JULY 9th
1932

NEW RECTIFIER TUBE

15c
Per Copy

RADIO WORLD
REG. U.S. PAT. OFF.
The First and Only National Radio Weekly
Eleventh Year—537th Issue

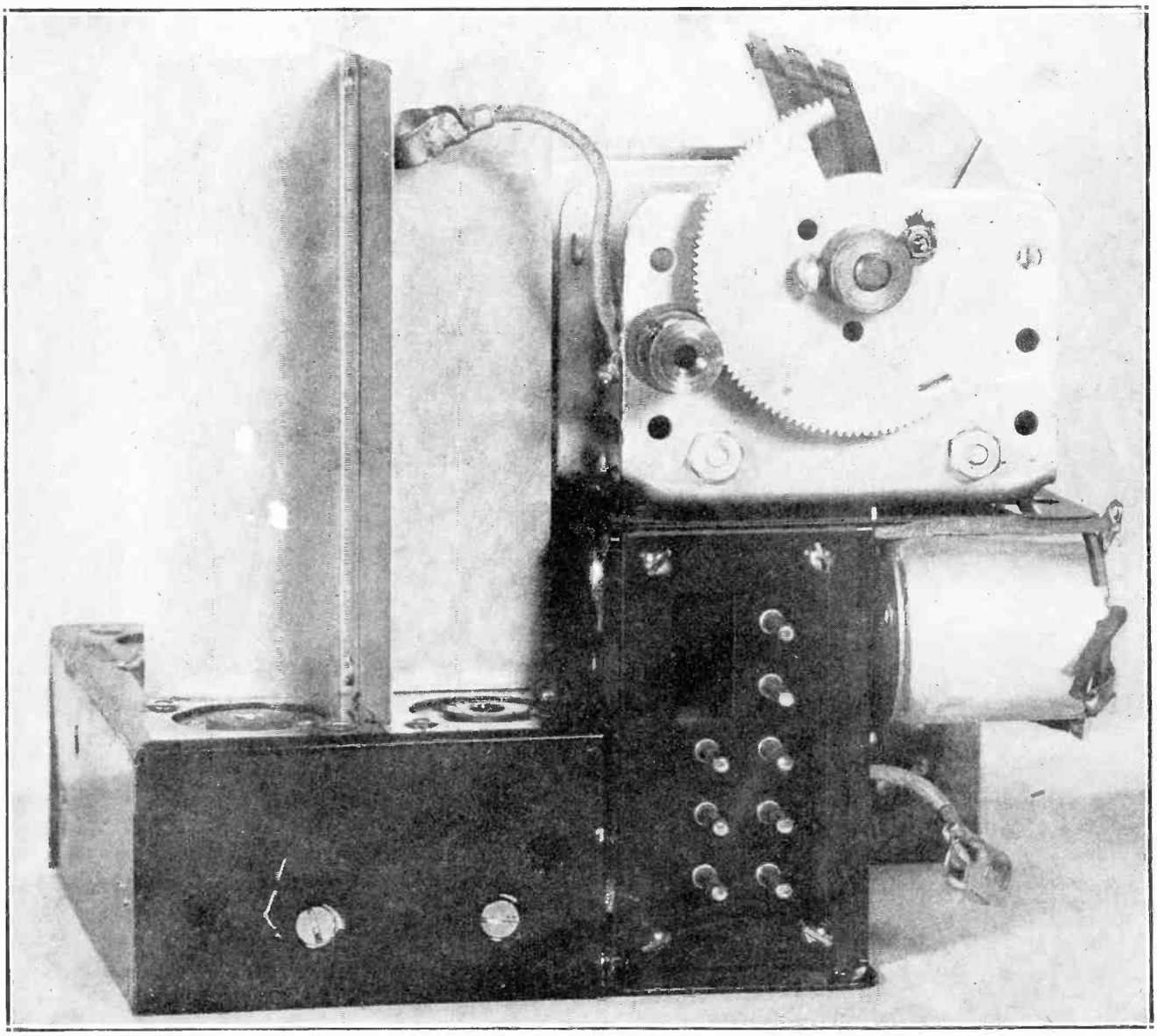
HOW NEW IS DIODE?

Amateurs Exceed 31,000

Time Lag Analyzed in A-V-C Circuits

8-Tube Commercial Super

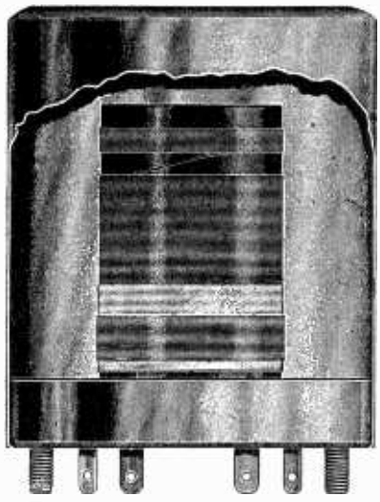
6-TUBE AUTO SUPER, 7½ x 7½ x 6¼



Here is a mere handful in size, yet a 6-tube auto super, with automatic volume control, quite a feat in engineering. See pages 12 and 13.

Coils That Exceed Your Requirements for Precision

Secondary Inductances Accurate to plus or minus 0.6 microhenry



CAT. NO. 1—Three matched shielded t-r-f transformers, for 0.00035 mfd., with 80-meter tap. $1.35

CAT. NO. 2—Three matched shielded t-r-f transformers, for 0.00046 mfd. (Scovill condenser), with 80-meter tap.....$1.35

CAT. NO. 3—Three matched shielded t-r-f transformers, for 0.0005 mfd., with 80-meter tap. $1.35

Three-deck long switch for above coils, $2.50

Tuned Radio Frequency Coils

THESE coils are for two stages of screen grid radio frequency amplification, using any type screen grid tubes, including the newest ones, and any type of detector tube. There are three coils to a set. Each coil is wound on a 1-inch diameter tubing and anchored to an aluminum shield base, to which base the shield proper makes a tight fit.

The bases have punched openings through which four lugs protrude, and also are provided with rigid 6/32 machine screws for mounting. These screws protrude downward and are 1 11/16 inches apart. The coils may be mounted on chassis cut for the wafer type tube socket, or may be mounted by means of threaded bushings, elevated half an inch from a chassis top, requiring no cutout chassis.

The shield has a small protected opening at top so the lead for the grid cap may be brought through. The opening is bevelled. This constitutes the protection against fraying the insulation of leadout wire to grid cap. The shield cover is 2⅛ inches outside diameter and 2½ inches high.

Inside the shield base are stamped designations as follows: P, B, G and ground symbol. These stampings are near openings through which the corresponding lugs protrude downward. Besides, there is a side lug, protruding outward near the bottom of the form. P and B are always the primary connections, P going to plate an B to B plus, except in the case of the coil used for antenna coupler, when P goes to aerial and B to ground. G is always the connection for grid cap of the r-f tubes, also grid cap of the detector if it is a screen grid tube, otherwise to G post of socket of the detector tube.

The side lug is the grid return connection, usually grounded in circuits. The stamped ground symbol is not the ground connection but represents a tap on the secondary for tuning to 80 meters. The broadcast band is covered in full with the entire secondary—G and side lug—while from 200 to 80 meters are covered when the ground symbol tap is picked up by condenser stator.

To accomplish 80-550 meter coverage, therefore, a three-deck switch, two positions for each deck, is required, and must be of the insulated type. The moving arms connect to condenser stators, and pick up either the full secondary or the tap, which is about one-quarter of the secondary, in number of turns. The full secondary is always in the grid circuit, wired as previously stated, but the tuned circuit is made to consist either of the full secondary of one-quarter of the secondary, by switching the condenser stator to either point.

The 80-meter tap does not have to be used, but is advantageous to those desiring to tune in television, amateurs, police calls, some relay broadcasting and other interesting transmissions in a band of frequencies replete with novelties for the usual broadcast listener.

High impedance primaries are used, the number of turns chosen so that the same coils may be used for antenna coupler and interstage couplers.

All coils are guaranteed to cover the wave band when condensers of the specified capacity are used.

All coils are sold on a 5-day money-back guarantee. We pay the postage on all coil orders, on basis of remittance with order.

Precision Coils for Double Detection Circuits

Tuner-Mixer Coils

THE tuning coils for superheterodyne construction are for a stage of t-r-f, modulator and oscillator, with oscillator secondary inductance accurately chosen on the basis of specified capacity of padding condenser. These coils are for broadcast band coverage only.

The coils are of the same type of mechanical construction as the t-r-f coils. Since there is no secondary tap, the code for connecting the t-r-f coils of the superheterodyne combination is different: P and B, primary; G and ground symbol, secondary. P would go to plate or antenna. G to grid cap, while B and ground symbol are the returns.

The oscillator has a smaller inductance secondary, for padding, and moreover is a three-winding coil. The three windings are: pickup, secondary and tickler. Th. pickup winding consists of 10 turns, and is brought out to two side lugs. The polarity of its connections unusually is of no importance. The secondary is represented by G and ground symbol, G going to grid and ground symbol to grid return, usually ground. The tickler connections for oscillation require that the lug at B be connected *not to B plus but to plate*, hence the P lug goes to B plus. In any case, if no oscillation results, reverse the tickler connections.

Tuning Coils for 175 kc Receivers

CAT. NO. 4—Three shielded coils, two for modulator and r-f and one for oscillator, for 0.00035 mfd. three-gang condenser. Oscillator coil has pickup winding. Intermediate frequency intended, 175 kc. Price includes padding condenser, 700-1000 mfd. $1.80

CAT. NO. 5—Same as Cat. No. 4, except that this set is for 0.0005 mfd.....$1.80

CAT. NO. 6—Same as Cat. No. 4, except that this set is for the 0.00046 mfd. Scovill condenser $1.80

Tuning Coils for 365-465 kc Receivers

CAT. NO. 7—Same as Cat. No. 4, except padding is for 365-465 kc and padding condenser is 350-450 mmfd.....$1.80

CAT. NO. 8—Same as Cat. No. 6, except padding is for 365-465 kc and padding condenser included is 350-450 mmfd.....$1.80

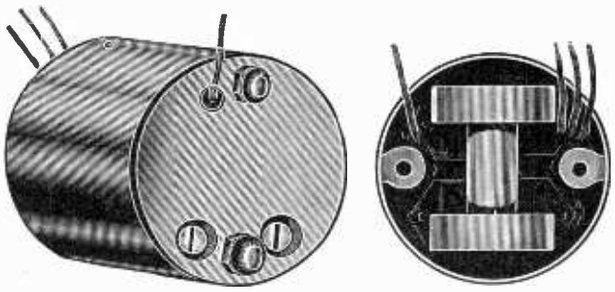
Short-Wave Plug-in Coils

WOUND on 1.25 inch diameter finest bakelite forms, with flange for gripping, these short-wave plug-in coils afford high efficiency. Tube sockets serve as receptacles for these coils. The coverage with four coils is 13 to 200 meters with 0.00014 mfd. capacity. Also 0.00015 mfd. may be used without change. The coils may he used for any of the popular short-wave circuits.

CAT. SWA—Four plug-in coils, UX base, primary and secondary; primary may be used for feedback if condenser connects aerial to grid.....$1.35

CAT. SWB—Four plug-in coils, 6-pin base; primary, secondary, fixed tickler.....$1.70

UX wafer sockets or 6-pin wafer sockets, 11c. each



The intermediate frequency transformers are in an aluminum shield and consist of two loosely-coupled low r-f resistance honeycomb coils, with compression type Hammarlund condensers that hold their setting.

Intermediate Transformers

THE intermediate transformers consist of two honeycomb coils, wound with low resistance wire, coils spaced 1 inch apart, and thus affording loose coupling, stability and high selectivity. The coil assembly is enclosed in an aluminum shield, with open bottom. The shields are 2⅛ inches diameter, 2 inches high. At bottom are two small rigid brackets, tapped for 6/32 machine screws. The taps are 1 11/16 inches apart. Four outleads, 6 inches long, are wired to the coils. Their colors are green, black, yellow and red.

The primary consists of the yellow and red leads, yellow to plate, red to B plus. The secondary consists of the green and black leads. Green emerges through a protected small opening in the top of the shield and goes to grid cap of a screen grid tube. Black is the return for the secondary, usually to ground. Both primary and secondary are tuned, and thus the coils are for screen grid tubes exclusively, except the second detector may be any type tube. The condensers for tuning the coils are Hammarlund's compression type, on an Isolantite base. The set-screws for adjusting these condensers with a screwdriver are accessible from the top of the shield.

CAT. FF-175—Shielded intermediate frequency transformer, 175 kc.....$1.10

CAT. FF-450—Shielded intermediate frequency transformer, affording choice by condenser adjustment of frequencies from 365 to 450 kc.....$1.30

Padding Condensers @ 45c Each

CAT. PC-710—For 175 kc intermediate. Put in series with oscillator tuning condenser. Capacity 700-1000 mmfd. Hammarlund, Isolantite base.

CAT. PC-3545—Same as above, except 350-450 mmfd. for 365-400 kc intermediate.

Prompt Service

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145 West 45th Street, N. Y. City

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ELEVENTH YEAR

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How New is the Diode?

Comparison with Leaky Condenser Detector

By J. E. Anderson

DIODE rectifiers are popular these days and we are discovering many new arrangements for their use. It would almost seem that the diode rectifier is new, although it is the oldest of all the vacuum tubes used in radio, for it is nothing but Fleming's oscillation valve. The diode rectifier is not even being used *again*, for its use was never interrupted. The diode rectifier was only combined with amplification and the combination was called a leaky condenser detector.

Is really the leaky condenser detector a diode rectifier with an amplifier following it? Surely, nothing else. This is easily seen by examining the circuit. Consider the circuits in Fig. 1. At the left we have a typical leaky condenser detector and at right a diode rectifier. The two circuits are identical with the exception that the grid leak and condenser in one are above the tuned circuit and in the other below it. The values of capacity and resistance may be exactly the same.

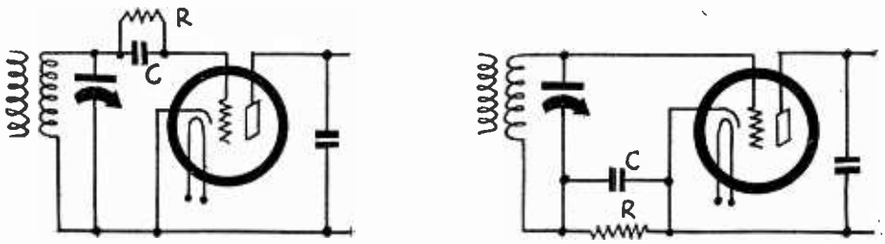


FIG. 1

Left—The regular leaky condenser type of detector in which the grid functions both as diode anode and amplifier grid. Right—The same circuit with the grid condenser and leak connected on the ground side of the tuned circuit.

The Diode Rectifier

For the time being let us forget all about the plate in the tube. Now what have we? We have a two-element tube in which the cathode is just that and the grid is the anode. We also have a voltage source, represented by the tuned circuit, and a load resistance across which there is a filter condenser. There is difference between the two circuits.

Now suppose a signal voltage exists across the tuned circuit. Then we shall have a voltage in series with the grid-cathode rectifier and the load RC. A current will flow which pulsates at a rate twice that of the carrier frequency. But the pulsations are taken out by the grid condenser, or let us call it the load filter condenser. We therefore have an almost constant voltage developed across the load resistance R. This applies to the diode as well as the leaky condenser detector, for they are one and the same thing. Now if the carrier amplitude varies, there will be a variation in the "steady" voltage across the load resistance, that is, the grid leak, and this variation is the audio signal.

Now we have an audio signal across a resistance, which is sometimes called a grid leak and sometimes a load resistor, depending on whether we think we have a diode rectifier or a leaky condenser detector. What shall we do with the voltage? The answer to that question will determine whether we have a leaky condenser detector or a diode detector, in so far as there is any difference at all.

Use of Amplification

If there is a plate in the same tube structure, and if the grid, which for the diode was the anode, is between the plate and the cathode, we can use the same tube for amplification at the same time that we use it for detection. We have obtained our audio signal voltage across the resistance, and we have taken out most of the carrier component, so we can disregard the tuned circuit and assume that we have an audio voltage across the resistor R without the radio circuit. What is left is nothing but a triode amplifier. There may be some carrier component left in the voltage across R and this will be amplified together with the audio signal. But in the plate circuit we can get rid of most of it by connecting a by-pass condenser from the plate to ground. That is what happens in the leaky condenser detector. We just have a diode rectifier followed by a triode amplifier.

The circuit at the right in Fig. 1 does not differ at all from that at the left, except in the position of the grid leak and condenser.

Grid Bias

Is the amplifier part in either circuit operated at positive, zero, or negative grid bias? If there is a steady carrier voltage impressed we found that a steady d-c develops across R. The direction of this voltage is such that the grid is negative with respect to the cathode. It can be nothing else for current can only flow from the cathode to the grid in the external circuit. The same applies to both cases. Therefore in either case the grid is negative with respect to the cathode, and the amplifier is operated with a negative bias. However, the bias is not fixed for it varies with the modulation. As a rule the bias is greater than it should be for best functioning of the amplifier.

Must Remain Positive?

How can there be a grid bias on the tube if the current pulses can flow only when the grid is positive with respect to the cathode? Does it not follow from this fact that bias must remain positive or that the current stop entirely? No, it does not. The average voltage of the grid may be negative with respect to the

(*Continued on next page*)

(*Continued from preceding page*)
cathode and yet there may be times, occurring in each cycle, when the grid is positive enough to send a pulse of current around the circuit. The higher the bias that builds up, the smaller the current pulses become, but the grid leak, or load resistance, prevents a static condition to be reached.

Use of Two-Element Tube

If we have a diode tube, that is, one without a plate or a grid, we can connect the same circuit as either of those in Fig. 1, disregarding the plate element. We would then have the tuned circuit and the RC combination in series with a rectifier. There would be a voltage developed across RC. What can be done with it? Well, we can impress it on the grid of an amplifier by connecting the negative end of the resistor R to the grid. This has been done in Fig. 1, because we used the grid for two different purposes. The same thing is done when the Wunderlich tube is used as detector-amplifier and automatic volume control. And exactly the same thing is done in the prospective 55 tube. In this tube there are two diode plates, a grid, and a triode plate, in addition to the cathode. The output of the diode, as developed across the load resistance, is impressed on the grid of the tube. When this is done directly, without the interposition of a stopping condenser, the case becomes exactly like that in Fig. 1.

As a detector-amplifier the 55 is superior to the ordinary tube in a leaky condenser circuit because in the 55 the grid can be biased independently of the diode, and to such a value that a signal many times stronger can be impressed on the diode without overloading the amplifier.

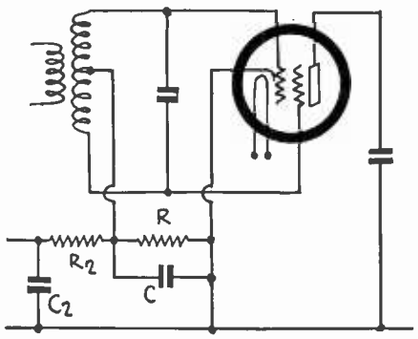


FIG. 2

In this leak condenser type detector a Wunderlich tube is used as a full-wave rectifier and a diode biased amplifier. Automatic volume control is also incorporated

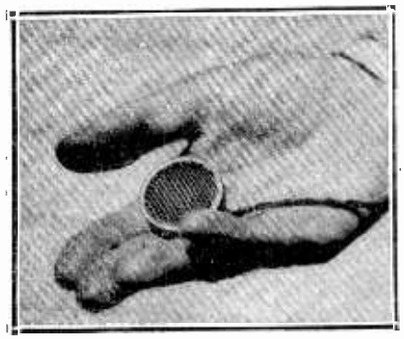
As in the previous cases, the drop in R makes the grids negative with respect to the cathode. Also, with respect to the center of the r-f transformer secondary, the two grids are in parallel. Hence the audio voltage developed across R is impressed equally on the two grids. They will control the current to the plate of the tube just as if they had not been used for rectification. While there will be comparatively little carrier frequency in the output of the tube, there will be some, due to unbalance and to frequency doubling, and therefore there is a by-pass condenser from the plate to ground.

Use of Wunderlich Tube

The Wunderlich two-grid tube is used in many automobile receivers as a combined diode detector, amplifier, and automatic volume control. Or we might say that it is used in a leaky condenser type of detector in conjunction with an automatic volume control. In Fig. 2 we have a typical circuit of this type. The two equal grids are first used as anodes for the full wave diode detector. The common load on these two is R and the usual filter condenser C. As in the other cases there is a d-c voltage built up across R, and this is used for automatic bias on the r-f amplifiers.

It should not be supposed that this circuit is different from the ordinary leaky condenser detector. It is not, for the only difference is that the grid leak and the condenser have been put on the ground side in place of the grid side. The operation of this tube, and of any tube in a leaky condenser hook-up, is the same as that of the 55 when it is connected as a "diode-biased" amplifier.

Lapel Microphones Popularized



(*Radio Television Industries Corp.*)

At left is shown how a lapel microphone is worn by a performer. Middle picture shows it in the hollow of a hand, so small it is almost lost. Right—Pointing out on the lapel of the coat.

The lapel microphone has been developed with the object of providing full freedom of action and more natural performance for speakers and singers. A microphone of this kind must be light in weight, inconspicuous, capable of good quality, and reasonably inexpensive.

The size of the present model is 1.25 inches in diameter and 0.25 inches thick and it weighs only one ounce. Despite this small size the performance is said to be comparable with that of the best of the standard microphones in respect to fidelity and sensitivity.

The present model is a carbon granule type with a stretched gold-plated duralumin diaphragm. A unique method of streching the diaphragm is employed, one that permits the full area of the diaphragm to vibrate freely. Full advantage has also been taken of the fixed position of the microphone with respect to the source of sound. Also, advantage has been taken of the fact that the angle of incidence of sound, that is, the direction from which the sound comes, is always practically the same. The elimination of the variable angle of incidence has permitted a design of high fidelity.

The carbon granules used have been carefully selected and subjected to vacuum treatment at high temperature for the removal of volatile matter and washing in ether, acetone, and zolol for the removal of every trace of grease. The precautions minimize hiss and crackling usually associated with carbon microphones. Special carbon buttons, highly polished with rouge, are used, which also help to reduce noise to a low minimum.

This microphone will replace any standard two-button microphone without additional equipment of any kind. It is provided with a long cord with connectors to fit any regular microphone jack. The outlet may be up to 50 feet away from the speaker.

The new lapel microphone enables the performer to move about freely in a natural manner without any restrictions in regard to the position of the microphone, for it is always with him and in the same relative position. Thus he is assured of absolute uniformity at all times.

The use of the lapel microphone is particularly advantageous to the lecturer who has occasion to turn his back to the audience for the purpose of illustrating his points on a blackboard or projection screen. In turning he need have no fear that his remarks will fail to reach the microphone. Actors before a television transmitter can also use it advantageously. The microphone may be concealed on his person so that his vocal performance will not be missed, yet there is no need of the appearance of a microphone on the picture.

Lapel microphones were used at the Republican and Democratic National Conventions so speeches from the floor could be broadcast.

Amateurs Total 31,859

100% Gain in Ten Years, 40% Since Last Year

Washington.

THAT there are 31,859 licensed amateur radio stations in the United States was brought out in an address by W. D. Terrell, director of the Radio Division, Department of Commerce, delivered at the Atlantic division convention of the American Radio Relay League.

Amateurs are to a large extent self-policing, asserted Mr. Terrell, attributing their large growth of the past few years—they have increased 40% in the past year, added two-thirds to their number in two years—to "freedom from discouraging regulations." Recalling the exile of amateurs to the low-wave region in 1912, then regarded as useless, and which the amateurs proceeded to develop into what is today the most valuable field in radio, he commented on their early development of a system of self-regulation, which has continued up through the present day.

Others to address the convention were Dr. Julius Klein, Assistant Secretary of Commerce, and Paul M. Segal, general counsel of the American Radio Relay League, whose discussions of current international amateur radio affairs were broadcast over the network of the Columbia Broadcasting System.

Recalls Early Days

Mr. Terrell's speech follows in full:

"It is evident that the amateurs and our universal enemy, depression, are not operating on the same waves.

"When you met in Washington in 1922 there were 15,504 licensed amateur radio stations. Today, ten years later, there are 31,859. Last year there were 22,739 licensed amateur stations, so there has been an increase in the last year of about forty percent. What has caused this growth in amateur interest? I have asked a number of people this question. Likewise a number of people have asked me this question. I do not know the answer nor have I found anyone else who has given me a reply which I consider satisfactory.

"Some seem to think that it is due to the use of the radio-telephone, some say it is because there are so many young men without employment who find some satisfaction in occupying their time in building amateur radio sets and operating them. As I see it there is one good reason for it. This reason does not apply to this year but applies to each year since the first radio law was passed back in 1912. I think it is a logical reason—freedom from discouraging regulations.

"In the early days of radio, better known to the old-timers as 'wireless,' the amateurs were given a free field below 200 meters. In those days we expressed ourselves in meters and wavelengths. So long as they kept their transmitters on or below 200 meters they needed no regulation and because of this they got into the good habit of regulating themselves which they have continued to do up to the present time.

Made a Picnic Out of Doom

"That old 1912 law, which stated that the transmitting wavelength of amateur stations should not exceed 200 meters or a transformer input exceeding 1 kilowatt except by special authority of the Secretary of Commerce, caused only momentary worry on the part of the amateurs.

"The wise radio legislators and radio engineers probably felt the amateurs had been exiled to an unprolific desert where they would perish, but instead of perishing the amateurs irrigated the old ether desert and turned it into the most fertile radio field. In fact they cultivated it so intensely and with such astounding results that it soon became a battleground for all kinds of radio communication.

"Back in those good old days when we were operating under the 1912 law the Secretary of Commerce granted to amateurs special amateur station licenses in connection with which they used a 'Z' call and a few of them had experimental licenses. In looking over these old records I find many of the special amateurs were permitted to use the wavelengths of 200 meters, 300 meters, 450 meters and were required to listen in for distress signals on 600 meters.

"Apparently the next jolt received by the amateurs was at the Second National Radio Conference, when the broadcasters began pressing for more space in the ether. This Conference recommended that the amateurs using C. W., I. C. W. and 'phone be given from 150 to 176 meters exclusively, from 176 to 200 meters for C. W., I. C. W., 'phone and spark exclusively, and from 200 to 222 meters special amateurs were permitted to share with technical and training schools using C. W.

200 Meters "Impossible"

"About this time Major Lawrence Mott was an active amateur. His station was situated on Catalina Island across from Los Angeles. Major Mott stated at that time he had spent nearly ten thousand dollars in getting his station as nearly perfect as possible. I quote from a letter received from Major Dillon, who was Supervisor of Radio, at that time. He stated: 'Major Mott is very much disgusted with the restrictions of wavelengths, which he says practically put his station out of business. In view of the fact that he is one of the most enthusiastic amateurs engaged in the practice of the art, I believe it would be desirable to license him in the special amateur class for 275 meters.'

"The Division received a letter from Major Mott, dated May 10, 1923, protesting against a rule of the Bureau of Navigation, stating: 'The use of radiating antenna for transmitting on any wavelength, between 200 and 1,000 meters, is not permitted under this license between the hours of 11:30 a. m. and 12:00 midnight, local standard time.'

"Major Mott stated: 'If this ruling as quoted holds literally true, then I for one drop out of radio effort for the reason that it will be impossible for me to maintain any sort of experimental effort over great distances on 200 meters.'

"Wonderful Opportunities"

"In replying to Major Mott I stated in part as follows: 'It has been reported to the Bureau that there are splendid results now obtainable in the very short wavelengths and you may find that on 150 meters you may be able to accomplish results which may surprise you. It was recently brought to the attention of the Bureau that some amateur had been heretofore using 200 meters with very little success and as an experiment adjusted his station for a wavelength of 120 meters and was heard in every state in the United States using very little power.

"'The Bureau has no intention of so restricting the amateurs as to put them out of business. It feels sure that this new field of endeavor will give to them wonderful opportunities to discover possibilities which these new wavelengths will apparently afford.'

"The next important fight we engaged in was at the International Radiotelegraph Conference held in Washington in 1927. At that time I stated in a committee meeting that there was no cause for conflict between amateurs and operating companies, that there is ample law in the United States to regulate the amateurs and the United States does so regulate them. I pointed out that amateur radio established a basis for ground work in knowledge of electricity and its application to radio communication and that I saw possibilities of promoting good-will through our amateurs communicating with the other amateurs of the world which resulted in closer ties of friendship and better understanding among the nations of the world. At that time I pointed out that the regulation of amateurs in this country was not a difficult problem, that to a large extent they regulated themselves and to a large extent they are doing the same thing today.

Some Few Break Laws

"It is important that amateurs carefully observe the laws and regulations which are intended largely to protect them. Their orderly operation encourages representatives of this government who attend international conferences to put forth every reasonable effort to safeguard the American amateur.

"Such a conference is scheduled to be held in Madrid, Spain, in September of this year and it is important that the amateurs have a clean record if they desire the same support at this conference as was given to them in 1927.

"Because of what I have just said I do not want you to get the impression that all amateurs are law-abiding. We are getting too many reports of amateur stations being off frequency and of unlicensed amateur stations using the call letters of licensed amateurs with their knowledge and sometimes with their consent.

Limitation on Amateurs

"A licensed amateur has no more right to allow an unlicensed amateur to use his call letters than he would have to permit him to use his automobile license plates.

"Not long ago it was brought to the attention of the Radio Division that a prospective amateur in Washington was using the call letters of licensed amateurs. It was reported to the Division that these licensed amateurs were aware of the fact but were unwilling to give this information to the Radio Division. Later on this unlicensed amateur presented himself for examination to obtain a radio operator's license. During the examination it was discovered that he was the individual who had been operating an unlicensed station using the call letters of other amateurs. Upon questioning he admitted this fact and later submitted an affidavit explaining why he had done so. This is not the proper kind of cooperation which is helpful to the unlicensed amateur or anyone else. It is starting him off with the thought that he can disregard the radio laws and regulations and be protected.

"So Few Violations"

"Having faith in the character and earnestness of the great majority of the amateur fraternity I am sure it is going to surprise those here to learn that there

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PADDING CONDENSER GROUN STANDARD

By Einar

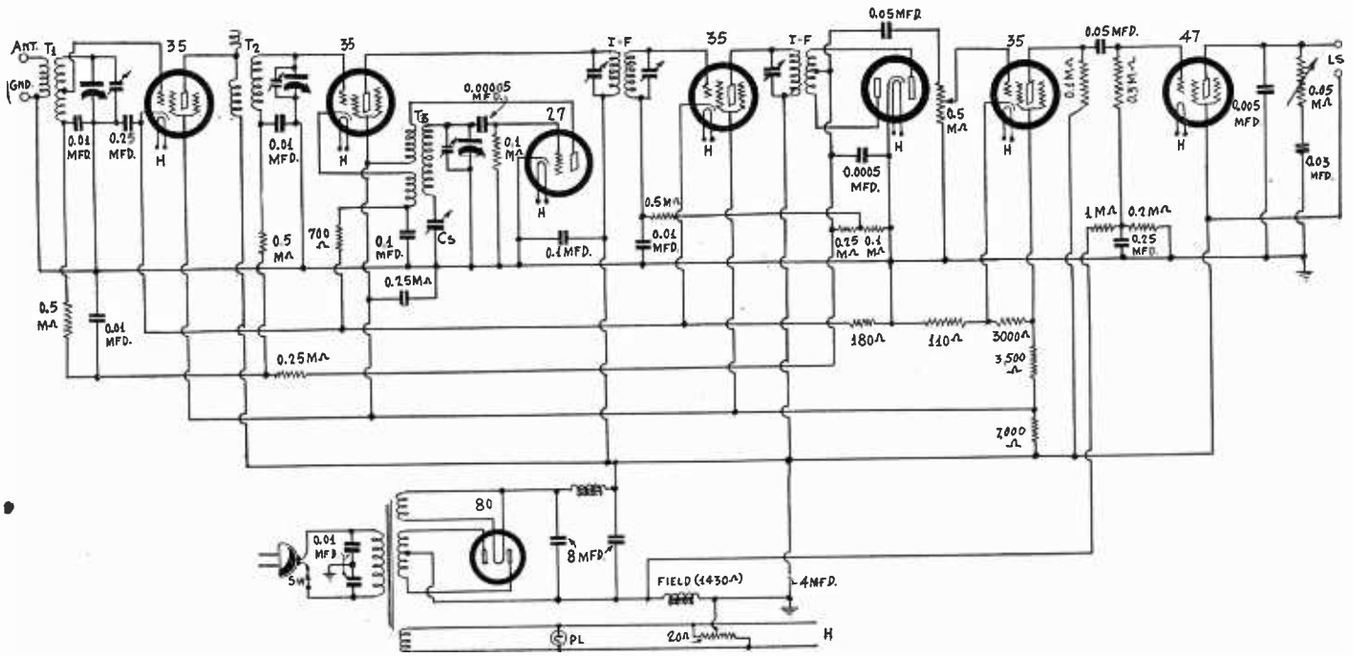


FIG. 1

HERE WE have the circuit diagram of the Majestic Model 200 eight-tube superheterodyne. With a few exceptions, all the values are given on the diagram, and these are authentic. What is surmised is the intermediate frequency and those parts of the circuit which depend on that frequency. There are really only two things that depend on this, the inductance of the oscillator coil and the value of the series padding condenser Cs.

Since it does not matter a great deal what the intermediate frequency is, within rather wide limits, we can choose any one of the popular frequencies, or even an unpopular one. However, if we stick to the popular frequencies we have the assurance that we can obtain the proper intermediate coils as well as the correct oscillator inductance and series padding condenser.

The first coil T in the circuit is a regular r-f transformer with the exception that the grid of the first tube is connected to a tap on the secondary rather than to the top. The main effect of so connecting the grid is to reduce the input to the amplifier. But the amplification in the set is obviously so great that this reduction would not matter in the least, especially if there is some other advantage in the connection. Well, the selectivity of the circuit might be a little greater when the tube is connected across only a part of the coil, and the effect of the tube capacity is virtually eliminated.

The second coil, T2, is different, being of the capacity coupled type. The little pigtail connected to the plate of the first tube and placed over the secondary of T2 is a small open winding at the grid end of the tuned coil and it acts as a small coupling condenser. The gain at the high frequency end of the tuning range is due mainly to this device. The winding that appears to be a primary, and that is connected between the plate and the B supply is not a primary at all. It is first of all a choke coil in the plate circuit of the tube, the choke which makes the previously mentioned coupler effective. But it also acts as a coupler in its own right because there is capacity between this choke and the secondary. It takes care of the gain at the low frequency end of the coupler. Though it is not apparent on the diagram, we assume that the choke coil resonates at some frequency near the lower limit of the broadcast band, for this is usually the case in such couplers. The coupler is used quite extensively and can be obtained from nearly all coil manufacturers for the usual tuning capacities.

The oscillator is of the tuned grid type, which is the most common because of its reliability. As usual, it contains three windings, the tuned, the tickler and the pick-up. To give a value of the required inductance of the tuned winding we have to know the intermediate frequency and also the value of the tuning condensers. We assume that the condensers are of the usual 350 mmfd. size. Now if the intermediate frequency is 175 kc, the inductance of the tuned winding should be 196 microhenries, which is approximately 0.8 of the value of the inductance of either of the tuned r-f coils. Suitable oscillator coils for 175 kc i-f and 350 mmfd. tuning condensers are made by all coil manufacturers.

If the intermediate frequency is 400 kc the inductance of the oscillator coil should be 145 microhenries, assuming the same tuning condensers and the same r-f inductance. These coils are also available although not so many manufacturers make

LIST OF PARTS

T1—One r-f transformer for 350 mmfd. tuning condenser, secondary tapped.
T2—One r-f coupler for 350 mmfd. tuning condenser.
T3—One oscillator coil for 350 tuning condenser.
Two i-f transformers, one with secondary center tapped.
One 30-henry choke coil.
One power transformer.
One gang of three 350 mmfd. tuning condensers, each with trimmer.
One 0.00005 mfd. condenser.
One 0.0005 mfd. condenser.
One 0.005 mfd. condenser.
Six 0.01 mfd. condensers.
One 0.03 mfd. condenser.
Two 0.05 mfd. condensers.
Two 0.1 mfd. condensers.
Three 0.25 mfd. condensers.
Two 8 mfd. electrolytic condensers.
One 4 mfd. electrolytic condenser.
One 20 ohm resistor, center tapped.
One 700 ohm resistor.
One 50,000 ohm potentiometer.
Four 0.1 megohm resistors.
One 0.2 megohm resistor.
Two 0.25 megohm resistors.
One 0.3 megohm resistor.
Four 0.5 megohm resistors.
One tapped resistor strip—180, 110, 3,000, 3,500, 7,000 ohms between taps.
Seven UY sockets.
One UX socket.
One line switch.
Four grid clips.
One pilot light.
One dial, slow motion adjustment.
One loudspeaker with a 1,430 ohm field.

High Ideals Crea

(Continued from preceding page)

have been a few amateurs, who for monetary consideration, have given over the use of their stations to racketeers for the conduct of illegal enterprises. It is almost inconceivable that a person who has become a member of the world-wide amateur fraternity should do this. I consider it unnecessary to warn the amateurs here present of the seriousness of such an offense.

"In connection with the unlawful use of amateur radio stations and the few cases which I have in mind, I desire at this time to again express my thanks to those amateurs loyal to the high ideals that really constitute the amateur radio

DED IN 8-TUBE SUPERHETERODYNE

Andrews

them. Coils for other intermediate frequencies can also be obtained.

The Padding Condenser

The value of the padding condenser depends very much on the intermediate frequency. The lower the intermediate frequency the larger must the condenser be. For an intermediate frequency of 175 kc the capacity of the series condenser should be 815 mmfd., approximately. Of course, it should be variable, so that the exact value needed can be obtained experimentally. An adjustable condenser having a range of 700 to 1,000 mmfd. should be used.

For an intermediate frequency of 400 kc the stopping condenser should have a capacity of 436 mmfd. There is an adjustable condenser having a range from 350 to 450 mmfd., which covers the range required.

It will be noticed that the padding condenser Cs in this circuit is connected between the coil and ground. There is one marked advantage in this connection. The condenser is grounded on one side so that there is no body capacity effects during its adjustment. Thus the final adjustment of the trimming is easy. However, there is also a disadvantage in the connection. The input to the oscillator grid is reduced by the fact that the voltage drop across the variable condenser only is used in the grid. This makes the circuit less lively, other things being equal. Moreover, the proportion will change with frequency since the variable condenser is varied. The circuit will oscillate more at the high frequencies than at the low.

Intensity of Oscillation

But there are many other factors which enter to alter this, or even to require such change in oscillation. We cannot conclude that the advantage of placing the series condenser where it is does not justify the connection. As a rule, the oscillation is too violent and must be reduced. This apparently is the case in this circuit, for the grid stopping condenser used is only 0.00005 mfd. Such a small value tends to reduce the intensity of oscillation and this is one way of doing it. Another is to put a resistor between the grid and the coil, in series with the stopping condenser. If one of these methods is not used, there is likelihood of blocking.

An Unusual Feature

An unusual feature of the circuit is the type of detection after the intermediate frequency amplifier. A special double diode, marked G2 in the diagram, is used in a full wave rectifier circuit. This tube is made by the makers of the Majestic set, and it may not be obtainable everywhere. However, it is possible to use the 55 double diode, as soon as that comes out, in the same kind of detector circuit.

The d-c part of the output voltage of the detector is used for automatic bias on the r-f amplifier, the first detector, and on the i-f amplifier, the full voltage being applied to the first two and only about 2-7 of the total on the i-f amplifier. The connection of the a.v.c. feature is such that the automatic voltage is in series with the fixed bias, and in the same direction. Therefore, when no signal comes in, the circuit is in its most sensitive adjustment, but as soon as a signal comes in the drop in the load resistor of the detector appears, and this drop is approximately proportional to the strength of the signal. This drop is added to the fixed bias, and therefore the stronger the signal the greater the bias and the lower the sensitivity. The result is that about the same volume comes out regardless of the strength of the signal at the antenna.

Manual Volume Control

The manual volume control is a half megohm potentiometer placed in the grid circuit of the first audio amplifier. While it is usual to place the manual volume control near the antenna or actually in the antenna circuit, it is permissible to put it in the audio amplifier in this case because of the automatic control in the r-f and i-f. At the detector the volume is always practically the same, and the circuit can be adjusted for this volume. If different output levels are desired the desired control can be obtained in the a-f amplifier. The range of the manual control is from zero up to the maximum of which the receiver is capable, and the maximum is greater than will ever reasonably be required.

There is another manual control in the set, a tone control, which is placed in the output circuit of the last tube. It consists of a 50,000 ohm variable resistor in series with a 0.03 mfd. condenser shunted across the input to the speaker transformer. In addition to this variable tone control, there is a fixed condenser of 0.005 mfd. across the output of the tube, which has the effect of suppressing the high audio frequencies ordinarily so prominent in 47 type tubes.

Grid Bias

The fixed grid bias on the r-f and i-f amplifiers, and part of the fixed bias on the first detector, are obtained from a common 180 volt resistor in their cathode leads. The resistor is a part of the voltage divider strip, although ground, or B minus, is so connected that no part of the bleeder current flows through it. The first detector has an additional bias resistor of 700 ohms. This value is unusually low.

The bias on the first audio amplifier is obtained from the drop in a 110 ohm section of the voltage divider. This section not only carries the plate and screen currents of the amplifier but also the bleeder current, and it is apparent that the bleeder current is so large in comparison with the current from the tube that the bias is determined almost entirely by the bleeder current. Hence the bias on this tube is quite steady.

Part of the drop in the field coil of the loudspeaker is used to bias the power tube, a voltage divider consisting of one megohm and one 0.2 megohm resistor being connected across the field, and only the drop in the 0.2 megohm resistor being used. If the bias on the tube is 16.5 volts, the total voltage drop in the field must be 99 volts, judging by the values of the two resistors.

Screen Voltage

We note that the screen voltage on the a-f amplifier is less than one-half as great as the screen voltage on the three other screen grid tubes and on the plate of the oscillator. This is quite in line with requirements for distortionless amplification in a resistance coupled circuit with a 35 type tube, or with any screen grid tube. The ratio of the two voltages can be obtained from the ratio of the 3,000 ohm resistor in the voltage divider and the sum of this resistance and the 3,500 ohm resistor.

The load resistance on the double diode is 0.35 megohm, made up of one 0.25 and one 0.1 megohm units. The grid of the i-f amplifier returns to the junction of these two resistors, through a 0.5 megohm resistor. This resistor serves the double purpose of filtering and of preventing short circuit for the audio component.

ited to Amateurs

who have rendered assistance by means of information and actual service in the apprehension of those who would blacken the name of amateur radio purely for the sake of monetary gain.

"When we consider the large number of licensed amateur radio stations—31,859—it is almost inconceivable that there are so few violations of the radio laws and regulations and so few complaints of interference filed against the large number of transmitters. Cooperation, self-regulation and high ideals which have continued over a period of twenty years make this possible and I fully appreciate this spirit."

Socket Connections For the New Tubes

The socket connections for the new tubes can be figured out in nearly all instances by those familiar with radio technique, even unto the six-pin-base type tubes, the 57 and 58. However, as to the 46, which may be connected one way for Class B and another for Class A, the connections can not well be figured out. Viewing the sockets from the bottom, with filament or heater prongs toward you, the connections are as follows in a clockwise direction from the heater or filament at right: .

46: filament, filament, inner grid, outer grid, plate. The outer and inner designations refer to tube geometry. For Class B tie both grids together. For Class A tie outer grid to plate. This is a power tube, whether used as Class A or B, driver or output. UY socket.

56: heater, heater, plate, grid, cathode. These connections are the same as for the '27, on which the 56 is an improvement. UY socket.

57: heater, heater, plate, screen grid, suppressor grid, cathode. The control grid connection is to cap of tube. This tube is an improvement on the '24 and is a pentode detector and audio amplier. Six spring socket.

58: Same connections as for 57. This is a pentode r-f amplifier, an improvement on the '35. Six-spring socket.

55: heater, heater, plate, diode, diode, cathode. The control grid for the triode is the cap at top of tube. Six-spring socket.

82: filament, filament, plate, plate. This is a mercury vapor rectifier. Same connections as '80 tube, but filament voltage is 2.5 volts, not 5 volts. UX socket.

83: same as 82. The 83 will be a mercury vapor rectifier of constant voltage drop despite large differences in current drain.

WHY SO MANY TUBES ARE IN THE

By Herman

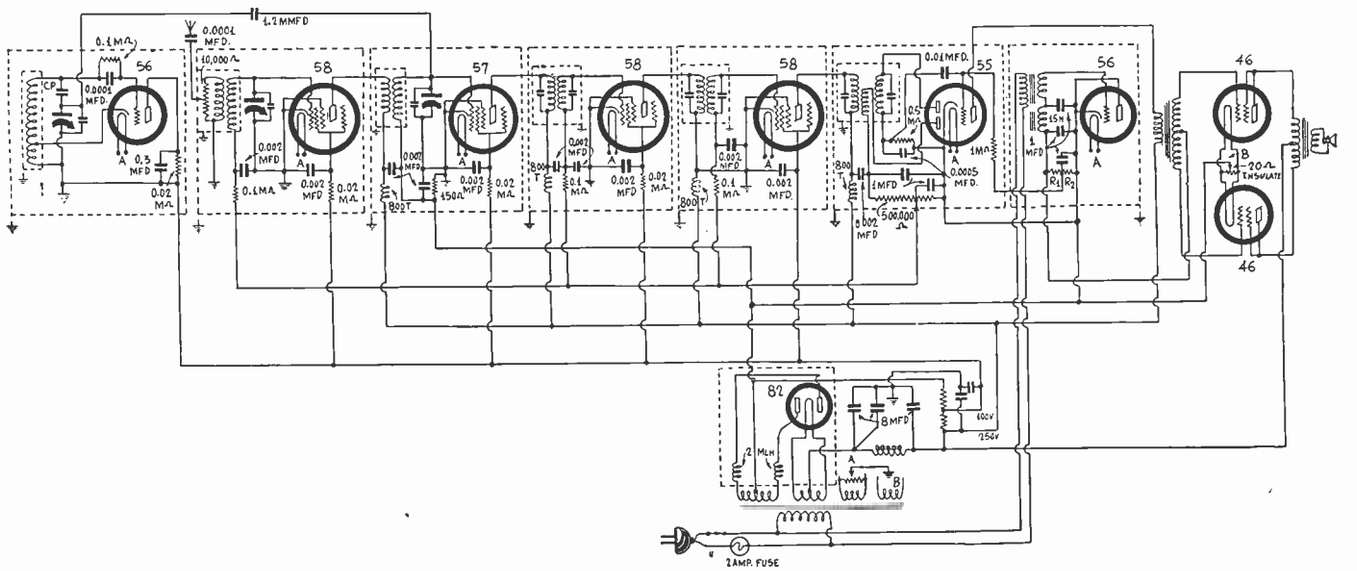


Fig. 1

All tubes used in this superheterodyne are of the new series, including the 55, which will not be released until the fall. Automatic volume control and a separate eliminator for bias are provided.

IT may be noticed that a-c circuits are running into more and more tubes, despite the greater performance per tube, and that means greater sensitivity, automatic volume control and better tone.

The advantages of the automatic volume control are that when a selected volume level is established no station will come in louder than that, fading effects are minimized, and quality improved by the reduction of overload danger.

With the new 55, to be released in the fall, past troubles with automatic volume control should almost disappear. To date the automatic volume control has been as much a nuisance as a blessing. With the 55 separate rectifiers may be used for the detector and the a-v-c, and thus the time lag is confined to the a-v-c and is not gaited to the detector. The hissing sound between stations, that is, when in otherwise silent areas of the dial, is still to be expected, but since it has no relationship to listening to a program it is not so important. It is due to the heightened sensitivity of the set when no signal is pushing the bias on the controlled tubes more negative, but may be reduced by increasing the limiting value of bias. So in the present circuit, Fig. 1, the negative bias is lifted to 6 volts constant, for that reason and because the same voltage makes the 57 a detector as makes the 58 tubes good amplifiers.

More Connections Now

The reduction of the hiss is purely relative, in that sensitivity even at signal reception has to be lowered accordingly. That requires a selection of a given sensitivity for maximum, with no signal input, and the automatic cutting down of that sensitivity when a station is tuned in. The stronger the input from the station the greater the reduction in the sensitivity. However, high-powered sets easily can develop so much sensitivity that you have plenty to spare, otherwise you would be at the noise level. At some frequencies the sensitivity may be a fraction of a microvolt per meter.

Another point about the new circuits is that they look more complicated. There are more connections to be made when there are more tubes, and when sensitivity is high the filtration at radio frequencies must be good, hence still more parts and connections. But as for complication, that can hardly be said to exist actually, as the connections are, in the main, familiar ones, with greater than usual repetition.

Let us see, therefore, if the present circuit is not subject to simple analysis, and whether it does not tread more familiar ground than would seem at first blush.

Shiepe's Oscillator

At upper left is the oscillator—for this is a superheterodyne—and it has a grid leak and condenser not for detection, since the steady bias is for amplification, but for frequency stability. Any grid current flow tends to neutralize itself because greater flow increases the negative bias and thus reduces the grid current.

The oscillator is of the Hartley type as modified by E. M. Shiepe, and is one of the simplest and most reliable. The plate is grounded to radio frequencies and is hence non-reactive, another frequency stability factor. The resistor-capacity filter in the plate circuit is simply to prevent the oscillation current from getting into the rest of the circuit, where not desired. Where coupling is desired a condenser of 1.2 mmfd., consisting of two 0.6 mmfd. in parallel, is used, from grid circuit of oscillator to grid circuit of modulator (third tube from left). The connection is easily made on the gang itself, from stator to stator, which is one reason for the chosen position.

Aerial is connected to the arm of a potentiometer, so that the input to the stage of tuned radio frequency amplification may be attenuated. The selectivity is practically constant in the input circuit with this type of volume control, which is an improvement over some other methods, wherein the selectivity is least as volume is least.

Distortion Avoided

The oscillator is a 56, the new tube that is something like the '27, but an improvement over it, and is recommended for use as an oscillator. The plate voltage on the oscillator is the screen voltage on other tubes, about 100 volts. The r-f amplifier tube is a 58, which is a new and improved version of the '35, with a more remote cut-off, and great reduction, almost elimination, of secondary emission. This prevention of the rebound of electrons from the plate, the limiting factor in most of the older tubes, improves tone quality because it reduces the detecting action of the amplifiers when the negative bias runs high, hence screen voltage low.

The cathodes of the r-f amplifier, detector and both intermediate amplifiers are grounded. Thus in each case the cathode is at the same d-c potential as the center of the heater winding, which is the recommended condition. As to the oscillator, the bias thereon is zero, also recommended, although the return is at a higher or positive voltage in respect to B minus, equal to the drop in the 150-ohm resistor shown from cathode of the 57 to B minus. The current through this resistor is about 40 milliamperes, as the oscillator plate current (though filtered) passes through it also.

Cathode Circuits Incomplete?

Perhaps it seems that these cathode circuits are not completed. Ground symbol is attached to the cathodes in question, therefore all cathodes so marked are tied together, the lead being ground, possibly the chassis itself. When we have cathodes united we need only one resistor to B minus to complete the circuit, providing the other voltages are supplied, which they are. Hence the sum of the plate currents of one 56, one 57 and three 58

USED NEW A-C RECEIVER CIRCUITS

Bernard

tubes passes through this resistor, as well as the screen currents of the 58's and the 57. So we have really the simple example of a common biasing resistor, the only unusual point being the grounding of the cathode rather than of B minus. In other words, the usual biasing resistor is in the usual position, but the grounded point is at a new position, cathode instead of B minus. As for the oscillator, its current has to find its way back to B minus, and the only way it can do so is through this same 150-ohm resistor.

All condenser rotors, three sections, in the mixer circuit are grounded, but the grid return does not go to ground in any of these instances except the one case of the oscillator. The r-f and three i-f tubes are automatically volume controlled. The reason for separating their grid returns is to enable connection to a point on the voltage divider of the automatic volume control circuit, so that the signal rise will swing the bias more negative, the change taking place in the voltage divider of the a-v-c in step with the change in signal amplitude, although in the opposite direction, because positive of the a-v-c, always cathode of that tube, is connected to B minus, and all voltages in the a-v-c are negative in respect thereto.

Two Intermediate Tubes

Although a long lead is required, the r-f is taken out by the resistor-capacity filters immediately next to the tube circuit concerned. The 57 modulator, however, and the 56 oscillator, are not controlled tubes.

Notice that there are two stages of intermediate frequency amplification, instead of only one. The two stages might have to be ruled out if we could not use the duplex-diode triode tube, for that tube virtally can not be overloaded by the signal as detector or a-v-c, for it will stand an input that will produce 20 volts d-c.

The 55 is excellent for the demodulator or second detector of a superheterodyne. The response will be virtually linear if the load resistance is high enough, that is, the tube resistance is small in comparison to the load resistance. This load is 0.5 meg. and is bypassed by a 0.0005 mfd. fixed condenser.

Let us look at the input to the 55. There is the secondary of the last intermediate transformer, connected between one diode plate and one side of the resistor, the other side of the resistor cathode. Thus the detector circuit is complete.

The other diode in the same glass envelope is entirely independent, except that the return is to a common point, the cathode, which does not mean there is any coupling, for the two sections really are independent. Therefore a separate feed is necessary for the other diode, to be used as a-v-c, and this is provided by an extra winding coupled to the other windings in the intermediate transformer.

The Pick-Up Winding

Thirty turns of wire may be wound around the hub at the separation between the two windings of the intermediate transformer, if a commercial type with extra winding is not obtainable readily.

The extra winding is connected, one side to remaining plate of diode other side to a resistor, the return of which is to cathode. Now, if this cathode, of the a-v-c tube, were grounded conductively the previously-mentioned 150-ohm resistor would be ineffective, since cathode of the controlled tubes would be at the same potential as grid at no signal input, for then there would be no a-v-c voltage.

However, the limiting bias is effective now, with a-v-c cathode tied to B minus. Now the value of the resistor in the a-v-c does not become very important, as the bias voltage will be lifted proportionately to the signal amplitude, and if the resistance is less the current will be more, but the voltage will not be much different, because the product of the two remains about the same. However, the resistance should be high for one reason, if no other, and that is to limit the current through the a-v-c diode, and to make the load a high multiple of the resistance of the tube itself. So a 500,000-ohm potentiometer is shown, and the slider may be moved to an acceptable position, and may be used even as an auxiliary volume control.

20 Volts Negative Bias

The duplex-diode triode is two tubes, as has been seen, but it is also another tube, the triode section, and this may be connected in circuit in several ways, one of them being as shown, with a stopping condenser between the negative side of the resistor and grid. Then the grid requires its grid leak, shown as 1 meg., and for 250 volts to be applied to the plate the negative bias should be 20 volts.

To provide this bias, as well as the bias for the power tubes, two 46's used as Class A amplifiers in push pull, a separate rectifier is used. It is a 56, with cathode and plate joined, for the positive side, the grid element (now anode, not a grid) being negative. Into this rectifier we put a-c from a 1 to 1 transformer, or if we have a 2.5-volt filament transformer we may connect the primary to the 2.5-volt winding of the power transformer and use the secondary as input to rectifier, at 110 volts. We shall have more d-c than we need, as the bias required for the output tubes is 33 volts, but we may move the grid return of the power tubes to a suitable point on the resistor to register the prescribed plate current at the rated voltages, which is using the tube as a vacuum tube voltmeter.

Rating of the 46

The 46 as a Class A power amplifier has the following rating: grid adjacent to plate tied to plate, from the viewpoint of tube geometry, or, as to socket positions, K spring tied to P spring; UY base; filament type tube, 2.5 volts a-c; filament current 1.75 amperes; maximum plate volts, 250; negative bias with a-c on filament, 33 volts; plate current under these conditions, 20 milliamperes; a-c plate resistance, 2,380 ohms; mutual conductance, 2,350 micromhos; voltage amplification factor, 5.6; ohms load per stated power output, 6,400 (single tube); power output, milliwatts, 1,250. For push-pull the ohm load would be twice that for one tube, because of the series connection resulting from push-pull, hence 12,800 ohms, while the power output may be conservatively rated for push-pull as twice that for a single-sided circuit.

As for frequencies to be tuned in, these may consist of the broadcast band and other bands as well, as the circuit is adapted for short-wave use with plug-in coils. For the broadcast band, 0.00035 mfd. tuning, the inductance of the oscillator should be 145 microhenries for an intermediate frequency of 400 kc, the padding condenser in the oscillator 350-450 mmfd., adjustable. For higher frequency bands a larger padding condenser is necessary. The inductance of the antenna winding should be 245 microhenries, also the same for the secondary of the modulator input transformer.

The tuned windings have 127 turns, except the oscillator, which has 86. The primary of the interstage coupler to modulator has 30 turns wound over the secondary, insulating fabric between, the winding being near the bottom of the secondary. Some commercial coils have two windings, 10 and 30 turns, and you can select which you prefer, depending on aerial length and location. The wire is No. 32 enamel.

The 400 kc intermediate transformers are commercial products, usually marked 450 kc, but adjustable to the other frequency.

Receivers Appointed for DeForest Company

The DeForest Radio Company announced that the Federal Court at Newark, N. J., had appointed a receiver in equity to manage the company's affairs and to preserve its assets.

The application was filed by Sarlat Brothers, a creditor, and the company consented to the appointment. The receivership is expected to bring about a reorganization plan.

The court appointed Leslie S. Gordon, president of DeForest Radio Company, and Ralph E. Lum, of the law firm of Lum, Tamblyn & Colyer, as receivers. Mr. Lum was president of the New Jersey State Bar Association. These appointments insure the operation of the business for the benefit of creditors and stockholders. It is stated that he assets exceed the liabilities.

NEW INCORPORATIONS

Brooklyn Radio Stores Corp., Brooklyn, N. Y.—Atty., S. J. Shapiro, 51 Chambers St., New York, N. Y.

The Codisco Corp., New York City, electrical devices—Corporation Trust Co., Dovel, Del.

DISSOLUTIONS

Appel and Henderson Electric Communications Equipment, New York City.

RECEIVERS APPOINTED

Polymet Mfg. Corp., 829 East 134th St., New York, N. Y., radio and electric parts—Liabilities about $400,000; assets about $100,000.

BANKRUPTCY PROCEEDINGS

Petitions Filed Against

Julius Modell, retail radio equipment, 2407 Ave. J., Brooklyn, N. Y., by Triangle Radio Supply Co., Inc., for $3,755.58; R. H. McMann, Inc., $804.19, and Wolfe Radio Co., $3,148.33.

Enterprise Electrical Co., 11 King St., Middletown, N. Y., by Stivers Printing Co., for $1,651; Herbert J. Watkins, $1,169; Alan M. Nugent, $1,856.

Radio Surplus Corp., 56 Vesey St., New York, by Weber Distributing Co., Inc., for $200; Cornish Wire Co., Inc., $100; Supreme Specialties Co., $250.

Corporation Reports

Weston Electrical Instrument Corporation and Domestic Subsidiary—Quarter ended March 31: Net loss after taxes, depreciation and other charges, $40,517, compared with net income of $60,644, equivalent under participating provisions of the shares to 53 cents a share on 34,800 no-par Class A shares and 28 cents a share on 150,000 no-par common shares in first quarter of 1931.

RECTIFIER WITH CONSTANT DESPITE

By Adam J.

THE advent of the Class B amplifier, of the type operating at zero bias at no signal, calls for a rectifier tube that will have a voltage drop across it that does not change with current. Otherwise there will be considerable voltage instability, due to the violent and rapid changes of voltage due to current changes. Numerous types of actual difficulties might be introduced by such voltage changes.

A rectifier of this type is the very kind that the tube manufacturers are said to be working on, the tube prophesied in these columns last week, and to be announced officially in the fall as the 83, a mercury vapor rectifier.

The plates of this full-wave rectifier will be about three times as far apart as those of the '80 rectifier, which led to the supposition that the tube is meant for high voltages, but it is stated that uniformity of voltage drop will be the main goal.

Even More Constant Drop

It will be recalled that a mercury vapor rectifier tube, the 82, was announced a few months ago (April 30th issue), and some manufactured sets use it. This tube, too, has a low voltage drop across its elements, about 15 volts, although this is somewhat subject to change with current changes. The 83, however, is expected to produce a much more uniform voltage drop of about the same voltage, despite the changes in current within the expectations of general usage, up to full emission.

The output volume of sound is related to the wattage used and therefore the current changes will depend not only on the modulation but on the volume control setting. Even so, and with automatic volume control, plus manual control, the wattage extremes on a new type receiver just announced, Class B audio, using two 46 tubes in the output, is from about 70 to about 130 watts.

Considering the resistors that are factors governing the voltage changes due to current changes we have (1) the tuner tubes and preliminary audio; (2), the power tubes; (3), the rectifier tube; (4), the high-voltage secondary of the power transformer; (5), the B choke coil resistance; (6), the voltage divider resistance. To these, in the case of radio frequency amplifiers, or intermediate frequency amplifiers, where the bias is changed for volume control, we might add these tubes, also, as a sixth classification, because they become adjustable resistors in parallel with part of the voltage drop across the rectifier output, and as such introduce current changes.

We can dismiss the tuner tubes and preliminary audio as not introducing sufficient current changes to be of much importance, hence the external voltage differences also are unimportant. It is assumed that any preliminary audio tube is a Class A amplifier, the type with which technicians are most familiar, and that the negative bias is high enough for the signal conditions.

Reason for Driver

The power tubes, if of Class B, using the 46's with the initial bias of zero, are operated on their positive characteristic. The grids are swung positive by the signal. This accounts for the great changes in current. Further to attest to this fact is the necessity for a driver stage, usually one 46 as Class A or two 27's or 56's as true push-pull, ahead of the output. Obviously there is power tube grid current, plenty of it, and the object of the driver is to compensate for the loss developed by the grid current in the succeding stage.

Since nothing can be done about stabilizing the current in the Class B amplifier of this particular type—46's used in the manner recommended by the tube manufacturers—it therefore follows that considerable progress toward voltage stability will be gained if the rectifier tube's drop is constant regardless of current differences within operating limits.

Since the Class B amplifier of this type calls for 400 plate volts, it is foregone that the 83 will be suitabe for this voltage, and while voltage stability is the main consideration, it can be seen that after all there is something to the surmise also that it will be of the high voltage type. That depends on what you mean by "high" voltage, and it is assumed that it is some voltage in excess of the 331 volts d-c filtered output needed for the maximum plate supply (275 volts) and bias supply (56 volts) of the type '45 power tube.

Inverse Peak Voltage

So, if the voltage is regarded as high, so may the current be, as sets that momentarily draw as much as 150 milliamperes or more may be supplied with the current from this rectifier, though 125 ma steady current may be the rated maximum.

A measure of the voltage-handling capability of the tube is obtained from a consideration of its inverse peak maximum voltage per plate. For the 83 it is believed this peak will be 1400 volts a-c, as in the 82. The inverse peak maximum voltage is the maximum voltage that may be applied when the plate is in its non-rectifying condition.

The 82 has the following rating: a-c plate voltage (maximum volts r-m-s), 500; d-c output current (maximum ma) 125; approximate tube voltage drop, 15 volts. The 83 may be expected to line up with these.

Therefore except for the constancy of the voltage drop in the 83, there is much similarity between the two. Both are mercury vapor rectifiers.

The 82 is of the medium sized glass envelope type, like the automotive tubes, but the 83 probably will be in a larger envelope of the dome type, similar to the 57 and 58, although without the cap at top, for the 83 is and will be a filament type tube, with the filament (cathode) positive, of course, and the plates (anodes) negative.

Bleeder Current

Thus, while the tube manufacturers are doing their share, the set designers must contribute also. They should provide transformers with low d-c resistance secondaries, for the d-c flows through this resistance; also use low d-c resistance chokes, which means larger-diameter wire with unreduced inductance and generally larger chokes, as to physical size, or, if they can not well do that, at least meet the tube manufacturers half way by using relatively low resistance voltage dividers (high current). Then a measure of stability is contributed by the bleeder current through the voltage divider, for the percentage of change is less, due to the steadiness of the bleeder.

The connections for the '80, 82 and 83 are alike. The 5-volt winding of the power transformer is connected to the filament for the '80, or 2.5 on the others. The extremes of the high-voltage go to the plates (anodes). The center of the high-voltage secondary is B minus. This may be ground or not, depending on the filter circuit used in the rectifier, whether choke is in the negative leg or not.

Tube Described

When the 82 was announced RCA Radiotron Co., Inc., and E. T. Cunningham, Inc., released technical information. This is reprinted herewith because of the application to the 83, with the tube number and the characteristics changed to conform to the 83 expectations:

The 83 is a full-wave, mercury-vapor rectifier tube of the hot-cathode type for use in suitable rectifying devices designed to supply d-c power from an a-c power line. It is particularly recommended for supplying power of uniform voltage to receivers in which direct current requirements are subject to considerable variation. The excellent voltage regulation characteristic of the 83 is due to its low and practically constant voltage drop for any current drain up to the full emission of the filaments. Under normal operating conditions, the tube voltage drop is 15 volts. This desirable feature makes it possible to attain very high overall operating efficiency.

CHARACTERISTICS

Filament Voltage	2.5 volts
Filament Current	3.0 Amperes
Maximum A-C Voltage Per Plate	500 Volts, RMS
Maximum Peak Inverse Voltage,	1400 Volts
Maximum D-C Output Current, Continuous,	125 Milliamperes
Maximum Peak Plate Current,	400 Milliamperes
Tube Voltage Drop	15 Volts
Maximum Overall Length	4 13/32 Inches
Maximum Diameter	1 5/8 Inches
Bulb	Dome Shape
Base	Medium 4-Pin

Mercury Vapor Considerations

The presence of mercury vapor in the 83 neutralizes the space charge voltage drop to a value where it is only 15 volts at normal operating temperatures. This drop remains constant with any current drain up to the full emission of the filament. It is apparent therefore that this tube under operating conditions has very low internal resistance, and that the current it delivers depends on the resistance of the load and the regulation of the power transformer. Sufficient protective resistance or reactance must always be used with this tube to limit its current to the recommended maximum value.

If current in excess of the total effective emission of the filaments is drawn, the tube voltage drop increases rapidly with current and thus causes harmful positive ion bombardment of the filaments. This bombardment may be so great as to

VOLTAGE DROP DRAIN VARIATIONS IS DUE

Warwick

cause permanent damage to the coating on the filaments in a short time.

It is characteristic of mercury vapor rectifiers that no appreciable plate current will flow until the plate voltage reaches a certain critical positive value. At this point the plate current rises steeply to a high value in a small fraction of a second. This surge of current reoccurring each time either plate becomes positive, may excite circuits in the vicinity of the tube to damped oscillation and result in noisy radio receiver operation. In receivers of low sensitivity, this noise may not be apparent but in very sensitive receivers it may be necessary to enclose completely the mercury vapor rectifier tube within perforated metal or wire screen shielding to eliminate objectionable noises. The shielding must be designed to provide sufficient ventilation to prevent overheating of the tube. It is usually necessary to place within the shield, small radio-frequency choke coils of low distributed capacity in series with each plate lead of the rectifier so that the slope of the current wave front to the filter is reduced sufficiently to eliminate impact excitation.

Installation

The base of the 83 is of the medium 4-pin type. Its pins fit the standard four-contact socket which should be installed to operate the tube in a vertical position with the base down. Only a socket making very good filament contact and capable of carrying 3 amperes continuously shoul dbe used with the 83. Unless this precaution is followed, poor contact at the filament pins will cause overheating at the pins and socket, lowered filament voltage, and also high internal tube drop with consequent injury to the tube.

The bulb becomes hot during continuous operation. Provision should be made, therefore, for adequate natural ventilation to prevent overheating. This point must be given proper consideration if shielding is employed around the tube.

The filament is of the coated type and is intended for a-c operation from one of the secondary windings of a power transformer. This winding, provided with a center-tap or center-tap-resistor should supply at the filament terminals the rated operating voltage of 2.5 volts when average rated voltage is applied to the primary.

The high current taken by the filament and the danger of damage to the tube caused by applying plate voltage to the tube with its filament insufficiently heated, make it imperative that all connections in the filament circuit be of low resistance and of adequate current-carrying capacity. All wire connections should be carefully soldered.

Transformer Secondaries

The plate supply is obtained from a center-tapped high voltage winding on the power transformer. This winding should be designed so that the maximum a-c input voltage per plate will not exceed 500 volts rms under varying conditions of supply line voltage. The return lead from the plates, i.e., the positive bus of the filter and load circuit, should be connected to the center-tap of the filament winding.

The secondary windings of the power transformer should be adequately insulated from each other to withstand the full peak voltage of the high voltage winding. Under recommended maximum operating conditions, the full peak voltage will be about 1400 volts. The resistance of the transformer windings should of course be low if full advantage of the excellent regulation capabilities of this mercury vapor rectifier is to be obtained.

Under normal conditions the filaments of this tube heat quickly when the set is "turned on" and are ready to supply full load current before the tubes in the receiver require it.

Disconnection Advised

It is recommended that the entire equipment be disconnected from the a-c power supply whenever the 83 is removed from or installed in its socket.

Shielding of this tube, particularly in sensitive receivers, may be necessary to eliminate objectionable noise.

Radio-frequency choke coils, connected in series with each plate lead and placed within the shielding if used, are usually necessary in receivers having high sensitivity. The inductance of the chokes should be of the order of one millihenry or more.

A fuse having a rating approximately 50% in excess of normal load requirements should be inserted in the primary of the power transformer. This fuse is necessary to prevent damage to the power transformer in case of excessive current which may flow under abnormal conditions.

Application

The 83 is recommended for supplying d-c power to receivers, particularly those employing Class B amplification in the audio output stage. The direct current requirements of such receivers are such as to cause considerable variation in the load impressed on the rectifier tube. Unless the tube and its associated circuit can take care of the load demand with good regulation, unsatisfactory receiver performance will be obtained. To meet this operating requirement for extremely good regulation even though the load current is subject to considerable variation depending on the signal, the 83 is especially suited.

In order to take full advantage of the regulation capabilities of this mercury vapor rectifier, the resistance of the transformer windings (refer to "Installation" above), and the filter choke windings should be as low as practicable. Since the drop through the tube is practically constant, any reduction in rectified voltage when the load is increased, is due to the drop in the transformer and/or the filter windings.

Condenser Next to Rectifier

If it is impracticable to use a transformer with sufficiently low resistance to give the desired regulation, improved regulation of the output voltage may be obtained by employing a bleeder across the filter circuit.

Filter circuits of the condenser input or the choke input type may be employed provided that the maximum voltages and currents tabulated under "Characteristics" are not exceeded.

If the condenser input type of filter is used, consideration must be given to the instantaneous peak value of the a-c input voltage which is about 1.4 times the rms values measured from plate to filament with an a-c voltmeter. It is important, therefore, that the filter condensers (especially the input one) have a sufficiently high break-down rating to withstand this instantaneous peak value. It should be noted that with condenser input to the filter, the peak plate current of the tube is considerably higher than the load current. With a large condenser in the filter circuit next to the rectifier tube, the peak current is often as much as four times the load current.

Reduced Peak Current

When, however, choke input to the filter is used, the peak plate current is considerably reduced. This type of circuit, therefore, is to be preferred from the standpoint of obtaining the maximum continuous d-c output current from the 83 under the most favorable conditions.

Under operating conditions, the 83 has a bluish-white glow filling the space within the plates and extending to some degree into the surrounding space outside the plates. This glow, caused by the mercury vapor, is an inherent operating characteristic of the 83.

Distributor Misaligned, Auto Sets Pick up Motor

There are still a few installation men who have an occasional job on which they cannot get rid of all motor noise, says Transitone Automobile Radio Corporation.

Usually this is caused by the distributor. The high tension terminals or contacts are not lined up perfectly due to shrinkage or warping of the head or to wear in the distributor gears. The rotor may strike a few of the contacts and miss the rest.

Chalk the Contacts

When peening a rotor under such conditions, the best plan is to chalk the contacts or terminals and then after the rotor has been carefully peened, turn over the motor a few times with the ignition turned off.

Remove the distributor head and examine the chalked terminals. If the rotor has cut the chalk on a few of the contacts, these contacts should be scraped down with a hard sharp tool and the rotor again peened.

Shielded Loom

This procedure should be carried on until the rotor just traces a line through the heavy chalk layer on all the contacts. Obstinate cases of interference can be eliminated this way.

As a further aid to installation there is a stock shielded loom for shielding the secondary ignition cable between the instrument panel and the dash. It is made up in eighteen-inch lengths.

SET AND CONTROL BOTH OI
AUTO R

By Hood

AN EXTREMELY compact six tube automobile superheterodyne incorporating diode detection and automatic volume control has made its appearance. The first r-f amplifier in the circuit is a '39 type screen grid tube, the combined oscillator and mixer is a '36, the intermediate amplifier is also a '39, the diode detector and automatic volume control tube is a '37, the first a-f amplifier again is a '39, and the output tube is a 41 tube.

The complete circuit diagram of the receiver is shown in Fig. 1. Let us examine it. The radio frequency amplifier follows the usual lines, but the transformers are of the capacity coupled type, a large primary winding for the low frequencies and a small open winding near the grid end of the tuned winding for the high frequencies. This type of coupler is used both in the antenna stage and the stage following.

We come to the first departure from the ordinary in the oscillator detector. The detector is of the biased type, the bias resistance R2 being 7,000 ohms. The grid winding of the oscillator is put in the cathode lead between the cathode and the bias resistor. The plate winding is not tuned as is usual in oscillator-detectors of this type, the tuning being done in a third winding coupled to the other two. Thus the tuned oscillator winding is not connected to anything but ground. The primary, or tickler winding, is connected in series with the primary of the first i-f transformer. The inductance of the tickler is so small that it offers no appreciable impedance to the intermediate frequency, and the tuning condenser in the i-f transformer is large enough to pass the radio frequency to the tickler.

The Intermediate Amplifier

The intermediate amplifier contains two tuned transformers and one 239 r-f pentode. The first i-f coupler is doubly tuned as usual but the second is tuned only in the primary. The reason for not tuning the secondary is obviously that it feeds the diode rectifier and that very little would be added to the selectivity by tuning.

The load resistance R4 on the diode is 500,000 ohms, but there is no filter condenser across it, nor any other intentional filtration, unless the open winding coupled to the second i-f transformer serves this purpose.

The grid of the i-f amplifier returns to the negative end of the load resistance through a 2 megohm resistor R6 and a 100,000 ohm resistor R5. The resistors together and condenser C7, of 0.05 mfd., prevent feedback to the i-f tube, but provide a high d-c voltage for automatic control. The junction of R5 and R6 goes to the grid return of the first tube, through a one megohm resistor R3. Another 0.05 mfd. condenser C1 completes the first tuned circuit by by-passing the automatic voltage control devices. The junction of R5 and R6 also goes to one end of a 0.5 megohm potentiometer R14, which is a manual volume control. This is mounted on the steering column.

Audio Amplifier

There are two stages in the audio amplifier, one a '39 tube coupled to the power tube by resistance and capacity. The input to the '39 is also coupled with resistance and capacity to the diode detector. R8, a 2 megohm resistor, serves as grid leak, C8, a 0.006 mfd. condenser, serves as stopping condenser, and R5 and R14 serve as "plate" resistor. It will be noted that the potentiometer R14 controls the input to the audio amplifier. The signal level in the r-f amplifier is controlled automatically.

In the plate circuit of the first audio tube we have a 100,000 ohm plate resistor, followed by a 0.02 mfd. stopping condenser, and finally a half megohm grid leak. The plate resistor is rather low for a tube of this type, but the gain is so great that it would not be practical to use a larger value, if distortion is to be prevented.

The grid bias resistor R9 is only 1,000 ohms, but it carries considerable current beside the screen and plate currents of the tube so the operating bias is much higher than would be the case if no additional current flowed through the resistor. The bias resistor for the power tube is R15 and has a value of 1,300 ohms. It is found over by the diode detector.

As a means of preventing excessive strength on the high frequencies, a 0.002 mfd. condenser is connected from the plate of the output tube to ground.

Floating Filament

The filament wiring is of the floating type. That is, neither side is connected to the chassis. Moreover, the wiring of the grid circuits is such that the bias on any tube does not depend on the heater connections. Hence the chassis may be connected to either the positive or the negative of the car battery and the circuit may be used on any type of car.

As the car is installed one side of the heater circuit is connected to the chassis, the side that is connected to the car chassis. The other side, which is marked "hot," connects through the fuse and the filament switch. B minus is connected to the chassis. Thus in some cases it is connected to A plus and in other cases to A minus.

The plate voltage on all the tubes, exclusive of the diode, is 180 volts. This is 45 volts higher than the voltage ordinarily used, but it insures high sensitivity and a good deal of output power.

Since there is a bleeder current it is necessary to put a switch in both the fila-

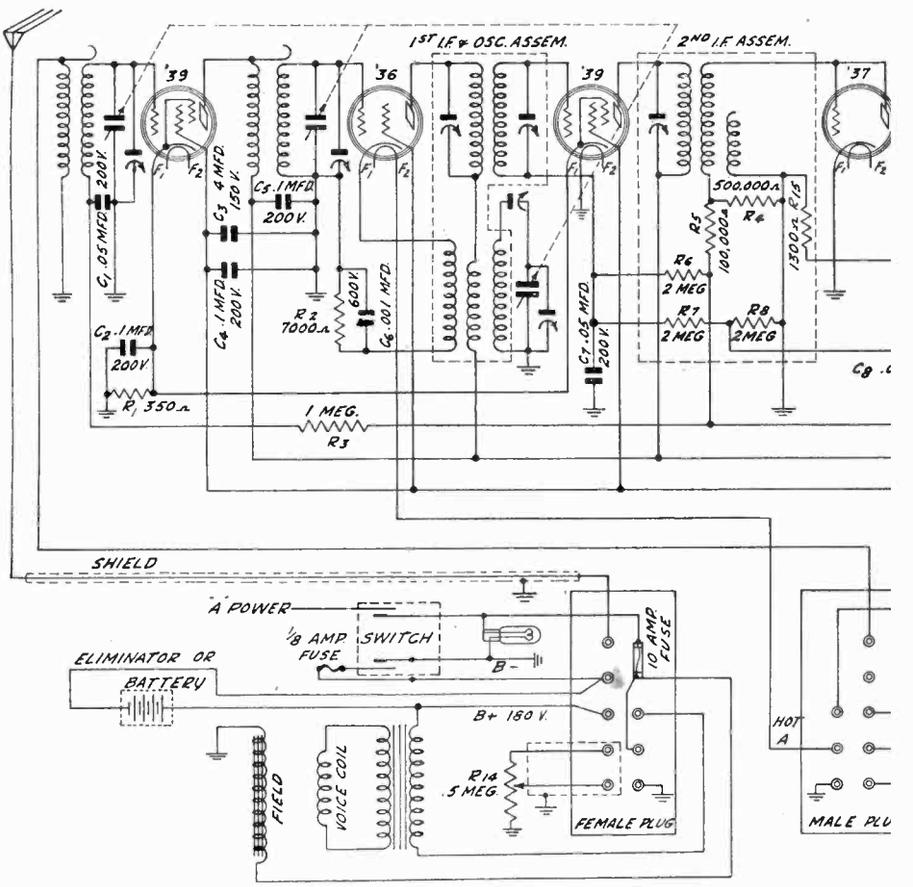
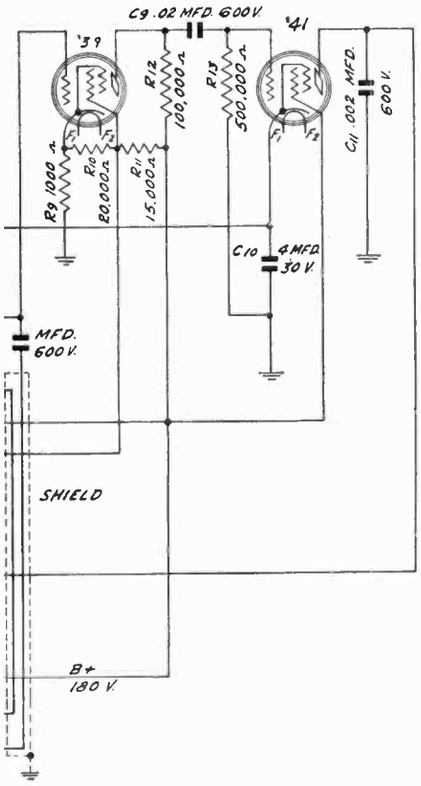


FIG. 1

The complete circuit diagram of the Wells-Gardner six tube automobile su diode detection and automatic volume control. Its sensitivity is r

I STEERING POST; ECEIVER ONLY 7.5 x 7.5 x 6.25

Astrakan



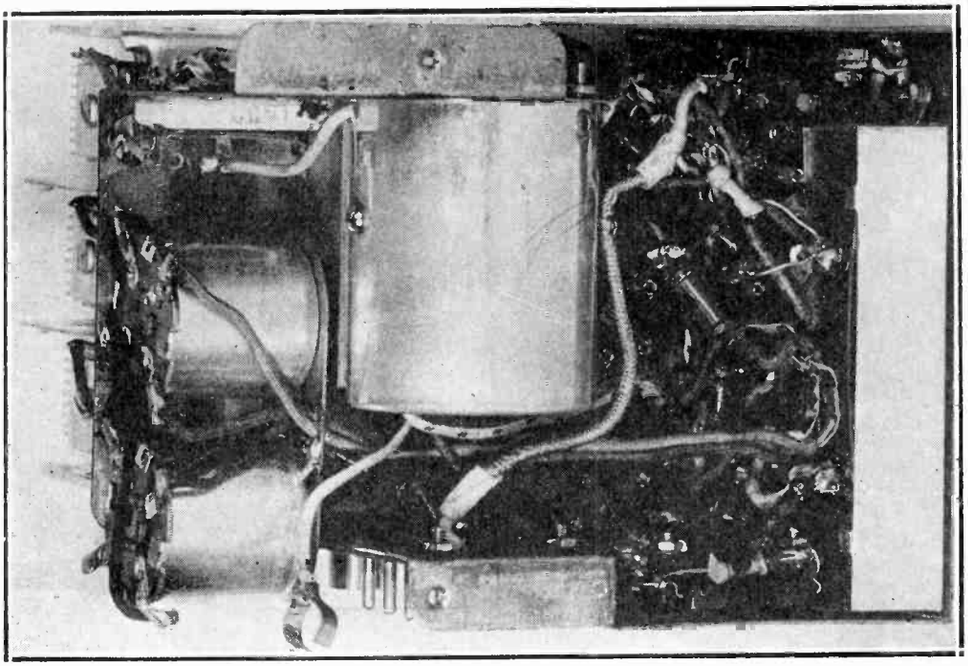


FIG. 2
Bottom view of the six tube superheterodyne showing the location of coils in respect to the tuning condensers as well as some of the wiring.

erheterodyne which is equipped with ed at 0.75 microvolts per meter.

ment and the plate circuit. The switch used is a two pole, single throw. It will be noticed that the filament switch is placed in the "hot" side next the battery and that the plate circuit switch is put in the B minus lead. Only two leads are necessary, one for the "hot" side of the filament battery and one for 180 volts. The other two leads are disposed of by making connections to the car chassis, or the set chassis.

As a source of B power either a battery or a high voltage generator can be used, as is indicated on the figure.

The extreme compactness of the set can well be realized from the dimensions of the receiver. It measures only 7.5 inches in length, 7.5 inches in height, and 6.25 inches from front to back. These are overall dimensions counting knobs and screws, with the exception of the front to back dimension which does not include the device for holding the control unit to the chassis and the variable condensers. This measures 0.75 inch. This small steel box contains all the tubes, coils, condensers, and resistors, together with necessary shields.

A highly sensitive dynamic speaker is used, and this is provided with a tone control by means of which the low notes may be accentuated when desired. The speaker is dust-proof and measures 7 x 7 x 4.75 inches. It mounts on the dash board and requires only two holes for mounting. The field current is 1.1 amperes and can easily handle the 600 milliwatts of output from the 41 power tube.

The total current drawn by the set from the car battery is 2.9 amperes, 1.8 amperes being required by the tubes. The plate battery voltage is 180 volts and at this voltage the total plate current, or drain on the B battery, is 33 milliamperes.

The net weight of the receiver with speaker and cables and control units is 19 pounds.

Tradiograms

By J. Murray Barron

Service That Pays Large Dividends

Notwithstanding the big competition in radio retailing and the fact that the public has in larger centers a wide choice of retail stores, we find in a great many cases, establishments that fail to appreciate the compliment paid them when Mr. and Mrs. Consumer select the place to make a purchase. Instead of trying to serve and build up good will some dealers appear to work in the opposite direction and often succeed in driving the customer from the place, never to return again.

An exception in mind, one very worthy of note, is that of a New York City establishment close to the main radio retail district. The proprietor did not enjoy the advantage of street store or ground floor windows, and yet through a desire to please and a full appreciation of the customer's rights and with a guarantee that meant something more than mere words, he not only made his place a live radio store, but actually succeeded in taking business from others in the district. No special effort was made to get this business, but their dealing and consideration attracted a few who in turn passed along the good news and in this way business came along. This case is true and known to many who do business in the radio retail sections of this city.

* * *

G. W. Stackman, sales manager of United American Bosch Corporation, Springfield, Mass., announces the appointment of the E. S. & E. Co., Inc., Albany, N. Y., as wholesale distributors in that district for the American Bosch radio line.

TIME CONSTANT AFFECTS DELAY OF

By J. E.

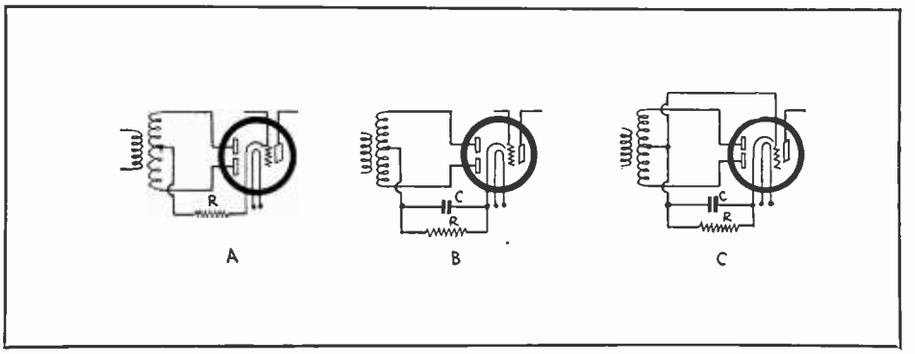


FIG. 1

Typical full-wave diode rectifiers in which the time constant of the load varies. In A the time constant is zero, for there is no condenser across the resistor. In B the time constant is RC. In C it is the same but the drop across R and C is impressed on a grid.

OFTEN reference is made to the time constant of a circuit and to its effect on the behavior of that circuit, or on a receiver of which the circuit forms a part. Since automatic volume controls have come widely into use the time constant has been brought into discussions more frequently. Just what is the time constant of a circuit, and what does it mean? Almost as often as the time constant is mentioned it is stated that it is the product of the resistance and the capacity of the circuit, assuming that the circuit consists mainly of capacity and resistance. The product of these two factors, if they are expressed in ohms and farads, respectively, is expressed in seconds. Hence the term time constant.

But knowing that the time constant is the product of the resistance and the capacity does not include knowing how it affects the behavior of circuits.

Time Constant of Simple Circuit

Suppose we have a circuit consisting of a resistor of value R and a condenser of value C, connected in series. Suppose further that we suddenly introduce a steady voltage E into that circuit. What happens? It can be shown by the aid of differential calculus of the simplest type that the current in the circuit flows according to the equation $\log (i/I) = -t/RC$ in which i is the current at any time t after the closing of the circuit and I is the current when t is zero, that is, at the instant of closing, and the logarithm is natural, or to the natural base 2.718. It is clear that at first there is a sudden surge of current and that the current dies down according to the exponential law. After an infinite time, which in practice may be less than a second, the current becomes zero. The condenser has then charged up to the full voltage E.

At what value of t is the logarithm of i/I minus unity? Clearly it is $t = RC$. That shows that RC is a time, but what else does it show? Well, since $\log (i/I = -1$, $\log (I/i) = 1$, by the property of logarithms, and since we are dealing with natural logarithms, the equation is equivalent to $I/i = 2.718$. Hence the time constant expresses that time in which the current dies down to 1/2.718 of its original value. Or, it expresses the time required for the voltage across the condenser to become 0.6325 of the voltage impressed on the circuit, for the voltage across the condenser is $V = E - Ri$, in which V is the voltage across the condenser and E, R, and i have the significance previously stated.

If the voltage across the condenser is what we are after, it is clear that the time constant has the effect of delaying the effect after the application of the voltage in the circuit. Hence it is said that time constant causes a time lag. Incidentally, it works both ways. When the applied voltage ceases suddenly, it takes some time for the voltage across the condenser to die down, and the rate of decay is the same as the rate of building up. Hence there is a lag in this direction also.

Phase Shift

In case the applied voltage is alternating and follows a sinusoidal law, we have a true time lag in the voltage across the condenser, but it is referred to as a change of phase, which means nothing but a change in time. That is, there is a difference in time between corresponding phases of the applied voltage and the voltage across the condenser.

In some cases the circuit requires that the time constant should be as large as possible and in others that it should be as small as possible. Take, for example, the time constant of the stopping condenser and the grid leak in a resistance coupled audio amplifier. The time constant should be as large as possible, or as large as practicable. This is not because we want a large time lag, for the time lag means nothing here, but because we don't want the low frequencies to be suppressed by the condenser. We don't want any voltage to build up across the condenser, even for the lowest frequencies, during the time allowed for charging between voltage peaks. We want all the voltage to build up across the grid leak, for it is that voltage only in which we are interested. A large condenser does not have time to charge up, or any condenser does not have time to charge up if RC is large enough.

Need of Low Time Constant

When the condenser is in shunt with the resistance we have the opposite case. For example, suppose there is a rather large condenser across the grid leak. or across the plate coupling resistor. Now the voltage across the shunt condenser is the same as that across the resistor, and we want the voltage across the condenser to build up. If the time constant is large there will be no time for it to charge up, and the voltage will always be low. The high frequencies will suffer first because the time of a cycle is shorter for them than for the low. Therefore when we put a large condenser across the grid leak, or plate resistor, or across the line anywhere, the high notes will disappear. If the condenser is large enough even the low notes will disappear. This fact is made use of in tone controls.

Suppose we have a condenser in shunt with a grid leak, which is also across the line. As we found, the time constant should be as small as possible. But it may be made small in one of two days, either by making the grid leak small or by making the condenser small. Which is the better way, if there is a difference? Well, if the grid leak is high and the condenser small, the voltage across either will be high. If the grid leak is low and the condenser large, the voltage will be low across them. Hence it is desirable to make the time constant small by making the condenser small and the resistance large. But if RC is the same in either case, there will be no difference in the quality, there will only be more of it in one case than in the other. If we cannot change the value of the capacity, which is often the case, then all we can do is to reduce the resistance in order to retain the quality, even if we have to sacrifice a little in volume.

Diode Rectifier Time Constant

In every detector there is a by-pass condenser which is used to eliminate the carrier frequency from the audio component. From the point of view of elimination of the radio component RC should be as large as possible, but from the point of view of the audio component it should be as small as possible. Therefore it is necessary to compromise by selecting a condenser that will make the time constant as small as practical with respect to the highest audio frequencies and as large as practical with respect to the lowest radio frequencies. There is no trouble at all to effect a compromise unless the carrier frequency is low, as it might be in some superheterodynes.

In the diode rectifier we have exactly the same problem, when it is used for detection. In Fig. 1A we have a typical diode in full wave connection. R is the load resistor. Through this there is a pulsating current having a frequency twice the carrier. Strictly, it has no d-c in it, although it may be said to have a d-c component. We do not want the pulsations but we do want a steady direct current through the resistor. If we put a condenser C across the resistor, as in B, the pulsation will mostly go through the condenser, leaving d-c in the resistor. However, no matter how large the condenser may be, there will always be some pulsating current in it. The proportion of pulsating and direct current in the resistor will depend on the time constant. If it is large, the a-c through the resistor will be small and the d-c will be more nearly pure. If the time constant is small, there will be little separation.

Large Resistance Used

In rectifiers of this kind, especially if the input is tuned, the resistance should be as large as practicable in order to put

PERFORMANCE; ACTION IN A-V-C EXPLAINED

Anderson

as low a load as possible on the tuned circuit. It should also be large because when it is, a larger proportion of the input appears across the resistor as a steady voltage. Hence if we are to make the time constant small we must do it by making the condenser small. For the 55 tube it has been recommended that the value of R be 0.5 megohm and that the condenser be 150 mmfd., or that the time constant be 75 microseconds. This is so small that it certainly would have no bad effect on the audio signal, but it may not be large enough to take out the pulsations at broadcast frequencies adequately.

The smoothing out action takes place as follows: When a pulse of current comes along part of it goes through the resistor and part of it into the condenser. As the current pulse recedes to zero the condenser discharges through the resistor, for there is no other way for the charge to go. Briefly we might say that the peaks of the pulses go into the condenser, only to be discharged to fill up the troughs. For perfect filtration the steady current through the resistor is equal to the mean value of the pulses, which is 0.636 of the maximum. A d-c milliammeter would measure the mean value even if there were no filtration because the meter would act as a filter due to the inertia of the armature and the needle.

Modulated Signal

For a steady r-f voltage applied in the rectifier, a steady current, assuming good filtration, will flow through the resistance, and there will also be a steady voltage across the resistor. But when the carrier is modulated the signal voltage is not steady and therefore the voltage across the resistor is not steady either. It will rise and fall with the modulation. It is this variation that constitutes the audio signal, and this variation is impressed on the first audio amplifier, as shown in Fig. 1 C.

Now if the time constant RC of the filter circuit is too large the slow variations representing the audio signal will also be eliminated. Therefore if RC is too large the signal impressed on the amplifier will be low, and it will be lower for the higher audio frequencies than for the lower. Since we are limited for resonance reasons to the use of a high resistance, we have to keep the time constant low by keeping the condenser small.

If we do use a small condenser and a low time constant, there will be a strong carrier component in the input to the amplifier, and this of course, will be amplified together with the audio signal. It may be taken out by connecting a by-pass condenser from the plate of the amplifier to ground. But this adds to the suppression of the high audio notes just as much as it would if it were added to the filter condenser C, assuming that the r-f suppression was the same. Hence we might just as well make the condenser large enough.

Automatic Volume Control

If the rectifier is to be used for automatic volume control the filter must be considerably higher than when it is used for detection, because we must not feed back any carrier to the controlled tubes. Now if we have one rectifier for the detector and another for the volume control this filtering problem is simple for we can use almost any capacity across the resistor for the automatic volume control. But if we are to use the same rectifier for both functions, we have to employ a more complex filter. In the first place we must put a high resistance, say half megohm, from the negative end of the load resistance R to the grid returns. The object of this resistor is to prevent short-circuiting of the input to the a-f amplifier and also to aid in the filtering of the automatic volume control voltage.

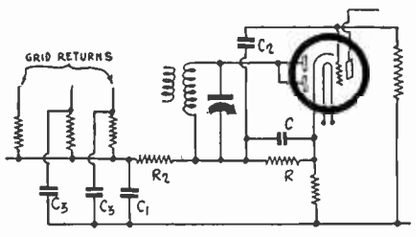


FIG. 2

This shows how diode rectification and automatic volume control can be combined. The tube is a 55 and therefore amplification is also possible.

At the grid return end of this second resistor we are at liberty to put in a much larger condenser to ground. We show the automatic volume control circuit in Fig. 2. Here R is the load resistor on the rectifier and C is the filter condenser across it. R2 is the resistor which prevents shorting of the input to the audio amplifier and condensers C1 and C3 are additional filter condensers to prevent feedback. These added condensers and resistors do not change appreciably the time constant of the rectifier circuit because to d-c current flows in the direction of the grids, and extremely little a-c, at least not from the rectifier to the r-f amplifiers.

Audio Feedback

Since there is considerable audio voltage between ground and the junction of R and R2, there will be some audio current through R2 and C1, and even through the remaining filter resistors and condensers such as C3. This would cause audio feedback and would have the effect of changing the modulation, because the voltage on the r-f grids would vary at audio frequency. No doubt it would result in distortion, too.

But since R2 is large in value and C1 is also large, most of the drop will occur in R2 and very little in C1. We have here exactly the same situation as a grid leak and stopping condenser. but in a reverse sense. However, both the order of appearance of the resistance and the condenser and the desired function are reversed so we must have a large time constant for R2 and C1. The larger it is the less will be the audio feedback because only the drop across C1 is effective. The d-c value of the feedback voltage is not affected since no d-c flows.

A. V. C. Time Constant

The time constant is mentioned most frequently in connection with automatic volume control. It must be large, yet not too large. If it is small, the modulation will be affected, as was just stated, and if it is large, the circuit will not respond quickly to volume changes. For example, if it takes five seconds for condenser C1 to charge up through resistance R2, an increase in signal intensity will make the output increase, and it will take about five seconds for the automatic volume control to take effect and bring the output down. The same thing will happen in reverse direction. That is, if the signal suddenly decreases the output will decrease and will take about five seconds for the receiver to come to the required sensitivity.

Let us assume that a time constant of one half second is all right as a compromise between the requirements for good automatic volume control and good audio filtration. In determining the time constant of the A. V. C. C1 and R2 alone do not fix the value. The resistance of the diode, the bias resistor, and even the other resistors and condensers have an effect. However, for practical purposes we can assume that C1 and R2 alone are effective, because the other elements tend to cancel each other's effects. Since we have selected a value of 0.5 megohm for R2, what should be the value of C2 to make the time constant 0.5 second? Clearly, one microfarad. But this is much larger than is necessary to prevent audio feedback. We might say that we do not need a time constant greater than 0.05 second to prevent audio feedback. This would require that the value of C1 be 0.1 mfd.

Literature Wanted

Readers desiring radio literature from manufacturers and jobbers concerning standard parts and accessories, new products and new circuits, should send a request for publication of their name and address. Send request to Literature Editor, RADIO WORLD, *145 West 45th Street, New York, N. Y.*

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J. Henry Kopp, 1788 Chicago Ave., Riverside, Calif.
B. C. Freeman, 213 So. High St., Steubenville, Ohio.
G. H. Schmit (sound equipment), 2905 No. 52nd St., Milwaukee, Wisc.
R. L. Kreiss, 741 Central Ave., Alameda, Calif.
J. H. Van Nice, RADIO SERVICE, 40 Main St., Waukon, Iowa.
Gordon J. Hallman, 8 Mill St., Danville, Penna.
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RADIO WORLD, 145 WEST 45th STREET, NEW YORK, N. Y.

Diagram for Boy of 13

I AM A BOY, THIRTEEN, and I want to build a crystal set for use with earphones. If I tune in one or two local stations I shall be satisfied. Please show a circuit.—P. A. W., Glenns Falls, N. Y.

The simplest crystal set is diagrammed in Fig. 1018. A coil is connected between aerial and ground. The aerial should be long, 100 feet or so, and as high as practical, for such a receiver is not sensitive. The ground connection may be to a wire running to a cold water pipe. Never use a gas pipe as ground. In a pinch a radiator in a steam- or hot-water heated house will do. A tuning condenser is placed across the coil. This is a parallel connection, or shunt. Put the frame of the condenser, equivalent to the moving plate connections, to ground, the other or stator connection to aerial. The crystal detector is placed between the stator of the tuning condenser and one side of the phones. Across the phones is a condenser that detours the radio frequencies, and thus prevents loss in the resistance of the phones. The other side of the phones goes to ground. C1 may be 0.00035 mfd. or 0.0005 mfd. capacity, and the coil may consist of 50 turns of any kind of insulated wire on a 3 inch diameter tubing, which may be an oatmeal carton mother will supply. The bypass condenser may be 0.00025 mfd. to 0.001 mfd. Selectivity is very low on such a receiver.

* * *

Nothing But Electricity

IS THERE ANYTHING that is nothing but pure electricity and if so what is it? Has it been measured?—K. U., Spokane, Wash.

Yes. An electron is considered as pure electricity. It has been measured and also the speed of the drift through certain conductors, particularly copper.

* * *

Inductance Curves

IN MAKING CALCULATIONS it is easy enough to determine the required inductance for combination with a specified capacity, but determination of the number of turns for different diameters is a time-eater, because of the necessity of trial and error (the error is necessary as a preliminary). Can not the turns per inch on various diameters be reduced to a curve, the other variant being the inductance? This is a great deal of work, but once done is done, and the whole electrical field will be benefited.—S.E.B., Venice, Calif.

The work that you suggest would be an important contribution, no doubt, and we are informed exactly that has been done, and that the book of curves, with some explanatory matter about inductance, and tables of inductances for specified capacities, will be published in the fall. For further information write to the Technical Editor.

* * *

Oscillation's Effect

WHAT IS THE EFFECT of oscillation on a tuned amplifier circuit? Does the oscillation increase the amplitude? It should, because of the close relationship between oscillation and regeneration. What is the cause of either or both? Is it worth while to introduce detector regeneration in a simple five-tube t-r-f set that suffers from some adjacent channel interference?—R. C. B., Camden, N. J.

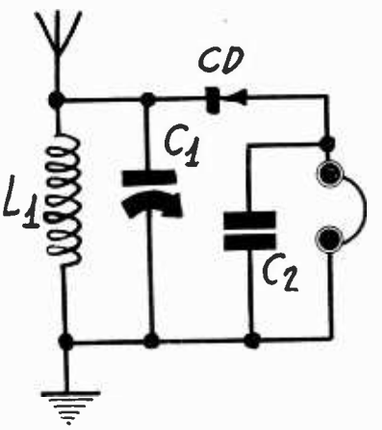

FIG. 1018
Diagram of the simplest crystal set.

The oscillation that you refer to is injurious. The usual effect is to reduce the carrier amplitude, rather than to amplify it. The amplifier tube saturates and turns detector. Besides, distortion runs high. The cause of oscillation is the feedback of properly phased voltages from output to input. Oscillation is the condition whereby a tube generates waves. Regeneration is a similar condition in that feedback is present, but dissimilar in that there is no generation of waves, since the common meaning of regeneration applies only to feedback that is less than enough to start oscillations. The most sensitive point to work the tube is just below oscillation. Of course lesser degrees of feedback may be used and these too would be regeneration. It is not worth-while to introduce regeneration in the set. The tuning may become critical, the entire receiver made unstable at radio frequencies, and the interference you seek to get rid of may not disappear, as it may be caused by a low order of selectivity ahead of the detector, and if the detector is regenerated the regeneration may be more effective on the weak interference than on the signal itself, due to the effectiveness of regeneration being equal to the two-thirds power of the grid space.

* * *

Two or Three Tubes?

YOU HAVE PUBLISHED something about a new tube that is to come out in the fall, the 55, and you call it the duplex-diode triode. While I appreciate that everything is contained within one small bulb. will you kindly tell me whether this is three tubes in one or two tubes in one? I am not quite clear about it, though I'm not blaming you.—F. S. C., Mauch Chunk, Pa.

The name duplex-diode triode is official, and it is as good as another to identify the tube verbally. The name would indicate that the tube consists of two diodes and a triode. Therefore the 55 may be used as three different tubes, e.g., as single-wave diode detector, as single-wave diode automatic volume control, and as triode amplifier. The triode part is something like the '27 in performance. However, full-wave detection may be used, because of the two equal anodes or plates of the duplex diode. In that case the 55, if its definition is governed by its use, is two tubes in one, since the diode becomes one full-wave rectifier. The cathode is common to the two diode sections and the triode. Each section is independent of the others in all other respects, and separate feed to each diode part is required, e.g., a pickup winding on the detector input coil for feeding the extra-purpose diode, as for automatic volume control.

* * *

Filament Feedback Control

IN A BATTERY-OPERATED SET I desire to control regeneration by rheostat manipulation. Is this all right? If tubes are operated at less than their rated filament voltage they seem to perform just as well. For instance, a tube will oscillate, and if it will oscillate that's a pretty good test for its general performance, isn't it?—K. R., Fort Wayne, Ind.

Rheostat control of regeneration is not recommended. It is too critical. Also it is better to operate tubes at their rated voltages, for they work best at the resultant temperature. This applies to the rest of your question as well. What you say is true, in general, about oscillation being a good test, but battery tubes, with filaments undervoltaged, will oscillate properly only when in a state of newness, and after the emission declines a little with use, oscillation stops. The rated voltages are such as to maintain oscillation over the normal life of the tube, which may be an oscillation life 100 times that of an undervoltaged tube. It so happens, also, that filament type tubes generally last longer when worked at their rated filament voltages, for at the rated values the coefficient of disintegration usually is lower.

* * *

Wants to Stop Oscillation

IN A FIVE-TUBE A-C RECEIVER, midget style, if there is oscillation at the high frequencies, what is the best method of eliminating it, as a service problem? Will the remedy reduce the low radio frequency stations to too low volume?—J. F. W., Cleveland, O.

The common practice, where vari-mu tubes are in the r-f channel, is to increase the value of the limiting resistor that is located between the volume control and the cathode. It is assumed that volume is controlled by changing the bias voltage on the two r-f tubes. The value of the limiting resistor may be 800 ohms in such a case, and often is, but if oscillation still persists the value will have to be increased until there is no oscillation. You mention servicing a set, and the advice given is consistent with ease of doing the job. Another consideration is reduction of the plate voltage. If 800 ohms as bias limiting resistor is not enough it is generally advisable to use a lower plate voltage, as the variable mu tubes detect a little when highly biased negatively, and as the volume control resistance is additional there will be a sacrifice of low notes and a general impairment of tone if the bias has to be raised too much. The new tubes, of the triple grid type, do not suffer this tonal sacrifice at heightened bias, as the extra grid (called suppressor), if tied to cathode, as recommended eliminates the secondary emission that in the other tubes limits the plate current swing and causes the objectionable detection. Large enough primaries will safeguard low frequency stations' volume.

North Pole, South Pole?

IN A MAGNETIC COMPASS, will you please state whether the needle points to the north pole or to the south pole, and why?—A. K., Hot Springs, Ark.

The needle points to the north pole. Perhaps you intended to ask a different question, e. g.: Is the pointer the north pole or the south pole of the needle? The answer is, that the pointer is the needle's north pole. The tail of the arrow is the south needle pole. The north pole of the needle points to the south magnetic pole of the earth, which is the geographic north. The basic law of magnetism is that like poles repel and unlike poles attract.

* * *

One-Tube Speaker Set

CAN A SINGLE-TUBE speaker set be developed and if so how can it be done?—G. W., Richmond, Va.

There have been several experimental models of such sets, but in general the results can not be classified as speaker operation. One has to be close to a broadcasting station and usually have ear close to speaker. However, perhaps a nominal achievement along this line is possible with the 55 tube, using single-wave diode detection, the other diode plate unused, and the triode serving as the amplifier. This would look like a one-tube set but perhaps it is fairer to remember it is a two-tube set, despite the single glass envelope. In trade parlance, of course, it still would be a one-tube speaker set. And to the eye it would be none other than that, too.

* * *

Coils for Broadcast Set

GIVE ME, if you will, the directions for winding a highly acceptable radio frequency coil for a small set using two r-f stages, screen grid tubes for r-f amplifiers and two stages of audio. — H. G., Dubuque, Ia.

Use 1 inch diameter tubing. Wind 127 turns of No. 3 enamel wire as closely as possible. This is the secondary, for tuning with 0.00035 mfd. condenser, and would have an inductance of 245 microhenries. If 0.0005 mfd. is to be the capacity, put on 91 turns (165 microhenries). Put two or three layers of insulation between primary and secondary—wrapping paper if you have nothing better—and wind primaries of 25 turns of any kind of insulated wire, near the bottom of the secondary. These directions imply shielding, with shields no smaller than 2 inch diameter, and half an inch away from the coil top and bottom. Use aluminum or copper for shielding, not tin.

* * *

Class B Bias

REGARDING the Class B amplifier, please state what it is, whether self-bias may be used as in ordinary push-pull circuits, and tell why the input transformer has to be special.—T. E., Tulsa, Okla.

The Class B amplifier is a type operated at approximately no plate current drain at no signal, the signal values changing the plate current abruptly, so that the output tubes operate on their positive characteristic, and draw grid current. The reference is to the '46 tubes with grids tied together, the present standard Class B amplifier for receivers. The purpose of the Class B amplifier is to handle very large values of volume with no more distortion than small values. If the impedances and voltages are correct the result is a push-pull effect. Self-bias may not be used, because of the intense voltage surges that would have to be filtered out, requiring a considerable filter, practically a prohibitive one. Thus the 46 tubes operated as Class B are designed to require no negative bias. The input transformer has to be special, and of a step-down type, with low leakage reactance, because of the grid current in the output tubes. The d-c resistance of the secondary must be low, otherwise the d-c voltage drop in th grid load would be high. Incidentally, the necessity for a driver, the extra tube to feed the Class B output, arises from the requirement of overcoming the power loss in the output tubes' grid circuits even with the special transformer.

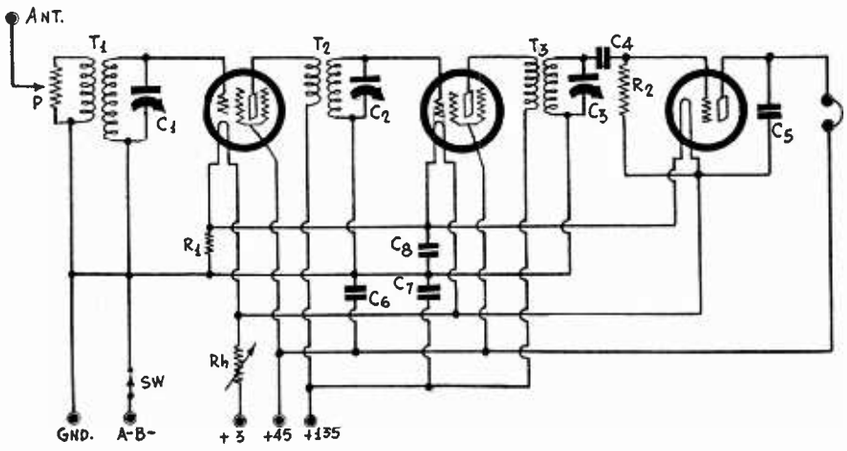

FIG. 1019
A battery-operated tuner that gives excellent results.

* * *

A Battery Type Tuner

CAN A GOOD battery-operated set be built for earphone use? Please suggest a circuit. A volume control is essential, as I may want to hook up the tuner to an amplifier later.—H. B. D., Salt Lake City, Utah.

You bet it can. See Fig. 1019. Two stages of screen grid amplification are used ('32 tubes), with a general purpose tube as detector ('30). The voltages are specified on the diagram. P is 10,000 ohms up, and is a potentiometer. C1, C2 and C3 are a three-gang condenser. See answer to H. G., Dubuque, La., for data on coil winding. C6, C7, C8 may be from 0.1 mfd. up. If one fixed condenser is larger than the others it should be used for C7. C4 is 0.00025 mfd. and C5 may have the same value or larger up to 0.001 mfd. R1 may be 4 ohms, and Rh a rheostat of 6 ohms or so, not on the front panel, but used for setting the resistance so that the voltage across the filaments themselves is exactly 2 volts. This filament voltage should be checked up from time to time and a rheostat adjustment made, if necessary.

* * *

The 58 Tube in Practice

REGARDING THE NEW variable mu tubes, the 58's, please let me know what would be a good value of starting bias, where the volume is controlled by a rheostat that alters the grid bias. Also, will these tubes amplify more than their predecessors, the '35's which I now have in the set? Are any changes to be made?—L. H., Butte, Mont.

A good value of minimum bias to use in the circumstances is 7 volts negative, for an applied plate voltage of 200 volts. Then as you introduce resistance from the volume control you will add to that bias and it will increase to 20 volts or more, provided that the rheostat has 20,000 ohms or so for one tube, 10,000 ohms or so for two tubes, etc. These tubes amplify more than the '35's, and the 57 you should use as detector is far ahead of the 724 in this respect, so it may be necessary either to increase the starting bias beyond 7 volts, as is being done in some commercial sets, or you may remove a few turns from the primary of the coupler between first r-f tube and second r-f tube (assuming a t-r-f set). You should increase the screen voltage to around 100 volts, which is probably greater than the present screen voltage, using the '35 tubes, and of course use 6-spring sockets. Shield the 58 and 57 tubes with the special tube shields made for them. These tube shields have a removable cap that when in place reduces electrode capacity. In case you are unfamiliar with the socket connections, they are as follows, assuming you are looking at the bottom of the socket, with heater springs toward you: to left from left-hand heater is the plate, next to the plate is the screen grid, next to the screen grid is the suppressor grid, next to the suppressor grid is the cathode, and next to the cathode is the other heater connection. The present general use is to tie the suppressor grid and cathode together. The directions are given for a bottom view of the socket because you would most probably wire the socket from the bottom, top-connection sockets not being much in use these days. The increased amplification has been alluded to and its general effect is to produce about 75 per cent. total volume of sound, with '45 output tube, compared to the volume of sound with '35, '24 and '47 tubes. The '45 has a mu of 3.5 while the '47 has a mu of around 90.

* * *

Dial Light Goes Out

THE DIAL on my set is of the ghost or travelling light type. When I tune to KDKA the dial light goes out for a moment, and then when I continue turn-the dial, in either direction, the light reappears. What is the cause and remedy?—U. S. F., Walla Walla, Wash.

The reason is that one of the leads to the dial lamp is not soldered to the lug of the lamp socket. Tension causes the contact to exist, hence the lamp to light, when the hole in the lug is not in line with the feed wire. When the two are in line the wire pushes up and probably its insulation prevents contact at that time. So solder the connection.

Tube List Prices

Type	List Price	Type	List Price	Type	List Price
11	$3.00	'31	1.60	56	1.25
12	3.00	'32	2.30	57	1.60
112-A	1.50	'33	2.75	58	1.60
220	3.00	'34	2.75	'80	1.00
'71-A	.90	'35	1.60	'81	5.00
UV-'99	2.75	'36	2.75	82	1.25
UX-'99	2.50	'37	1.75	'74	4.75
'200-A	4.00	'38	2.75	'76	6.50
'01-A	.75	'39	2.75	'86	6.50
'10	7.00	'40	3.00	'41	10.00
'22	3.00	'45	1.10	'68	7.50
'24-A	1.60	46	1.50	'64	2.00
'26	.80	47	1.55	'52	28.00
'27	1.00	'50	6.00	'65	15.00
'30	1.60			'66	7.50

A THOUGHT FOR THE WEEK

TO MANY FOLKS, the most interesting phase of the Sharkey-Schmeling championship fight—or was it merely a little argument between a couple of pals?—was not which man outpointed the other, but why a certain popular announcer seemed to be a trifle hazy and hesitant as he told the story of the contest.

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Eleventh Year

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

British Phone Chain to Aid Small Ships

Washington.

The Department of Commerce issued the following information:

A chain of small wireless stations for the use of yachts, fishing vessels and other light craft, is to be thrown around the coasts of Great Britain and Ireland, if plans of the British Post Office materialize, according to a report from the Commerce Department's London office.

Within the past two weeks more than 45 of these small installations have been placed into operation for various owners, it is stated. A British company is offering two types of small telephone installations, one of 300 watts power and one of 60 watts. Messages sent by telephone to the coast stations will be transmitted as telegrams to their destination on land.

While the plan is still in a stage of development, orders have been placed by the General Post Office for the installation of wireless telephone equipment in stations about the coast of Britain. The wireless stations at Wick, Fishguard and Humber have had telephone equipment for some time, but the present temporary scheme will provide for a chain around both Britain and Ireland. If the idea proves a success it will be made permanent.

New stations to be equipped will be Cullercoats, North Foreland, Niton, Land's End, Seaforth, Port Patrick, Malin Head, and Valentia.

It is stated that there has already been great activity at the fishing ports of Hulfax and Grimsby in having wireless equipment in trawlers.

THE 55 IN T-R-F SETS

WHAT ARE your recommendations in regard to the prospective use of the 55 duplex-diode triode tube in a tuned radio frequency receiver? I have had some experience with diodes as detectors, and the sensitivity is low.—H. G. D., Milwaukee, Wisc.

The 55, which is not on the market yet, will be primarily for superheterodyne receivers, and not for tuned radio frequency sets, because of its low sensitivity and because the t-r-f system itself usually does not provide any excess amplification that can be devoted to automatic volume control. Such a control always results in reduced sensitivity. In hooking up the diode detector, any type, whether in the 55 tube or otherwise, do not follow the conventional system as applied to triodes, for then there would be virtually no d-c resistance in the external or load circuit of the diode, and a high one is neces-

"New Champion" Jolt to Fight Hearers

Instead of Graham McNamee describing each round, as has been the previous custom in fight broadcasts, McNamee shared opportunities for honors with Charles Francis Coe, author, fight expert and himself a former Navy pugilist, in describing the Sharkey-Schmeling fight over the National Broadcasting Company's chain. The Lucky Strike manufacturers bought the privilege of sponsoring the broadcast, using some extra time prior to its own 10.30 p.m. start, and giving the audience, as an announcer said, "a ringside seat" at the fight.

As there were few frills and thrills in the actual contest the two fight announcers did not have very much material to work on. McNamee took the first three rounds (not as a participant, you know), Coe the next three, and then they alternated round after round until the end. The fight terminated with listeners eager to hear the result, as officially determined, and then Joe Humphries, the arena announcer, was heard to say:

"The winnah—and new champion—"

Enough for the Men

The rest was drowned in the combined boos, jeers, cheers and shouts of the spectators at the Madison Square Garden Arena, in Long Island City, just across the East River from Broadway. Women folk listening in, not so familiar with fight affairs, may have been baffled at so much commotion without the actual audibility of the winner's identity, but "new champion" meant everything to the fight fans at ringside or fireside. (Of course there were no fires for home heating that day in late June.)

Both McNamee and Coe did their very best to be absolutely fair in reporting the fight. This came as an agreeable fact to those who had heard McNamee broadcast the fight two years ago between the same contenders, that ended in a victory for Schmeling on Sharkey's foul in the fourth round. Since then the New York State Boxing Commission amended the foul rule, so that a foul can not determine the outcome of a fight.

Difference of Opinion

Following the passage of the heavyweight championship title to Schmeling two years ago a protest against claims of foul was made by fight fans and hence the amendment. This time there were protests, but of a different nature, because many of those present deemed Schmeling the victor. For instance, of 22 sporting writers canvassed at the ringside, 1 called it a draw, 7 said Sharkey won and 14 believed Schmeling the victor.

There was hardly any comment from McNamee and Coe as to how the tide of the fight was going, although toward the end Schmeling was described as getting warmed up and starting things. Sharkey's injured eye, closed from the tenth round on, was the subject of much comment by the announcers, as was the activity of the fighters in "trading lefts."

Twenty-six listeners were canvassed. It was found that, basing their judgment on what the announcers described of the actual fighting, some expected the decision would be a draw, most expected that Schmeling would be declared victor, but none thought that the heavyweight championship title would go to Sharkey.

Coe made a high mark for the speed, accuracy and enlightenment in his description of what was going on in the ring. It was his first big fight broadcast, although he has been associated with fighters for years, and toured the country with Jack Dempsey. During one round he mentioned that Schmeling looks like Dempsey, "and I know my friend Jack is listening in at Reno tonight."

Between the fourteenth and fifteenth rounds Coe discussed with McNamee the procedure for getting the fighters before the microphone at the end of the fight. Coe was to carry the mike into the ring. When the fifteenth round was over Coe kept urging McNamee to get the fighters to the mike, but McNamee reminded him the decision had not yet been announced.

After the decision the announcers succeeded in getting both fighters to say something, but the crowd's noise was so great it was almost impossible to tell when Sharkey was talking, or that he was talking, and impossible to determine what he said, whereas Schmeling in broken English that competed with hisses and cheers directed at the decision, said, "Charkey a very good fighter" and a few more words to that effect, not intelligible.

Robbed, Says Jacobs

Then Jim Buckley, Sharkey's manager, said a few words of elation, and Joe Jacobs, Schmeling's manager, was called to the mike. He said:

"I'm not a bad sport, but I want to say that Schmeling did not lose his title in this ring tonight. He was robbed of it."

The decision was two-to-one, the two judges disagreeing and the referee, Gunboat Smith, casting his vote for Sharkey. Jacobs had protested against Smith, saying that unless Sharkey were knocked out there was no chance of Smith ruling in the German's favor.

There were 68 stations tied in, the largest number in any fight broadcast, millions of persons listening in. Besides, there was a short-wave transmision for the benefit of Germany. In the short-wave event some celebrities spoke. Mayor Walker said that he was surprised that the decision and championship had been given to a man for walking away from his opponent. Gene Tunney privately made the same comment, and Schmeling publicly stated the same situation, adding that he was certain he had won, was surprised that the decision went against him, and asked what a man has to do to get a decision. However, he was stoical about it, ready to bury his grievances in the hope of an early return bout, which Sharkey said he was willing to give him. Jacobs was more perturbed than his charge.

ANSWERS TO CORRESPONDENTS

LOIS MEILUN, Berkeley, Cal.—Shall run John S. Young's biography in a future issue. If you write to "The New Yorker" may get the name you request; I have no authority to divulge it.

P. Wildman, Brooklyn, N. Y. — Jessica Dragonette will resume her radio activities in the Fall. Thanks for your kind words about the page. Probably will publish the poems in book form in a few months.

—Alice Remsen.

Station Changes

Changes in the "List of Broadcasting Stations by Frequencies," published in our issue of June 4th, 1932:

660 kc—Delete WTIC.

680 kc—KPO—Change owner to Nat'l B'dg. Co., Inc.

760 kc—Delete WBAL.

890 kc—Delete KSEI (See 900 kc below.)

900 kc—Insert KSEI, Radio Service Corp., Pocatello, Idaho—250 w.

1260 kc—WLBW. Change owner to Broadcasters of Pennsylvania, Inc.

1270 kc—KGCA. Change power to 100 W.

1200 kc—WMBX. Change owner to WMBX B'dg. Corp.

1440 kc—WBIG. Change power to 1 KW—daytime.

1460 kc—WJSV. Change owner to Old Dominion Broadcasting Co.

Change in "Time Table of Television Transmitters," published in our issue of May 28th, 1932:

2000-2100 kc—Add W9XK, 100 W, State University of Iowa, Iowa City, Ia.

STATION SPARKS

By Alice Remsen

Pan

FOR RUSS COLUMBO, WEAF

Sundays, 11:15 p. m., Mondays and Tuesdays, 11:00 p. m., Wednesdays, 11:15 p. m.; Thursdays, Fridays and Saturdays, 11:00 p. m.

Listen to Pan! He is piping again!
Piping a dance for the sprites in the rain!
Piping a melody, haunting and clear;
A melody just for a few folk to hear.

Pan is a brown man with ears small and pointed;
Long-limbed and tall, finely made, slender-jointed.
Pan is a sly one who laughs at convention,
Never a mortal can guess his intention.

Pan is elusive and cannot be captured.
His pipes leave the folk of the forest enraptured,
Throwing them into the wildest confusion,
Caught in a network of dreamy illusion.

Down through the forest his hoofs are rebounding.
Down through the ages his pipes are resounding.
Faintly an echo of silver tones blending
Into a message of song, never ending.

Listen to Pan! He is piping again!
Piping a dance for the sprites in the rain!
Piping a melody, haunting and clear;
A melody just for a few folk to hear.

—A. R.

* * *

AND RUSS COLUMBO is Pan brought up to date with his haunting voice and clever dance orchestra. Run up to Woodmansten Inn and see him, or, failing that, tune in on WEAF. He holds more appeal than ever for romantically inclined young folk.

* * *

News of the Studios

WABC

The Dupont program, "Today and Yesterday," has faded off the air for the summer, but is scheduled to return this Fall. Mabel Jackson, soprano on the program, will vacation at her home in Dayton, O., for a while and then play a few weeks as guest artist on WLW, Cincinnati, before returning to New York.

* * *

Gerardine has returned to the air with another Broadway columnist in the role of commentator. Sidney Skolsky, Broadway chronicler, is presenting his Broadway Tintypes, familiar to the readers of a daily tabloid. This is Skolsky's first regular radio assignment. He was preceded on this program by two other well-known columnists—Walter Winchell and more recently, Ed Sullivan. Jack Berger's orchestra and guest artists provide the entertainment. WABC and Columbia network, Thursday, 8:30 p. m. EDST.

* * *

Columbia has signed the two-piano team of Peggy Keenan and Sandra Phillips, the titian-haired young women who recently made a successful broadcast from a Curtiss Condor plane while flying high over New York. The girls may be heard over WABC and a Coast-to-Coast network each Tuesday at 7:15 p. m. and each Friday at 5:45 p. m. EDST.

* * *

NBC

Eileen Piggot, NBC soprano and the "Ma Smithers" of the "Memory Lane" broadcast, emanating from the San Francisco NBC studios of KGO, is very pleased with herself, for she has just broken a world record for continuous performance on the same radio program. Since April, 1927, she has never missed a performance in over five years, passing Virginia Rae's record by a wide margin. Virginia, it will be remembered, was the Olive Palmer featured for so long on the late-lamented Palm Olive hour. Incidentally, Miss Piggot has sung "Beulah Land" more than five thousand times in "Memory Lane."

* * *

Frank Parker, the handsome young tenor heard each week over the WEAF-NBC network on the A. & P. Gypsies and the Cities Service programs, looks with a decidedly unfavorable eye upon personal appearances. Frank has received many flattering offers from the theatrical moguls to make personal appearances on the stage of local picture and vaudeville theatres, and has refused them all. Personally, I think he'd be a drawing card. He has a good appearance, fine stage presence and an excellent voice, besides having a fan following.

* * *

WOR

WOR is radically curtailing its expenditures for sustaining programs during the summer. It is understood that one of its finest features, "Moonbeams," will be cut out entirely in order to make room for the Jack Denny broadcasts; and another popular feature, "Footlight Echoes," will be sliced to the bone, minus its soubrette and male chorus, leaving only Maria Cardinale, soprano, and Jack Arthur, staff baritone, to bear the burden of an hour's broadcast. Of course, there will be the usual non-paid guest artists, for which we can hardly blame the station; and George Shackley's excellent orchestra will still carry on.

* * *

WMCA

You might be interested to know that Miss Ada Patterson, famous as one of the original "sob sisters" of newspaperdom, and who has been broadcasting for some time at 10:30 a. m. Thursday mornings, over WMCA, on the program, "Interesting People I Have Met," has been assigned to another spot on WPCH, sister-station of WMCA, at noon on Thursdays, on its Education and Science hour. This is good news, as Miss Patterson has plenty to say and always says it well.

* * *

WBAL, Baltimore

If you are living in the vicinity of Baltimore, or can reach WBAL on your set, dial in at 9:15 p. m. EST on Tuesdays and hear Jack and Sally Howard, new radio stars, in their ultra-modern idea of letting the radio listeners in on their home-building plans. Jack and Sally are newly-weds, building their love nest out on Northwood, a beautiful suburban development of Baltimore. The house will actually be built and described step by step over the air. The continuity is in the form of a dramatic program and many prospective home-owners will get a big kick out of the new and novel ideas to be embodied in "The House That Jack is Building." The continuity for the program is being written by Broughton Tall, Supervisor of the Literary Research Department, of WBAL. The cast includes Elinor McCurley, as "Sally"; Edward Waesche, as "Jack"; Leonie Redue as "Gwen"—Sally's best girl friend; Walter N. Linchium as "Chick," Gwen's husband; and Mary Spotswood Warren as "Selina," the maid.

Sidelights

LEONARD JOY, NBC orchestra leader, hates to have his picture taken. . . . ANDRE KOSTELANETZ was born in Petrograd when it was known as St. Petersburg. . . . FREDDIE RICH has written a symphonic jazz work which he calls "Penthouse 54." . . . BEN ALLEY is halfway through his ten-week Loew Circuit contract. . . . JIMMY DORSEY, saxophonist in NAT SHILKRET'S orchestra, doubles in trumpet once in a while. . . . ANN LEAF'S latest composition is entitled "The Mirage"; it is an unusual selection and depicts the thoughts of a traveler lost in a desert. . . . Canada would like to get their favorite band leader, JACK DENNY, back, but New York is being too good to Jack. . . . JOHN LANGSFORD, of JOE HAYMES' Columbia orchestra, is the tallest saxophone player in captivity; he is seven feet high. . . . DAVID ROSS is ping-pong champion among the Columbia announcers. . . . GENE AUSTIN'S boyhood ambition was to be a wrestler. . . . RUDY VALLEE'S real radio debut was made in London, England, over the BBC. . . . BILLY DALY broils a good steak, and how! . . . ROSARIO BOURDON made his debut at a concert in Lavell University, Montreal, when he played a cello solo before the late Queen of the Belgians.

Biographical Brevities

ABOUT HOWARD LANIN

Born in Philadelphia, 1898. Father a violinist, mother a pianist. Educated in Philadelphia secondary schools and University of Pennsylvania. Started playing trumpet but graduated to drums. When eleven years old made his first professional appearance in the old Crystal Palace movie theatre in Philadelphia. There he first met Harry Rosenthal and Benny Baker, trumpet players, and Lew White, organist, all well-known NBC artists. The pay was 35 cents a night. White struck for more money; the rest followed suit; fifty cents was demanded—and they won out.

Howard landed in the Nixon Theatre, where he played for the first performance of Charlie Chaplin. There also was a sunburned youth with an unruly lock of hair, who chewed gum and twirled a lariat—Will Rogers. An engagement at the Stone Harbor (N. J.) Yacht Club started Howard on his way to become "the society Maestro." He was seventeen years old.

He first met the microphone at WDAR, now WLIT, in the days of crystal sets—1921. Lanin's orchestra became a by-word, and still is, of Quaker City society. Has traveled quite 40,000 miles to meet his engagements. Lives in Philadelphia, commutes to New York. Began network broadcasting with the Atwater-Kent programs; today is the maestro of the Bourjois "Evening in Paris" program over the Columbia network. Favorite dance tune "Underneath the Stars"; favorite opera, "La Boheme." Reads detective stories for relaxation. Drives a big automobile. In clothes, prefers gray suits, blue shirts and red ties. Is five feet, nine and a half, black hair, dark brown eyes, ruddy complexion. Stocky build, packs boxing punch; is handball fan; golf and football are his sport hobbies.

Married Miss Clayre Finston of Philadelphia in 1923. She is Howard's honest critic. They have three children, Myron, Betty Ann and little Jay. Has just purchased a beautiful estate opposite Fairmount Park, right beside the Edwin Forrest Home in Philadelphia. Has offices in Philadelphia and New York. Manages orchestras totaling over 250 men. His eight brothers and one sister, all musicians. Possesses a sunny smile and disposition, which have made him a million friends—in other words, he has "It."

TELEVISION IN 1937 OR LATER, SAYS NBC HEAD

San Francisco.

Radio, which has been called a competitor to the stage and the films, may be the means of renewing popularity and prosperity for the entire amusement industry, says Merlin Hall Aylesworth, president of both the National Broadcasting Company and the Radio-Keith-Orpheum Corporation, who is in California on a short visit.

Tanned and cheerful, the youthful-looking head of the two great corporations of microphone and stage spent a day in the NBC headquarters here, conferring with Don E. Gilman, vice-president in charge of the National Broadcasting Company's Pacific Division.

Will Present Movie Stars

"Radio, far from keeping audiences out of the theatres, can be an effective agent to stimulate public interest in stage and pictures," Mr. Aylesworth declared. "But first the picture people must learn radio showmanship, a far different kind from that of their own business. The day has passed forever when the listening audience gets a thrill out of hearing some noted film luminary step up to the microphone and say 'Hello, folks—can't tell you how delighted I am to be here!'"

One of the purposes of his visit to Hollywood, he said, was to make preliminary arrangements for a series of radio programs to be broadcast from here, with noted stars featured.

"But they must be radio programs, built and produced to meet microphone needs," he added. "I firmly believe that audiences which hear the voices of these stars will want to see them in pictures or on the stage, and radio can work hand in hand with the latter two mediums of entertainment."

Television 5 Years Off or More

The most recent opinion of experts on television is that it will be at least five years longer before this branch of radio is on a working basis, Mr. Aylesworth said.

"There are so many obstacles in the way of television's development as a practical thing that it may be still longer before we can sit in our homes and watch football games and prize fights as they take place," he continued. "From the entertainment side, television is almost bound to develop through the films, and the cost of television receiving sets, while it might not have daunted the buying public of '28 and '29, will be out of the reach of most purchasers of the present era.

Antagonism Broken Down

"We will not see a buying public like that of those two years for a long while to come, and I do not think this altogether unfortunate. Individuals and companies alike were living and operating on the theory that they had more money than they actually possessed. Nowadays we can be proud of wearing a four-year-old hat!"

Radio has done more to break down the antagonism between differing religious faiths and various sections of this country than any other agent, Mr. Aylesworth said, pointing out the freedom of expressio npermitted on the microphone.

Higher Power to 4 on 940kc Opposed

Washington

The request of four regional broadcasting stations that the Federal Radio Commission relax its power regulations and grant the stations permission to operate with 5,000 watts, 4,000 above the maximum prescribed for regional outlets, was recommended for denial in an examiner's report.

Elmer W. Pratt held that the applications of the stations, WCSH, Portland, Me.; KOIN, Portland, Ore.; WDAY, Fargo, N. Dak.; and WFIW, Hopkinsville, Ky., proposed action directly violating Commission regulations, and approval would not serve public interest.

The applicants, constituting all of the stations in the United States which operate evening hours on 940 kilocycles, urged that they be allowed greater power because their location demanded that they serve greater areas than regional stations located in thickly populated communities.

GET RESPITE ON 50-CYCLE RULE

Washington.

The 50-cycle rule has been in effect about two weeks and listeners have been able to determine for themselves whether there has been any improvement in reception because the broadcasting stations are restricted to such a narrow frequency deviation. The rule is expected to get rid of considerable heterodyne interference.

Not all stations could get their equipment in time, so some of them were given a little leeway, but warned by the Federal Radio Commission that once the equipment was installed there would be no condonement of violations. Strict penalties will be enforced, including refusal of license renewals.

The new rule is regarded as the greatest technical advance in the broadcast transmitter art in recent years, according to Federal Radio Commissioner Lafount.

Manufacturers of monitoring equipment for achieving this high degree of accuracy have to get their products approved by the Bureau of Standards, and three such companies have obtained certificates of approval. The demand was so great at the last minute that manufacturers could not oblige all the stations on time.

SPONSORS PAID $77,758,049; NBC GOT 32%

Washington.

Financial data on the broadcasting structure were furnished to the Senate by the Federal Radio Commision in its requested report on radio methods and conditions throughout the world. Both financial and educational considerations were discussed in the report.

The financial features brought out included the following:

Total investment in broadcasting plants in the United States (excluding 50 small stations that did not report): $47,879,249.

Distribution of investment: $36,845,046 in 558 individual stations; $10,721,129 in the National Broadcasting Company and Columbia Broadcasting System. NBC figure, $6,193,670; CBS, $4,527,459.

$77,758,049 for Advertising

Advertising revenue received during the year by all chain networks and all individual stations: $77,758,049. Of this NBC had $25,895,959, and CBS, $11,621,424. Individual stations received more than $30,000,000, and smaller chains got the remainder.

Total expenditures by chains and all stations reporting aggregated $77,995,406 during the year. Stations and chains thus realized a total loss for the year of $237,357.

Of these expenditures, chains totaled $40,641,325, with NBC expending $28,137,716 and CBS expending $10,826,699, and smaller chains and individual stations the reremainder of the $77,995,406 total.

Three Just Broke Even

A total of 333 stations reported that the year's operations netted a total profit of $5,451,711, with a low gain of $13.94 to a high of $376,279. One hundred and eighty stations reported an annual loss, totaling $2,200,744, with a minimum loss of $22.50 to a high of $178,536. Three stations said their budgets balanced exactly.

Although many individual stations reported losses for the year, stations as a whole showed profits as follows: Under 100 watts—$48,913; 100 watts—$174,155; 500 watts—$428,024; 1,000 watts—$1,278,510; 5,000 watts—$414,117; and over 5,000 watts—$731,990.

Wisdom Statue to Mark Entrance to RCA Building

The figure of Wisdom, flanked by two figures representing Light and Sound, will decorate the main entrance to the new RCA building, future home of the National Broadcasting Company and dominating structure of New York City's new art and amusement development. Rockefeller Center, popularly known as Radio City.

The award for the sculptural treatment of the entrance to the 70-story building recently was awarded to Lee Lawrie, noted American sculptor, who submitted the design "Wisdom—a Voice From the Clouds." The conception of Wisdom harks to a verse from Proverbs: "I love them that love me and those that seek me early shall find me."

In the completed work the figure of Wisdom will occupy the lintel of the central arch of a three-arch loggia. This loggia, forming the main entrance on the east side of the building, will overlook the central Forum, or Sunken Plaza, in the center of the Rockefeller Center development. From the opposite side of the Forum a wide promenade will lead to Fifth Avenue, providing passersby with an unobstructed view of the RCA Building.

On either side of the central arch, flanking curves will bear the figures of Light and Sound. A physical background for Lawrie's sculptural conception of Sound may be found in the radio and telephone. Mental and spiritual connotations are found in the enlargement of man's frontiers of information by the perfection of media for transmitting the oral word.

The conception of Light finds a physical background in sunlight, artificial illumination, motion pictures, television and other marvels of man or nature. Figuratively, Lawrie considers Light as suggesting the broader education and better understanding of the present state of human progress.

RULES ISSUED COVERING NEW TAX ON RADIOS

Washington.

Regulations concerning the new tax, which includes 5 per cent. on radio receivers, were formulated by David Burnet, Commissioner of Internal Revenue.

While from the terms of the radio section parts as such are not taxable, a complete kit of parts would be, according to the Commisioner, who added:

"A manufacturer who sells a taxable article in a knocked-down condition, but complete as to all component parts, shall be liable for the tax under Title IV and not the person who buys and assembles a taxable article from such component parts."

Taxpayer Defined

The Commissioner defines the producer, or taxpayer, whether or not the amount of the tax is passed on to a purchaser, consumer or otherwise, as a person who produces a taxable article by "processing, manipulating or changing the form of the article, or produces a taxable article by combining or assembling two or more articles."

Under this ruling a set manufacturer would have to pay a tax on the complete set, including the speaker and cabinet, because the manufacturer of the speaker or cabinet can obtain an exemption if the cabinet or speaker is to be used, "as a component part of a taxable article to be manufactured or produced by the vendee." The other exemption applies to material to be used in the manufacture and production of a taxable article, relating to distinct manufacturing, as contrasted to mere assembling, covered by the other exemption.

When Tax Applies

However, if actual manufacture is done for the benefit of another, the one for whom the work is done is regarded as the producer and subject to tax. The test is whether ownership rests with the factual manufacturer or with the person, firm or corporation ordering the work done.

The tax applies in general when ownership passes from the manufacturer (seller) to the vendee (buyer). This is usually on delivery, but delivery to a carrier is deemed to be delivery to the buyer. Jobbers and wholesalers are not subject to tax.

A monthly report is to be made by the taxpayer, and forms are obtainable from the Bureau of Internal Revenue, including the district offices of the bureau.

Washington

Guidance for the radio industry, in connection with the new Federal radio tax law, was given by Treasury Department officials at a conference of the radio manufacturers arranged by the RMA. Taxable and exemption provisions of the new law were explained by W. E. Dodge, chief, Manufacturers Excise Tax Section Bureau of Internal Revenue, in charge of administering the radio tax law. Treasury rulings are subject to revision and are being changed as new facts are presented.

The RMA delegation attending the conference represented about thirty members and was headed officially by Mr. Fred D. Williams of Indianapolis, president of the RMA; Captain William Sparks of Jackson, Michigan, acting chairman of the RMA receiving set group; Mr. S. W. Muldowny of New York, chairman of the RMA tube group; Mr. Scott, RMA Legislative Counsel, and Mr. Bond Geddes, RMA executive vice president.

No recommendations of practice or policy were made by the RMA. Such practices and policies are left entirely to manufacturers. The RMA has confined itself to securing and transmitting all information possible on the new tax law. The receiving set group attending the conference recommended that list prices be increased to cover the tax and no mention made in advertisements of the tax. The tube group advised tube manufacturers to avoid double taxation of tubes by billing tubes to set manufacturers on the certificate plan, leaving payment of the tax to the set manufacturers. Warning to manufacturers, jobbers and dealers against pyramiding the tax or increasing it beyond the exact amount paid to the Government also were sent.

Receiving Set Suggestions

The set manufacturers recommended that new list prices be established for advertising purposes by adding to present list prices an amount equal to the total excise tax. They recommended that no mention whatever of the radio tax either as included or as an extra charge be mentioned in any advertising or literature or sales promotional work. They recommended that jobber or dealer discounts be applied to existing list prices to be used as "base" prices for billing purposes only, with invoices to jobbers and dealers to indicate the amount of the tax as an addition to the net amount of the invoice. This plan was recommended by the set group so that existing discount plans might not be disturbed. These recommendations, made by the set group, and not by the RMA, were advisory, leaving complete freedom of decision on business policy to all manufacturers.

The Treasury officials gave the following interpretation to portions of the new radio tax law:

"A complete radio receiving set is not taxable as a set. The new tax law specifically imposes the tax on the manufacturer's selling price of chassis, cabinets, tubes, reproducing units and power packs. It also imposes a tax on the other parts and accessories of a radio receiving set when such other parts and accessories are sold on, or in connection with the sale of a radio receiving set.

"Tube rectifiers are taxable if suitable for use in connection with articles enumerated in Section 607—rectifiers, other than tube rectifiers, are not taxable if sold separate from a receiving set.

"Repair parts, other than those enumerated in Section 607, for sets and phonographs are not taxable when sold separate from sets or phonographs.

Exports Exempt

"Electrical transcriptions are taxable unless it can be proven to satisfaction of Treasury Department that such transcriptions are not phonograph records. In the discussions of this item by Committees of Congress, transcriptions were included and were considered to be taxable.

"No tax will be imposed on export shipments. The proof of such export shipment by bill of lading as provided in 1926 tax law will apply to the new tax law. It will appear as Section 1121 in the new law.

"Aerials and wire are not taxable when sold separate from a receiving set.

"Loudspeakers are taxable.

"B and C batteries are not taxable when sold separate from receiving set.

"Tubes used, or suitable for use, in radio receivers are taxable. Not those for laboratory, transmitting or other purposes.

"Head phones are taxable when sold as part of receiving set. When sold separately the Treasury is uncertain but will consider same taxable until it is proven that they are not reproducing unit. Advise paying tax and applying for refund, when sold separate from set.

"Volume control, fixed resistors, switches, sockets and similar articles, when sold separate from a receiving set, are not taxable.

"Condensers, either fixed or electrolytic, are not taxable when sold separate from receiving set.

"B eliminators are not taxable when sold separate from receiving set.

"Phonograph mechanisms are taxable but not a phonograph.

"Remote control of a receiving set is not taxable if sold separately and so invoiced; otherwise it is taxable.

Tentative Tax on Auto Sets

"An automobile receiving set is taxable under Section 607. It is possible that this ruling may be changed so as to permit sale thereof for further manufacture, tax free under Section 620.

"Receiving sets for police cars are not taxable providing they are sold directly to the State or municipality, but not through an intermediary. A sale to the United States Government is taxable.

"Receiving sets, sound equipment, amplifiers, etc., sold directly to a State or municipality, for use in State or municipally controlled hospitals, schools or for other State or municipal purposes, are not subject to tax.

"Sound equipment, amplifiers, etc., sold to privately operated hospitals, schools, hotels, etc., are taxable as an entire system unless the parts specified in the law as taxable are segregated on the invoice. If separately invoiced then the tax applies to the parts mentioned specifically in the law, but the tax does not attach to other parts used, such as wire, switches, plugs, sockets, etc. The billings must be divided to secure exemptions of such items not enumerated in the law.

"Receiving sets leased are subject to tax.

"Receiving sets, sold or leased for marine, aviation or communication services appear to be subject to tax. However, it is suggested that pending definite ruling to the contrary that tax be paid and refund claimed.

"If merchandise is sold to a subsidiary, the selling price must be the fair market price or the tax will be based on the fair market price. If it is a bookkeeping transaction the tax may be paid by the manufacturer at the fair market price, or the subsidiary may pay the tax based on the subsidiary's selling price.

Freight Deductible

"Bonus, cash and other discounts when actually earned and taken may be deducted in determining the manufacturer's selling price. If such discounts are taken after the manufacturer has made his monthly return to the Collector of Internal Revenue, he may carry such discounts as a rebate or credit claim on his next monthly return. The manufacturer must be careful to note on his books exactly what discounts are claimed for rebate or credit and why, in order that such information may be readily available to the field inspectors.

"Freight charges are deductible in determining the selling price, providing the invoice carries freight charges as separate item, but if invoice bills at a price which includes freight the tax is computed on the whole amount. If the manufacturer's selling price at the factory is the same as that at distant points delivered, freight included, then the freight charges are not deductible. If manufacturer attempts to make a profit on his freight charges, then such profit is considered a part of his sales price and is taxable."

TRADE DECIDES COURSE ON TAX AT CONFERENCE

BLUEPRINTS
of RADIO WORLD'S Star Circuits

80-550-METER T-R-F RECEIVER

BLUEPRINT No. 627, full-scale, with schematic diagram also included, as well as a list of parts, is our most popular star circuit, since it is a-c operated and covers from 80 to 550 meters. Thus you can tune in television, police calls, some relay stations and the broadcast band. It uses five tubes: two vari-mu, either —35 or —51, one —24, one —47 and one —80. The chassis is 14½x7¾ inches, so may be fitted into a midget cabinet as illustrated.

The reason for the great popularity of this circuit is that it represents the highest achievement so far in a five-tube tuned radio frequency design, with high sensitivity all over the dial, including the high wavelengths, on which most t-r-f sets drop off considerably. For instance, patients at a sanitarium at Liberty, N. Y., were most eager to receive WEAF, 660 kc, about 150 miles distant, and all sets tried, including supers, failed to produce sufficient volume. But the 627 circuit not only brought in WEAF loudly but met all other requirements, arousing such enthusiasm that several such receivers now will be found in that sanitarium.

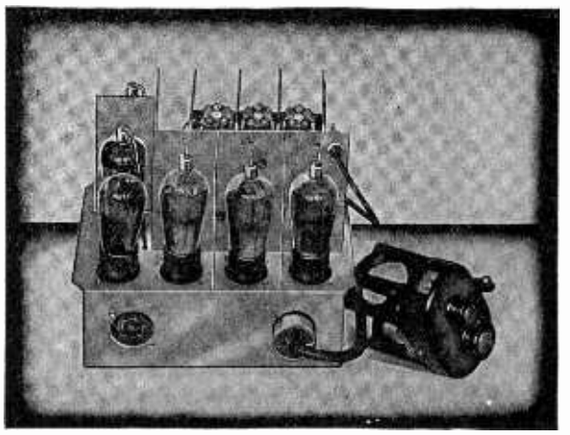
As to selectivity, strong local stations can be cut out within a very few degrees of the dial, to bring in distant stations, and it is nothing unusual of an evening, in Winter or Summer, to tune in fifty or sixty different stations without interference. From various points in the United States many users receive Cuban and Mexican stations with plenty of volume.

Special precautions have been taken to make the tone the very best. This includes complete filtration in the B supply, since hum is ruinous to tone quality. The circuit is as free from hum as any a-c receiver can be, which means you can scarcely hear the hum with no station tuned in, and your ear against the grille.

The 627 circuit was carefully engineered in **Radio World's** Laboratories, and represents the selection of fourteen different circuits, all of the five-tube t-r-f variety. So not only has the trouble been taken out by experts, but the virtues have been built in with great engineering skill.

Order BP-627 @ 25c

6-TUBE AUTO SET



A SIX-TUBE automobile receiver, using remote control tuning, with tuning-switch-volume control assembly on the steering post, is covered by our Blueprint No. 629. The size of the chassis is only 7x9 inches, and the chassis, enclosed in a steel cover, may be placed at rear of the fireboard, just under the instrument board, to the driver's right. Since there will be little aerial pickup the receiver has been made extremely sensitive. It is of the t-r-f type, using the new —39 variable mu r-f pentode tubes, and two pentode output tubes, —38's, in push-pull. All the tubes are of the 6-volt automotive series, to work from the car's storage battery, and requiring 135 volts of B battery.

Steel partition walls serve to shield the r-f and detector tubes, while two outlets are for plugging in the remote control unit and the speaker, which should be an automobile dynamic, as set forth in the blueprint. A schematic diagram and list of parts are included on the full-scale print.

Order BP-629 @ 25c

WE have just completed an 8-tube pentode push-pull automobile superheterodyne, designed by J. E. Anderson, technical editor of **Radio World.** This is Blueprint No. 631, full-scale, including schematic diagram and list of parts.

Order BP-631 @ 50c

SHORT WAVES

A TOTALLY a-c operated short-wave converter that can be built for $7.60, comprising three tubes, and affording excellent results when worked with any broadcast receiver, including a superheterodyne, is covered by Blueprint No. 630. No plug-in coils are used, there are two tuning controls for maximum sensitivity, both oscillator and modulator tuned, and the construction is so simple that any novice can make a great success of this circuit.

Order BP-630 @ 25c

OUR blueprints also include two short-wave receivers for battery operation, one for earphone use, the other to work a speaker. These models use plug-in coils, with UX sockets as coil receptacles. The 2-volt tubes are used in both instances.

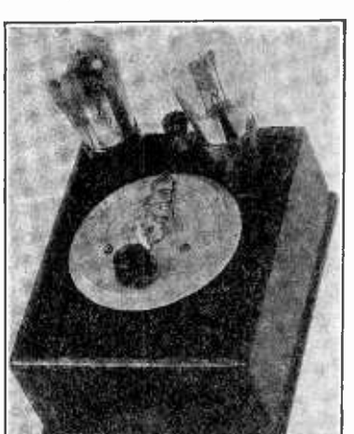
The earphone model, Blueprint No. 633, consists of an efficient and specially sensitized detector, with one stage of transformer coupled audio. With this circuit many foreign stations have been tuned in by hundreds of users. In fact, all our short-wave blueprints call for designs that yield foreign reception not as a rarity but as a fairly steady record. Two —3 tubes used.

The four-tube model, Blueprint 634, uses a stage of tuned r-f, a tuned detector specially sensitized, and two stages of transformer-coupled audio frequency amplification, the r-f tube being the —34 vari-mu r-f pentode, and the output being a —33 pentode. Schematic diagram and and list of parts included on blueprint.

These two blueprints, Nos. 632 and 633, are full-scale, on one large sheet, the complete data for one on one side, and for the other on the other side.

Order BP-633-634 @ 30c

OSCILLATOR



A MODULATED battery-operated oscillator, 540 to 1,500 kc, and 150 to 250 kc, by switching. One tube is the oscillator, the other is the modulator. Modulated-unmodulated service by switching.

Order BP-635 @..... 25c

GUARANTEE

WE guarantee that the circuits embodied in the blueprints listed on this page have been carefully engineered.

Radio World takes great pains with its circuits and renders them as free from trouble and as abundant in satisfactory results as is possible. This record for authenticity has helped to make **Radio World** one of the most outstanding publications in its field.

Now in its eleventh year, **Radio World** has been catering to the home experimenter and service man with a faithfulness that has won it a wide following. Published every week, dated Saturday, **Radio World** is obtainable at newsstands at 15c per copy, or by subscription at $6 per year (52 issues), $3 per six months (26 issues), or trial subscription, $1 per 8 weeks. No extra charge for subscriptions to Canada.

Radio World, the first and only national radio weekly, technical accuracy second to none, invites you to familiarize yourself with the exceptional service it is rendering to radioists the world over, and to profit by the expert engineering reflected by the circuits featured in its columns.

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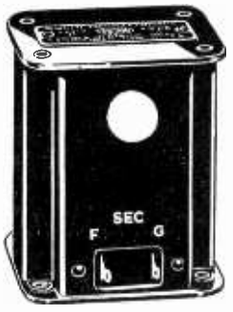

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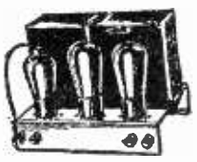

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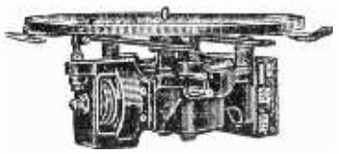

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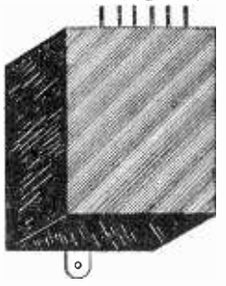

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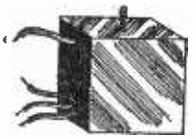

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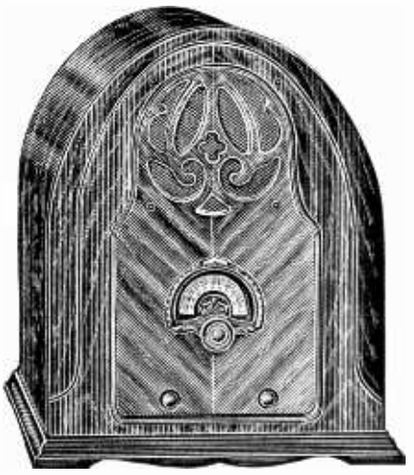

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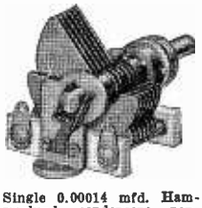

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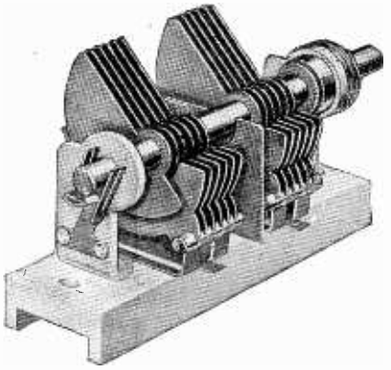

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