OVAL BUILDING OF 12 STORIES FOR RADIO CITY

The skyscraper that will rise in New York City as part of the radio capital which the Rockefeller interests are backing is to be 60 stories high, and the oval building, that will face Fifth Avenue, will be twelve stories high, with the other Continental United States.

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

Space for Separate Theatres

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

On the ground floor of the twelve-story structure will be shops, while on the roof another area will be a rooftop terrace and promenade and outdoor auxiliary tables.

Work for 10,000 Persons

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

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

ANOTHER AVOWAL OF VOWELS

If yeah—while you’re at the job of restoring the lost R to New York—see what you can do about the classification which can’t have been intended. The linguistic refinement in ascribing the English affected by Piccadilly’s fops. To many of us, the erroneous tendency toward the “modern” in our so-called cousins across the continent causes “regret” rather than the hoped-for admiration.
SILENCING FOUL TALK IS CALLED NO CENSORSHIP

Washington.

Violation of the public trust imposed upon a station, the same trust that every station must bear, was the reason for ruling KVEP, Portland, Ore., off the air, and the expulsion order was not due to the exercise of what might be termed "censorship," says the Federal Radio Commission in its decision with notice of Appeal of the District of Columbia. The brief is an answer to the appeal taken by the station, which asked the court to order the license issued because the Commission exercised prohibited censorship. The conduct of a station is to be judged by the standard of "public service, convenience and necessity," says the Commission's brief, and even though the radio law which now prohibits the exercise of censorship, this does not authorize the use of indecent and obnoxious language, any more than the right of free speech under the First Amendment to the Federal Constitution ever was construed to authorize such language.

Wildcat Starts Fracas

KVEP was ruled off the air following nightly talks by Robert G. Duncan, self-styled Oregon Wildcat, who denounced banks, newspapers and individuals, until civic leaders, unionists and as individuals, organized to petition the Commission to silence the station. Duncan, a defeated candidate for Congress, according to the brief, carried on a "program of villification." The brief states also that the station and its owner, William H. Schaefer, had been guilty of other offenses which themselves would have been sufficient to warrant removal of license, in addition to the above. Education, the brief continued, was based on "the nature of the broadcasts which have been emanating from this station."

Why It Is Not Censorship

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

"This test is set up as the essential criterion for all programs and the right of freedom (of) speech as the censorship thereby has been qualified as a right subject to such reasonable control by the Commission as would be necessary with the primary consideration of the public welfare. In any event the restriction on censorship is not in consistent in its usual character than the First Amendment to the Federal Constitution, which confers the right of free speech, and this constitutional provision was construed to permit the expression of indecent and obnoxious language," it is stated.

Innuendo Not Public Service

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

STATIC PRECEDES STORM

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

Damrosch Gives Culture Advice

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

"All cultured people should know how to sing and how to play one instrument," he wrote. "Radio and the phonograph can not replace the piano in the home. Music teachers, and that many pupils who begin earnestly enough to take lessons, become discouraged and stop.

FULTOGRAPH'S SCOPE WIDENED

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

The Fultograph will be thrown on the screen by means of a special optical system. The photographs will be in the nature of news pictures, Capt. Fulton said, which will be accompanied by special music from the station including the pictures. The Fultograph is widely used in Great Britain and on the European continent and has been adopted by the British Navy and Army. Other European countries having adopted the system are Germany, France, Holland and Spain. An English news bureau serving 600 publications in the British Isles has also agreed to use the system. American municipalities are interested in the system as a means of sending finger prints, pictures, and facsimile matter.

The system is a method of sending a picture at a speed that it takes about three minutes to transmit a picture 3½ x 5 inches. In announcing his progress in the transmission of colored pictures, Capt. Fulton said:

"I have recently perfected a system using three recording cameras which will intercept photographs in their original colors. One cylinder will reproduce the red parts of the picture, another the yellow tints, and the third the blues. These will be reproduced in an accurate, homogeneous surface rivalry in smoothness and texture the original." Capt. Fulton's system is not one of television but rather one of the transmission of facsimile. It requires 3 minutes to send a complete picture by this method, whereas in television the same picture would have to be transmitted in one-sixteenth of a second. That is to say television is at least 2,880 times as fast. It follows that, for the same transmission circuit, the Fultograph picture would be 2,880 times as great as that for the same size television picture.

FREQUENCY AS "PROPERTY" UP IN COURT AGAIN

Washington.

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

The frequency was used after it had been allotted as a clear channel in another zone. Therefore, it is Chief Justice Hughes of the Supreme Court, he will not sit in either of the "property-right" cases when they come before the court for consideration. The second case is that of White versus Johnson.

Reason for Unconstitutionality

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

In obtaining its license in 1927 WMBB signed a waiver of "any right or any claim of right as against the United States for the renewal of the license, or to the use of the ether in radio transmission because of previous license to use the same or because of the use thereof."
The effect of this waiver is to be construed.

Literature Wanted

Chas. W. Galloway, 204 N. Congress St., Jackson, Miss.
Theodore G. Eley, 101 Bonner St., Hartford, Conn.
Robert G. Duncan, 21 Wallace St., Greensville, S. C.
Reiley, 166 Girard St., N.W., Washington, D. C.
H. E. Nowakowski, 314 Commercial St., E., Brain-
tree, Mass.
Charles E. Danforth, 50 Valley St., Cambridge, Mass.
Arthur R. Ann, 601 3rd Ave., Kansas City, Mo.
Stephenson W. S. W. A. 85 Riverside Dr., New York City.
Arthur E. Braun, 324 Graham St., Chicago, Ill.
Robert G. Duncan, 201 Broadway, New York, N. Y.
Lincoln Rader, 3 C. Brecher, 31 Layet-
ette St., New York, N. Y.

New Corporations

Radio Science Corp., Brooklyn, N. Y., printing, publishing—Corps Trust Co.
Guadalupe Radio Corp.—Arty. A. Brody, 301 Broadway, New York, N. Y.
Lincoln Rader, 3 C. Brecher, 31 Layette St., New York, N. Y.
The Legal Dilemma

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

In regard to the Federal Radio Commission, it is not, as is generally supposed, an agency that must be held as the final word on all the details of the radio business. The Commission must have legal authority for its every act. So it decides that a certain law requires stations to be operated for the "public interest, convenience, and necessity," foul language poured into the home is utterly indefensible and intolerable. The only means to stop the others, is to silence the station. But a station so silenced will point to the radio law itself, saying that censorship is prohibited in express terms.

The Commission has only three limited powers under the law that it possesses as by no means settled. Just now one question to the fore concerns the right to rule a station off the air that permits the repeated broadcasting of obscene and indecent language.

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

The Commission must have legal authority for its every act. So it decides that a certain law requires stations to be operated for the "public interest, convenience, and necessity," foul language poured into the home is utterly indefensible and intolerable. The only means to stop the others, is to silence the station. But a station so silenced will point to the radio law itself, saying that censorship is prohibited in express terms.

The Commission has only three limited powers under the law that it possesses as by no means settled. Just now one question to the fore concerns the right to rule a station off the air that permits the repeated broadcasting of obscene and indecent language.

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

The Commission has only three limited powers under the law that it possesses as by no means settled. Just now one question to the fore concerns the right to rule a station off the air that permits the repeated broadcasting of obscene and indecent language.

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

The Commission has only three limited powers under the law that it possesses as by no means settled. Just now one question to the fore concerns the right to rule a station off the air that permits the repeated broadcasting of obscene and indecent language.

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

The Commission has only three limited powers under the law that it possesses as by no means settled. Just now one question to the fore concerns the right to rule a station off the air that permits the repeated broadcasting of obscene and indecent language.

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

The Commission has only three limited powers under the law that it possesses as by no means settled. Just now one question to the fore concerns the right to rule a station off the air that permits the repeated broadcasting of obscene and indecent language.

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

The Commission has only three limited powers under the law that it possesses as by no means settled. Just now one question to the fore concerns the right to rule a station off the air that permits the repeated broadcasting of obscene and indecent language.

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

The Commission has only three limited powers under the law that it possesses as by no means settled. Just now one question to the fore concerns the right to rule a station off the air that permits the repeated broadcasting of obscene and indecent language.

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

The Commission has only three limited powers under the law that it possesses as by no means settled. Just now one question to the fore concerns the right to rule a station off the air that permits the repeated broadcasting of obscene and indecent language.

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

The Commission has only three limited powers under the law that it possesses as by no means settled. Just now one question to the fore concerns the right to rule a station off the air that permits the repeated broadcasting of obscene and indecent language.

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

The Commission has only three limited powers under the law that it possesses as by no means settled. Just now one question to the fore concerns the right to rule a station off the air that permits the repeated broadcasting of obscene and indecent language.

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

The Commission has only three limited powers under the law that it possesses as by no means settled. Just now one question to the fore concerns the right to rule a station off the air that permits the repeated broadcasting of obscene and indecent language.

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

The Commission has only three limited powers under the law that it possesses as by no means settled. Just now one question to the fore concerns the right to rule a station off the air that permits the repeated broadcasting of obscene and indecent language.

In favor of sustaining such power, one state courts assumption, that the foul language poured into the homes is utterly indefensible and intolerable. The only means to stop the others, is to silence the station. But a station so silenced will point to the radio law itself, saying that censorship is prohibited in express terms.
QUEST OF GOLD HELD BLOW TO AIR EDUCATION

Washington.

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

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

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

Distrust of Commercialism

While commercial interests offer to help education by radio, the committee finds that lack of co-operation exists between the commercial and the educational groups. This is ascribed to widespread distrust among educators of commercial motives and the practice of commercial stations offering educational programs for the good-will and public value, that is, to help the stations. The only considerable group of broadcasting stations devoted primarily to educational purposes was composed of those owned and operated by colleges and universities, and which were State institutions. As the well-organized and powerful commercial broadcasters struggled to acquire radio channels, the educational stations were more and more restricted.

Less Power, Unfavorable Waves

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

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

Amos 'n' Andy Now

Real Life Taxi Men

Amos 'n' Andy, of Fresh Air Taxicab fame, have been made life members of the National Association of Taxi cab Owners.

At the recent meeting of the taxi cab men in Chicago the two comedians were unanimously voted a life membership. Cards were presented to them at the National Broadcasting Company's head-quarters in New York City.

NBC Willing to Aid Teaching by Radio

Washington.

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

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

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

GETTING READY FOR HAGUE, '32

Washington.

Organization of representative American radio engineers into committees to make recommendations for the solution of problems not decided by the International Radiotelegraph Conference held at the Hague, Holland, last fall, was perfected.

The meeting was called by the Federal Radio Commission and was attended by engineers of the Government and of private companies interested particularly in broadcasting.

Four committees were appointed. They will hold meetings during the Summer and submit their reports to the full membership of the general committee at a meeting September 4th. Action will then be taken.

The reports will be submitted by the American delegates to the International Technical Consulting Committee, which will meet in Copenhagen, Denmark, next year.

The action in Copenhagen will be recommendatory, also. In 1923 the International Radiotelegraph Convention will be held in Madrid, Spain, at which time the recommendations of the Copenhagen meeting will be presented for final action.

Dr. C. R. Joliffe, chief engineer of the Commission, was chosen executive chairman of the four American engineers. Officers and members of the four committees were selected, also.

STATIONS GET SAFEGUARD BY NEW LAW RULE

Washington.

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

In the legal category, the most important change is that the interest of an owner other than a party, a hearing must be held. A quorum of the Commission need not be present, but if not present, then the testimony and a written report and the findings of the Commission must be sent out to each committee, and a copy to each of the parties.

May File Exceptions

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

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

May Reduce Number of Appeals

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

THE BIGGER PROBLEM

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

N. B. C. Chicago Studios Classy

Chicago.

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

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

Different Colors

Each of the six studios will be finished in different color schemes, with adjoining client's rooms and observation rooms colored to harmonize with the studio proper.

Tinted and acoustically treated tile walls will blend with the ceiling in each particular studio.

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

World's Largest Studio

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

Throughout the various corridors and lobby will be special carpeting that deadens footsteps. Made of twisted yarn, the carpeting will offer a spring-like effect.
MAJESTIC ASKS
POOL DAMAGES
OF $30,000,000

Washington

The threatened legal action by the Grigsby-Grunow Company, of Chicago, makers of Majestic sets and tubes, against the National Association of American and associates, has taken the form of a suit for $30,000,000 damages. The complaint is that the Majestics, and RCA, the Sherman anti-trust law, is involved in the suit. It is claimed that the actual damage is $30,000,000, and the suit is for three times the alleged actual damage.

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

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

Paid $6,000,000 Royalties
To date, states the complaint, the plaintiffs are claimed to have paid $6,000,000 in royalties, arising almost entirely from the payment under a license the Grigsby-Grunow Company, and RCA and the RCA and other manufacturers to manufacture receivers for home use.

The license fee is 7½ per cent, with an annual minimum of $100,000.

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

The license fee demands were exorbitant and illegal, states the complaint, and the plaintiff, G. H. Grigsby, was threatened to limit his demand for the number of persons and companies engaged in the manufacturing of receivers, and even the licensor refused to permit the manufacture of sets for use in schools, in communication for to parts, for airplanes, for hotels, churches, and public institutions generally.

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

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

Grigsby-Grunow recites that it was damaged $3,000,000, because RCA and associates failed to deliver, all of its tubes when they were badly needed, or at the same time the set makers distributed more Major sets had no trouble in obtaining tubes. Other items of damage are listed.

The complaint sets forth that there are more than 4000 patents involved in the cross-licensing pool of the "conspirators."

Gave $240,708
and Got License

Kansas City, Mo.

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

To obtain the licenses, dealers and distributors had been "intimidated," the Majestic makers say they were compelled to accept "unlawful dictation" and pay $140,708 more for the license, plus $80,708 damages for alleged prior infringement, and pay "an onerous, burdensome and confiscatory royalty" at 7½ per cent, minimum $100,000 a year.

PETRIE IS NEW
NBC ANNOUNCER

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

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

Petrie sold securities for five years before entering radio. Successful in his song recitals at local stations, he soon developed the studio presence and micro-phone confidence so essential in announcers. And it was not long before he was fully launched on a radio career.

Petrie found that broadcasting afforded outlet for much of the musical and dramatic training he had had at school.

His early preparation for a career was pointed toward radio. Successful in his song recitals at local stations, he conducted the glee club, performed with various instrumental groups and appeared in dramatic productions. As soon as he was done with school, Petrie hurried off to specialize in music. For several years he studied with Ivan Morawski in Boston, in the meantime devoting his spare time to choir work at various churches.

Last year he did some dramatic work with Clayton W. Gilbert at the New England Conservatory, which included appearing in "The Trial of Mary Dugan."

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

Plants Closed
By Universal

Buffalo, N. Y.

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

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

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

THIRD NATIONAL
CHAIN IN VIEW,
WOR TO BE KEY

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

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

Since then, however, WOR has become perhaps as a small broadcast, in wps, WLC, Cincinnati; WMAQ, Chicago, and WMBF, Binghamton, N. Y., are the other members, these four being known as The Quality Group.

Chain Needs Lots of Money

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

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

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

Seek More Power

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

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

Dissemination of propaganda on an international basis by broadcasting stations operating with powers sufficient to produce radio waves of the globe could be effected without violation of existing radio laws, either international or national, if the fear were genuine that the \textit{fortuna} of propaganda originating in one country could cover the world, says the \textit{New York Times}. The commission of the International Radio Telegraph Convention, the Federal Radio Commission, and the Commissioner, with far less power, however, a broadcasting station in the United States could cover the entire European Continent.

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

New Rules for Airplane Radio

Washington. Regulations governing the use of radio facilities by the \textit{Military} and \textit{National} administrations of communication, embracing established transport service as well as itinerant craft, were adopted by the Federal Radio Commission in a new general order. The order presents all other orders and regulations having to do with aviation radio, says "\textit{The United States Daily}," and sets forth the channels, totaling about 30, in the low, intermediate and high frequencies, set aside for radiotelegraph and radiotelephone communications along established airways and for point-to-point, plane-to-ground and ship-to-shore, as well as experimental operations.

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

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

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

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

Beats of Hearts Heard Overseas

Heart pulsations and sounds made in the lungs by breathing were transmitted from Buenos Aires to Madrid by radio telephone with such rapidity and fidelity as to enable Spanish physicians in Madrid to diagnose diseases from which patients used in the experiment were suffering, says a special cable from Madison via The \textit{New York Times}. The experiment lasted for an hour.

The heartbeats of several persons also were sent to Spain. In every case the doctors telephoned back the condition of the heart and lungs heard. The transmission was made over an ordinary commercial telephone circuit from an instrument recently invented by an Argentine surgeon which sends sounds from the heart and lungs greatly amplified through a loudspeaker and at the same time registers their intensity on a galvanometer.

Three Mikes

At present three condenser microphones are used on the average studio program, one for the orchestra, one for a chorus, and one for S. L. Rothafel (Roxy). The theatre proper is equipped with field engineer's ingenuity is taxed to the utmost, as this pickup point is of such enormous size and the variation of programs is so rapid, that every week when a new show is broadcast fresh problems present themselves.

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

Outlets Everywhere

There are microphone outlets in the footlights, backstage, in the wings, in the orchestra pits, in the boxes, on the roof, and even in the balcony. Experimentation of difficult pickup is always being carried on.

The broadcast control room is situated on the sixth floor of the theatre next to the radio and has distanced the engineers to view the proceedings in the studio. When a broadcast is planned from the theatre, on Monday night, many rehearsals of the cast are given in the studio. They are made so that all fine points and kinks, which are hardly noticeable to the trained ear, can be eliminated. The power room is next to the control room and all power units are in duplicate in case of failure of one set.

WLS SUES COMMISSION

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

Large theatre leads in vast pick-up plan

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

There are two of them: one in the broadcast studio on the sixth floor of the theatre, and the theatre proper. These systems are complete with individual microphones, enabling the engineers to have any combination of microphones for a particular broadcast, although actual tests have proven that a single condenser microphone placed in the proper position, with the orchestra handle properly, will give excellent results.

NYBOY who thinks Summer isn't a great radio season must be a swimming instructor or professional golfer.
WHAM OBTAINS ANOTHER WRIT TO KEEP WAVE

Washington.

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

The new writ was issued to supersede the one formerly issued by the same court. The Commission proposed to shift WHAM from 1,150 kc to 1,160 kc under the reallocation which several injunction suits temporarily halted, and which is in limbo pending determination of those cases.

One of 26 Changes

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

Interference Reduced, Says Board

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

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

New Rule for Use of 900-Meter Wave

Washington.

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

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

"The frequency, 333 kilocycles, now assigned to certain stations within the limits of the United States and to certain aircraft operating within the limits of the United States is hereby changed to 939 kilocycles, and the use of 333 kilocycles is prohibited effective July 1, 1930."

TUBES USED TOO LONG

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

New Television Method Claimed

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

No motors or scanning discs are used, but a special type of disc inside which are inscribed the quantum set distribution of the transmitted frequencies among the inductors corresponding to those frequencies.

At the transmitting end selenium cells are used, and the process is in reverse of what it is at the receiving end. The luminosity and definition are said to be good.

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

Washington.

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

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

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

The channels granted the company are 48,400, 47,200, 46,000, 44,800, 43,600, 42,400, 41,200, 39,000, 37,800, 36,600; 49,500, 48,300, 47,100, 45,900, 44,700, 43,500, 42,300.

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

SLICE OF WBT IS PURCHASED BY COLUMBIA

Washington.

Following up its recent acquisition of WPG, Atlantic City, the Columbia Broadcasting System has bought an interest in WHAM, Charlotte, N. C., the Mutual Telephone Company, Inc. The frequency is 1,080 and the power 5,000 watts.

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

The National Broadcasting Company has six "ownership stations."

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

Competitors Frank in Discussion

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

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

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

Amos 'n' Andy Retained

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

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

KYW Takes Dig at Commission

Chicago.

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

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

"Its full power is 50,000 watts, but it has never been operated at this power, so the Radio Commission will not permit the station to use but 10,000 watts power. The Commission granted the station a permit for the station to use more than 10,000 watts in the future, but refused to allow the station to go to full power, and the members of the Commission refused to allow KYW to employ more than 10,000 watts of the available power."
"Seconds"

But Serviceable Tubes Nevertheless at Prices That Seem Incredible

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

112A - $0.50; 5c
12A - $1.20; 5c
20A 1/4 to 1/8 in. - $0.50; 5c
20A 3/4 to 1 in. - $0.80; 5c
24A - $1.20; 5c
255 - $0.80; 5c

DIRECT RADIO CO.
Room 504, at 1352 Broadway, N. Y. C.
(42nd and 45th Sts.)

RA DIO WORLD and "RADIO NEWS" FOR ONE YEAR @ $7.00

You can obtain the two leading radio technical magazines that cater to experimenters, service men and students, the first and only radio weekly and the leading monthly, for one year each, at a saving of 80c per year. Regular mail subscription rates for Radio World for one year is $6.00. Remit in $1.00 extra, get "Radio News" also for a year—new edition. Total, 14 issues for $7.00.

If renewing Radio World subscription, put cross in square at beginning of this sentence.

If renewing "Radio News" subscription, put cross in square at beginning of this sentence.

Radio World, 145 West 45th Street, New York, N. Y.

NEW DRAKE'S ENCYCLOPEDIA 1,650 Alphabetical Headings from A-battery to Zero Beat; 1,825 Illustrations, 920 Pages, 240 Combinations for Receiver Layouts. Price, $6.00. Radio World, 145 W. 46th St., N. Y. C.

GUARANTEED Neontron Tubes!

"Firsts" only—at Bargain Prices!

224 @ $1.20 UX199 @ $1.20
250 @ $2.20 UV199 @ $1.20
210 @ $2.20 199, Nickel Tube @ $1.00
245 @ $1.20 120A @ $1.00
240 @ $1.20 120 @ $1.20
30-day free replacement guaranteed.

KELLY TUBE COMPANY
143 West 45th Street
NEW YORK, N. Y.

"Two" for the price of One

Get a FREE one-year subscription for any ONE of these magazines:

☐ CITIZENS RADIO CALL BOOK AND SCIENTIFIC DIGEST (quarterly, four issues).
☐ RADIO (monthly, 12 issues; exclusively trade magazine).
☐ RADIO ENGINEERING (monthly, 12 issues; technical and trade magazine).
☐ Radio Tube Data (monthly, 12 issues; catalog, programs, etc.).
☐ SCIENCE & INVENTION (monthly, 12 issues; scientific magazine, with some radio technical articles).
☐ AMERICAN BOY—YOUTH'S COMPANION (monthly, 12 issues; popular magazine).
☐ BOYS' LIFE (monthly, 12 issues; popular magazine).

Select any one of these magazines and get it FREE for an entire year by sending in a year's subscription to RADIO WORLD for $1.00. Cash in now on this opportunity to get RADIO WORLD WEEKLY 12 weeks, at the standard price for such subscription, plus a full year's subscription to the magazine of your choice, in the above list, fill out the coupon below, and mail $6 check, money order, or stamps to RADIO WORLD, 145 West 45th Street, New York, N. Y. (Just East of Broadway).

Your Name ________________________________
Your Street Address _________________________

City ________________________________________ State _______________________

☐ If renewing an existing or expiring subscription for RADIO WORLD, please put a cross in square at beginning of this sentence.

☐ If renewing an existing or expiring subscription for another magazine, please put a cross in square at the beginning of this sentence.

RADIO WORLD, 145 West 45th Street, New York, N. Y. (Just East of Broadway)

DOUBLE

TRADE MARK

Quick Advertisement

Radio World's Speedy Medium for Enterprise and Sales 10 cents a word — 10 words minimum — Cash with Order

SPECIAL BARGAIN OFFER of Standard Radio Replacement Power Transformers to supply plate and filament for any combination of one to six 220 or 250 tubes; one or two 250 tubes; one 250 tube. Can be used in Lofkin White Circuit, transmitting station, custom radio sets and amplifiers. Write for bulletin description and special low price offer. Radiant Corporation, 1320 Sharon Avenue, Cleveland, Ohio.

FOR SALE—Ultradyne and Hi-QO. P. L. Hanson, Ionia, N. Y.


RA DIO AND OTHER TECHNICAL BOOKS

At a Glance

"Audio Power Amplifiers," by Anderson and Bernard 3.50
"Prake's Radio Cryptologia," by Prake 5.00
"The Electric Word," by Shubert 2.50
"Elements of Radio Communication," by Morecroft 3.00
"Experimental Radio," by Ramsey 2.75
"Practical Radio," by Moyer and Westeyn 3.00
"Mathematics of Radio," by Rider 2.00
"Practical Radio," by Moyer and Westeyn 2.50
"Practical Radio Construction and Repairing," by Mayer and Westeyn 3.00
"Principles of Radio," by Hennes 2.00
"Principles of Radio Communication," by Morecroft 7.50
"Radio Blueprint Library"—AC Hook-ups. 35
"Radio Receiving Tubes," by Moyer and Westeyn 2.50
"Radio Telegraphy & Telephony," by Duncan 7.50
"Radio Trouble Shooting," by Hazen 3.00
"The Superhetrodyne," by Anderson and Bernard 1.50
"The Thermonic Vacuum Tube," by Moyer and Westeyn 2.50
"Wireless on Testing Units," by Rider 4.00
"Trouble Shooter's Manual," by Rider 3.50

TELEVISION

"A B C of Television," by Yates 3.00

AVIATION

"A B C of Aviation," by Maj. Page 1.00
"Aerial Navigation and Meteorology," by Capt. Wilcox 1.50
"Everybody's Aviation Guide," by Maj. Page 4.00
"Ford Aircraft Model 'A' Operating and Maintenance Manual," by Maj. Page 3.00
"Modern Aircraft," by Maj. Page 5.00
"Modern Aviation Engines," by Maj. Page 9.00

NEW NATIONAL THREAT BOX

Cat. ACSWS, National complete parts for 5-tube AC Short Wave Thrill Box; list price, $79.50, net price, $43.35.
Cat. DCWS, National complete parts for 5-tube battery operated Short Wave Box; list price, $75; net price, $42.75
Wired by Jackson Laboratories. $2.70 extra. Add letter "W" to catalog symbols.
AC model uses two UY224, three UY237, with provision for pentode in RF stage if desired. Cat. ACSWS does not include power supply. Type, usage for home with vol. coil, $4.75; 350 plate volts, Cat. 5880-A; list, $24.50; net, $13.50; steel cabinets for Short Wave, Order. Key box @ 1.13 net.

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

New Polo Power Transformers and Chokes

Shallled single choke, 200 ohms D.C. resistance, non-saturable at 100 milliamperes, with two black outlets, each 6 inches long. For filtration of B supplies In- dustrial, 50,000. Cat. SH-6-C, price $5.00.

The shielded single choke will pass 200 ma. One end of the choke will be the current to 100 ma or less; the other end of the filter will be the output. For using with filters of less than 90 to 200 ma. will be obtained. For using with filters of less than 90 to 200 ma. will be obtained.