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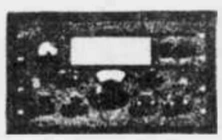
THE HORN SPEAKER

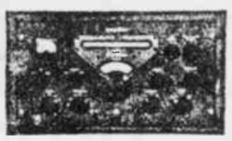
MORE AREA OF EASY TO READ CLASSIFIED ADS THAN ANY OTHER OLD RADIO PUBLICATION

Clarence D. Tuska- -1896-1985

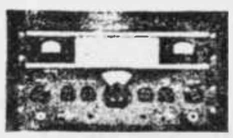
One of the early pioneers of early radio sets, Clarence D. Tuska, passed away June 20, 1985 at the age of 88. His sets were named after him and frequently used the second name, Superdyne. Many Tuska sets occupy a prominent place in many a collector's display.

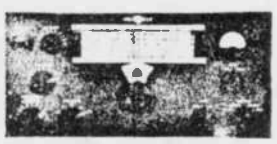
COLLINS EQUIPMENT

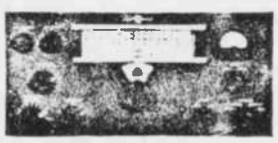

75A-1 . . . 1948

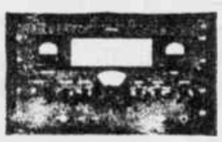

75A-2 . . . 1950

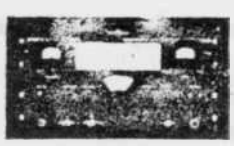

75A-3 . . . 1953


32V-1 . . . 1948

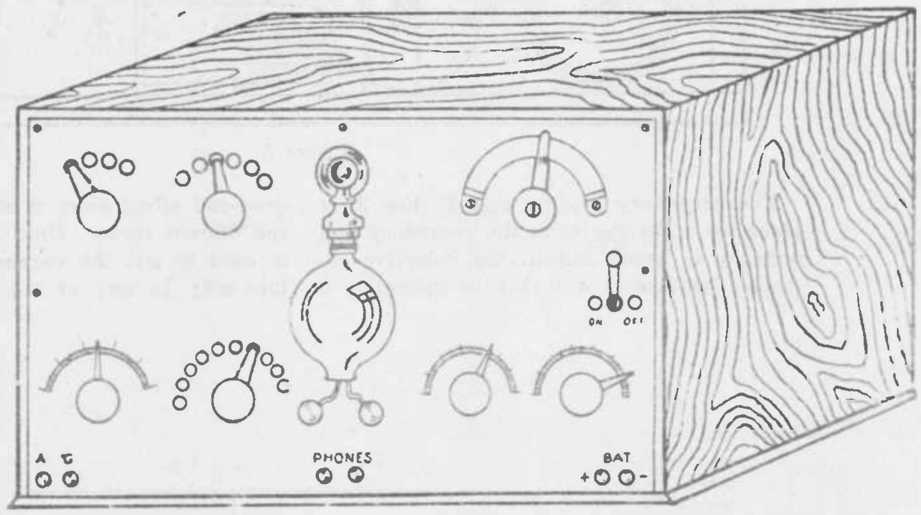

310B-1 . . . 1948


310B-3 . . . 1948


32V-2 . . . 1949


32V-3 . . . 1953

MODEL	PRODUCTION YEAR	COST NEW
75A-1	1948	$ 375
75A-2	1950	440
75A-3	1953	530
32V-1	1948	475
32V-2	1949	575
32V-3	1953	775
310B-1	1948	190
310B-3	1948	215



A Short Wave Regenerative Receiver

Complete Description with Instructions for Building

FOLLOWING the rapid growth of our relay work, there has come a continual and increasing demand for a receiver which would operate with efficiency and maximum sensitiveness on waves of less than 600 meters. It was required that the instrument be very selective. With the advent of the regenerative systems, there was room to design just such a set. At the present time, a number have been placed on the market employing tuners of altogether better design than was dreamed of among amateurs two years ago. It has been found that much of the efficiency was due to the care with which dead-ends were eliminated.

During the recent period of improvement, more than one of us began to feel that two receiving sets were necessary for the up-to-date amateur. One for relay work on short waves, the other for long wave spark and arc signals. With much completeness and care, Mr. Godley described in our August and September numbers, the design and operation of the regenerative system. Following all the latest kinks, the following set has been designed for short wave work.

It was first decided to have the audion circuit separate and individual, but on second consideration the audion was built into the set for convenience and efficiency. Fig. 1 shows a view of the complete instrument. This general layout may be improved upon and changed to suit conditions. One of the things worth noticing is that the complete set is mounted on a panel so that the panel may be drawn out of the case, bringing all the apparatus with it and opening it for inspection or repairs.

Fig 2 shows the back of the panel and the loose coupler, variables, etc., with the frame work on which the apparatus is supported. For the sake of clearness, the high voltage battery B, has not been shown, but it fits in the space outlined at B in Fig. 2.

The most important part of the set is the loose coupler. The primary consists of a cardboard tube 4½ inches in diameter and 1½ inches long. No size is given for the walls of the tube since this is a stock article. The secondary tube is 4 inches in diameter and 1¼ inches long. The secondary loading coil is 4 inches in diamter and 6 inches long. These three tubes should be boiled in paraffin to exclude all moisture and the possibility of warping. The primary is wound with thirty turns of No. 22 double cotton covered copper wire. Taps are taken out every turn for six turns and then every six turns making six taps for single turns and four taps with six turns each. The taps should be soldered and made as short as possible. The primary coil is fastened to the end of the frame upright C, by means of a wooden disc ¼ inches thick and of the right diameter. This completes the primary and it should be given a coat of thin shellac to hold the wires in place.

The secondary coil proper is built in a similar manner but wound with twenty-five turns of No. 26. No taps are taken off and the terminals are connected to two flexible conductors to allow for the coupling which moves on arm E. A wooden disc is fitted into the end of the secondary on which arm E is fastened.

inches long, wound with 100 turns of No. 26 double cotton covered wire. Taps are taken out from every ten turns, giving a total of ten taps, the first turn being connected to the secondary proper as shown in the wiring diagram, Fig. 4. A connection is made between the last tap and the switch which acts as a reducer for the

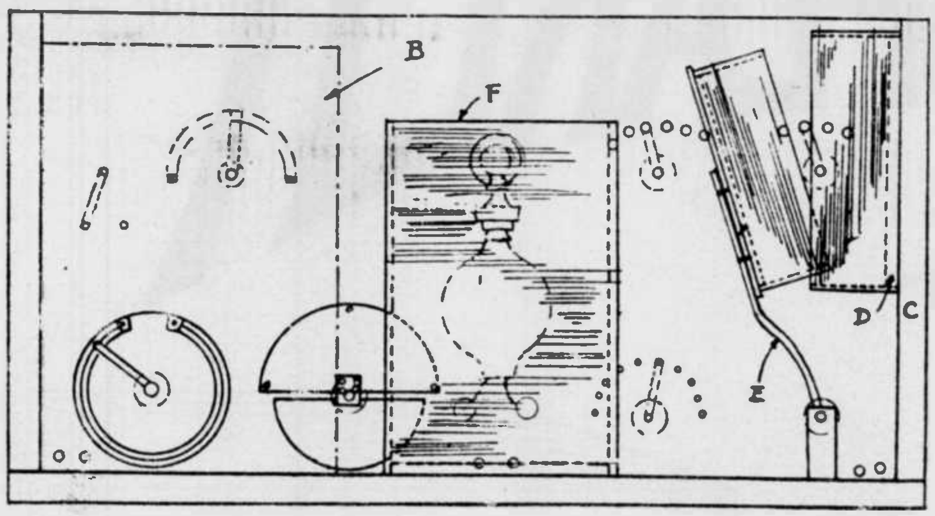
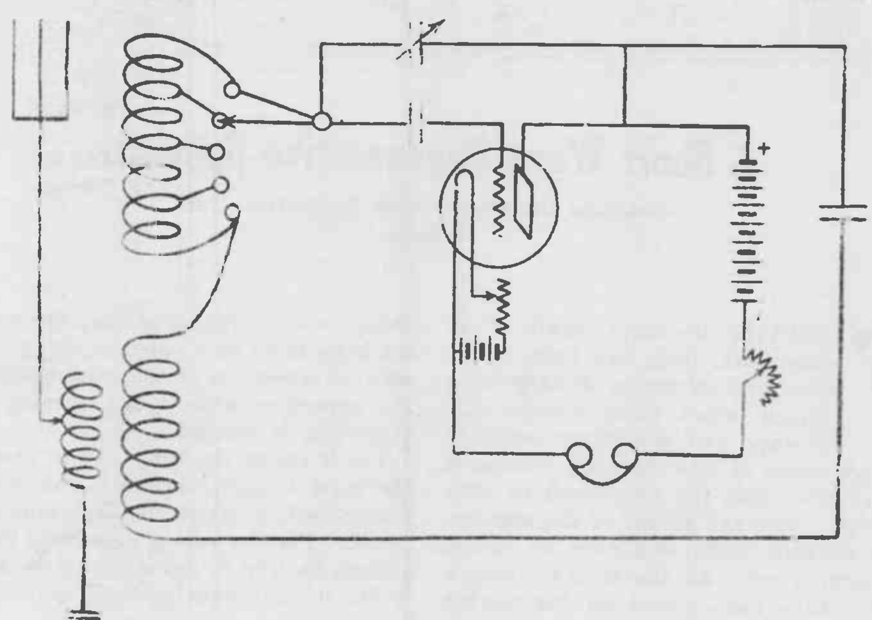


Figure 2

The secondary loading coil F, Fig 2, is placed at right angles to the secondary and primary to avoid undesirable inductive effects. Its size is 4 inches in diameter, 6

dead-end effect since it short-wave circuits the unused turns. One variable condenser is used to get the regenerative effect and this may be any of the small condensers



with about ten plates. The fixed condensers are about the size of a stopping condenser in the audion circuit. A piece of mica about 2 inches x 4 inches coated on each side with tinfoil gives the approximate capacity. A little experimenting will determine the exact size needed.

For adjusting the high voltage battery, a potentiometer has been shown. This is of the carbon resistance type such as is used on an RJ9 DeForest audion. With this circuit, either the tubular or round bulbs may be used with equal degree of success.

The apparatus may be mounted on a Bakelite or hard rubber panel. Figures may be stamped into the rubber and filled with a chalk and water mixture so that one will have no difficulty, with the proper tools, to label all the connections and switches. We have purposely withheld from giving in detail absolute and exact sizes and locations for switches, etc. This is to give opportunity for original work, and a chance to make the apparatus fit special conditions. Detailed operating instructions are not given since no two operators agree as to the best way to tune, but it is well to bear in mind one or two points: For example when working the regenerative system, it is always well to use less capacity than inductance. One also finds that the capacity of one's hand is enough to throw the set out, but after working with the apparatus awhile, one gets accustomed to this and it causes no trouble. We can promise that if one follows with care the dimensions of the loose coupler and circuit given, remarkable results can be had. Amplifications of from 25 to 100 are often obtained with a circuit of this type. Sets similar to this but not as complete are in use at the present time in several of the best amateur stations. Relay work has been done which would not have been attempted a year ago.

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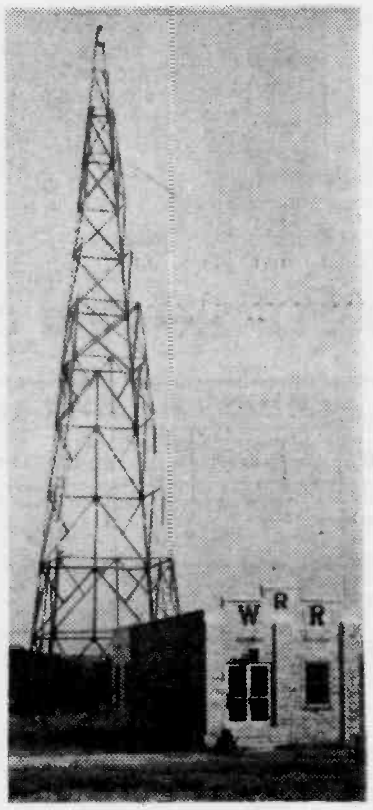
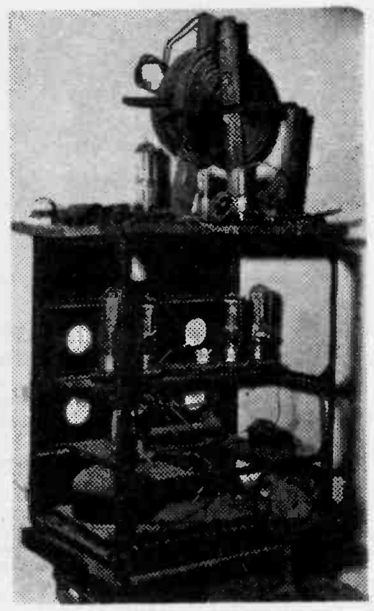
WRR

First WRR antenna





First WRR transmitter

Actually, nobody knows when WRR went on the air. It has a Commerce department document RENEWING its license in July 1921. Generally, it is accepted that WRR was on the air regularly sometime in 1920.

Most people are surprised, and rightfully so, to find that the City of Dallas owns and operates Commercial Broadcast Stations WRR and WRR-FM. The natural question then they ask is: "Why is the City of Dallas in the radio business?" The answer is simple. Dallas owned WRR many years before there was any commercial broadcasting in the country. In fact, the City of Dallas established WRR so long ago that it was the first radio broadcast station in Dallas, in Texas, the south, and, in fact, it was one of the first three or four in the United States.

WRR was established in 1920, primarily for the purpose of supplying communications to the Fire Department, although there were no automobile receivers, and in fact, no home receivers. Experiments were carried on with a transmitter and receiver designed and built by Fire Department employees. WRR can perhaps lay claim to having the first announcer ad-libs, newscasts, weather-casts and D. J.'s.

The firemen first started broadcasting by just simply ad-libbing. This became a wearisome task, so they started reading news from the newspapers and reading weather information also gathered from the newspapers.

This continuous talking also got to be pretty tiring, so again the firemen cast around for some easier means of putting on tests without having to talk continuously, so they acquired a mechanically operated phonograph and placed the microphone in front of the speaker, which rebroadcasts, after a fashion, the music that was coming out of the speaker.

This information leaked to the public and was given prominent play by the newspapers. This fired the imagination of the citizens of Dallas, who in turn joined the ranks of the city experimenters. They built their own receivers, which consisted mainly of a pair of headphones, many feet of wire closely wound on a round oatmeal cardboard box and a sensitive piece of galena with a "cat whisker".

The nostalgic age of radio, at WRR's beginning, is depicted in the attached editorial page cartoon from The Dallas Morning News dated December 10, 1967.

From this meager beginning, the City of Dallas has continued to operate WRR as a broadcast station until today it is one of the leading and prominent stations in the nation. Of all the city owned broadcast stations, WRR has set a record of more prominent than any city owned radio station in the country. WRR not only has been self-sustaining, but has contributed millions of dollars in cash and services to many other departments of the city. In addition, WRR has contributed heavily in the field of Public Service and Public Information. At an early date, WRR pioneered in the field of city communications and established communications systems for just about every department in the city.

WRR Personnel not only started and pioneered in police, fire and other city communications, starting in 1931, but operated and expanded the services of these communications systems through the years until 1969.

Drawing: reprint from The Dallas Morning News

TROUBLE-SHOOTING CHART

POSSIBLE SOURCE OF TROUBLE	SYMPTOMS OF TROUBLE					
	NO RECEPTION	VOLUME WEAK	IRREGULAR RECEPTION	DISTORTION	NOISY RECEPTION	HUMS AND WHISTLES
"A" BATTERY	Battery exhausted. No water in storage battery. Battery terminals corroded.	Battery exhausted. Poor connection at corroded terminals. Charger not equal to demand on battery Trickle charger not functioning.	Loose connection.	Battery exhausted.	Battery sulphated. Connected charger operating.	Hum from charger operating. Whistles from depleted battery.
"B" BATTERY	Battery exhausted. Battery not properly conneeted.	Battery exhausted. Volume starts off well but quickly diminishes while set is played.	Defective cell. Loose connection.	Battery exhausted.	Erratic noises — battery exhausted. Fluttering, motorboating — high resistance of run-down battery.	Whistles from-run-down battery.
POWER PACK	Not connected to power socket. Rectifier tube not operating. Filter coils burned out. Resistor burned out. Fuses in power supply burned out. Plate of rectifier tube red hot—condenser broken down or short circuit in filter. Electric light line power off—or fuse blown.	Eliminator overloaded. Rectifier tube worn out. Transformer short circuited. Buffer condensers punctured. Filter condensers punctured. Improper resistor values in voltage divider. Electric light line voltage too low.	Interrupted current supply from power lines. Poor voltage regulation of power line.	Plate voltage too low. C bias resistors not properly adjusted. Too high resistance in choke coils. Insufficient capacity of filter condensers.	Defective resistor in voltage divider. Sparking—over punctured condenser. Motorboating—insufficient capacity of last filter condenser. Improper value of resistors in voltage divider. Rectifier tube wearing out.	Transformer not balanced on center tap return. Eliminator overloaded. Insufficient inductance in chokes; cores too small; ohmic resistance too high. Insufficient capacity in condenser bank. Choke coil short circuited, or not functioning. No grounded shield between primary and secondary of power transformer. Eliminator not adequately shielded. Coupling between A.F. amplifier stages and eliminator, placed too close to set.
ANTENNA AND GROUND	Antenna grounded. Antenna disconnected. Ground connection open. Defective lightning arrestor.	Antenna disconnected. Antenna poorly insulated, grounded or wire corroded. Antenna too short. Antenna too long: insert midget condenser. Coupling between antenna coil and secondary too loose. Loose or corroded ground connection.	Swinging antenna becoming grounded at times. Loose or corroded ground connection.	Parallels, or too close to antenna of nearby oscillating receiver.	Antenna too close, or parallel, to power lines. Antenna too long—picks up too much stray noise. Loose or corroded ground connection. Antenna runs too near interfering electrical devices.	A.C. hum or commutator ripple picked up from nearby power lines. Negative side of filter circuit not grounded. (B—).
TUBES	Tube burned out. Tube paralyzed. Tube prongs not making contact.	Tubes exhausted. Wrong type of tube used. Power detector not warmed up. Too much grid bias. Corroded tube contacts.	Imperfect prong contacts. Detector tube paralyzed. Improper value of grid leak.	Tubes worn out. Tubes getting insufficient current. Improper "C" bias on grids. Detector tube overloaded. Wrong type of tube in last stage.	Microphonic tubes: require cushioned sockets. Gaseous rectifier tube aging. Hissing, due to power detector tube starting characteristic, or worn-out tube.	Tube deteriorating. Too high voltage on detector tube. Wrong type of A.C. tube in detector stage. No center tap in detector tube's filament circuit.
CIRCUIT	Switch open. Open circuit in set. Burned-out A.F. transformer winding.	Insufficient regeneration (S. W. set). Antenna too long (S. W. set). Grid leak improper value. Imperfect contacts. Defective piece of apparatus. Neutralization system out of adjustment. Insufficient plate voltage. Burnt out A.F. transformer winding.	Loose connection somewhere in set, eliminator, power supply or speaker connection. Sharply moving wires or set while in operation will accentuate trouble.	Over-regeneration. Nearby oscillator. Poorly designed transformers. Coupling condensers too small. Circuit too sharply tuned. Last stage inadequate. No biasing on tubes.	Squeals, bloops — set not neutralized. Neutralizing condensers not properly adjusted. Defective grid leak. Motorboating — lower the value of resistors in resistance coupled amplifiers. Broken wire or imperfect contacts. Burnt out audio transformer.	Oscillation from over-regeneration. Set not properly neutralized. Magnetic feed back between stages. Open grid circuit. Center tap of transformer not balanced. Grid return to center point of potentiometer across A.C. tube not properly adjusted.
SPEAKER	Speaker disconnected. Open circuit in speaker unit, jack, plug or cord. Speaker short circuited. Coil in speaker unit burned out.	Speaker out of adjustment. Loose contact. Leak across speaker cord. Choke coil in output circuit has too high resistance or insufficient impedance.	Defective cord, jack or plug.	Speaker overloaded: eliminate direct coupling by using output transformer or choke condenser coupling. Not matched to tube in last stage. Poorly designed speaker.	Sound vibrations communicated from speaker to tubes in set. Electrical feed back from speaker cord to amplifying circuits.	Buzz or rattle in dynamic speaker due to moving coil rubbing against pole pieces. Hum due to worn-out rectifier. Feedback from speaker circuit to amplifying stages due to sound vibrations communicated from speaker to tubes in set.
GENERAL	Incorrectly wired set. Shielded location or dead spot. "SOS" on air. Set not turned on. Breakdown at broadcasting station—try another station.	Set inadequate. Spot poor for reception. Fading.	Breakdown in broadcasting—try another station.	Improper tuning. Fading. Weather condition. Unsatisfactory transmission from station—try another station.	Static; try disconnecting aerial and ground. Eliminator too close to set. Near-by regenerative set. Sparking electrical machinery.	Two stations on nearly same wavelength cause heterodyne whistle Interference from near-by oscillator. Near-by regenerative or oscillating receiver.

Radio-Frequency Amplification From the Ground Up

Applying Radio-Frequency to Single-Circuit, Three-Circuit, Super-Heterodyne and Reflex Methods of Reception and Some Suggestions for Combining the Last Two Methods

By ARTHUR H. LYNCH

PROVIDED with a circuit of the type shown in Fig. 1, it is possible for us to obtain many interesting and satisfactory results from almost any of the more common forms of receivers. Last month the application of a circuit of this variety to three-circuit tuners and loop antennas was explained, and now some comment upon applying radio-frequency to a single-circuit receiver may be of interest.

To begin with, the single-circuit receiver used in conjunction with Fig. 1, may be regenerative or non-regenerative, depending upon what is used to connect X^4 and X^5. For simplicity of operation, the non-regenerative method may be used, but where long distance and greater selectivity are sought, regeneration is helpful. If a short piece of wire connects X^4 and X^5, the regenerative action of the detector tube is not brought into play, but a variometer or the tickler coil of the common single-circuit regenerator inserted between these two points will, on the other hand, take advantage of regeneration, which may be controlled in the usual manner.

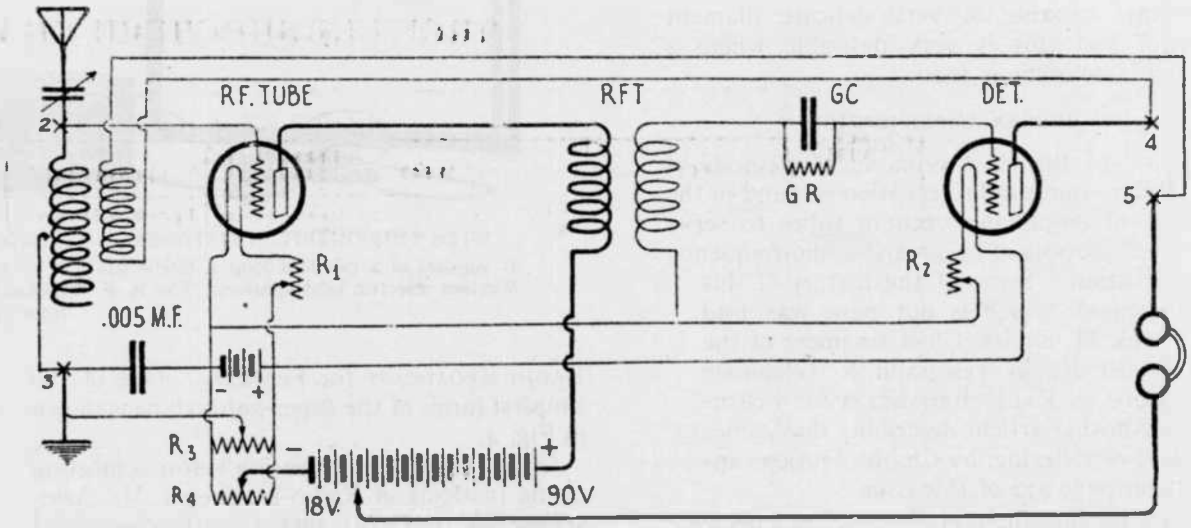


FIG. 2

By making the connections indicated here, the range of a single-circuit regenerative receiver may be greatly increased. If regeneration is not desired, a direct connection between X_4 and X_5, and the elimination of the tickler coil, are the only changes necessary

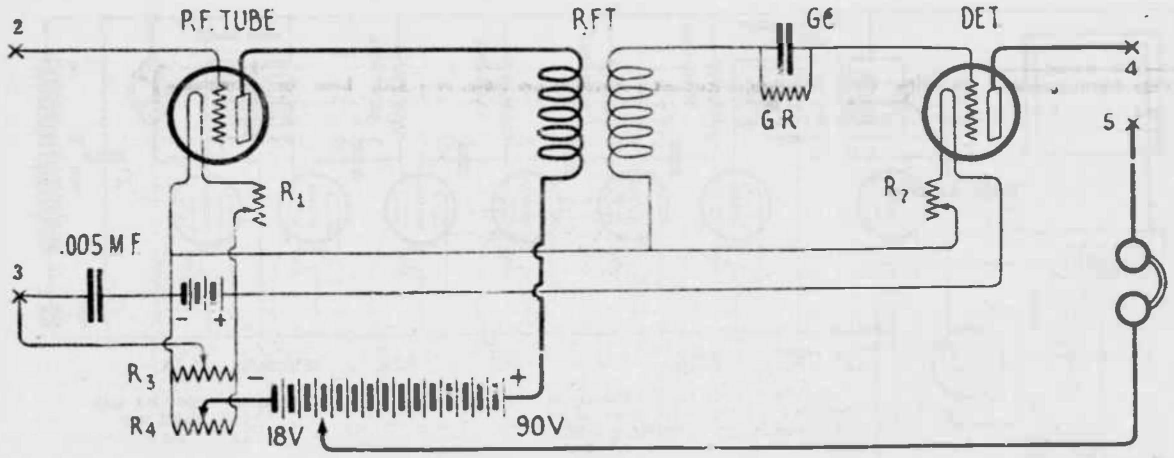


FIG. 1

A single-stage, transformer-coupled, radio-frequency amplifier and vacuum-tube detector applied to a standard coil mounting. Various adaptations of this arrangement are possible

The character of the antenna circuit of the single-circuit outfit makes but little difference. It may be a variable condenser and tapped coil between the antenna and ground; a fixed condenser and a variometer in a similar position, or merely a variometer. Connection to the points X^2 and X^3 are made to the upper and lower ends of the *active* turns of the inductance. Condensers, either fixed or variable may best be placed between X^2 and the antenna. By *active* turns, in speaking of inductance, is meant those turns actually in use. For instance, one common form of single-circuit regenerator employs a variable condenser and a vario-coupler as its turning units. The primary of the latter is tapped. The upper end of the primary winding is connected to X^2 while the various taps are connected to switch contacts and the switch lever is connected to X^3. This arrangement is shown in Fig. 2.

Audio-frequency amplification may be added to a circuit of this variety in the usual manner though it is not necessary unless a loud speaker is to be used. For this purpose a single stage will usually suffice for local stations and two stages for the more remote stations.

REGENERATIVE R. F. AMPLIFICATION

FOR those who use the vario-coupler and twin variometer circuit, the addition of a single stage of radio-frequency is a comparatively simple matter. It is but necessary to take the grid condenser and leak out of the circuit in which they are usually found and make a direct connection to the grid in their place. If you wish to leave the wiring as it is, the grid condenser and leak may be short-circuited by a small piece of wire. An amplifier tube is then put in the socket which formerly held the detector and the plate voltage is raised from the customary $16\frac{1}{2}$–$22\frac{1}{2}$ to 45–90. It is then but necessary to couple the output of the regenerative amplifier tube to the input of a detector tube circuit. This arrangement is shown to the right of the plate variometer in Fig. 3.

The units required for this circuit arrangement, in addition to those in use with the regenerative receiver, include:

R^2 Filament rheostat (with vernier or compression type preferred)
C^1 Fixed Condenser, .001 M. F.
R^3 Resistance may be a grid leak resistance,

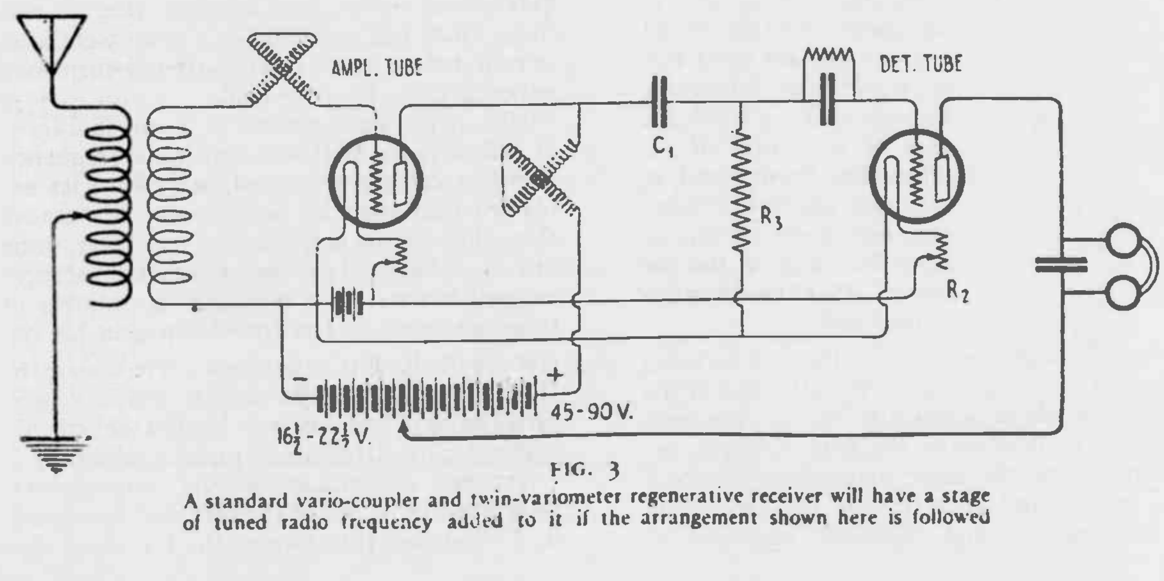


FIG. 3

A standard vario-coupler and twin-variometer regenerative receiver will have a stage of tuned radio frequency added to it if the arrangement shown here is followed

its resistance is not a critical factor.
A vacuum-tube socket, an amplifier tube and from one to three additional B batteries complete the list.

The necessary elements for this circuit may be included in the receiver cabinet, or an additional cabinet for the coupling elements and detector control may be added. In fact there is plenty of room in most of the detector control units now on the market to mount the condenser and resistance in them. Such units, however, are not frequently provided with rheostats capable of very delicate filament control and this is very desirable where a "gassy" detector is used.

REFLEX AMPLIFICATION

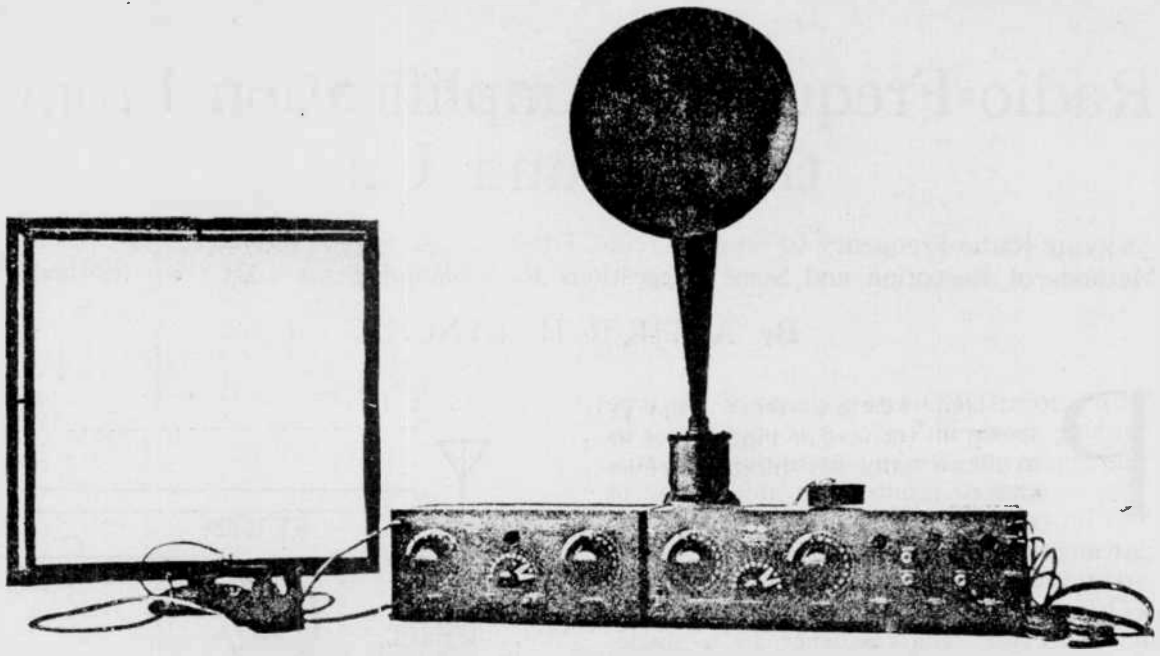
ONE of the most economical methods of long-range radio reception is found in the system of employing vacuum tubes to serve the dual purpose of radio- and audio-frequency amplification. Some of the history of this arrangement, which is not new, was told by Frank M. Squire, Chief Engineer of the De Forest Radio Telegraph & Telephone Company, in RADIO BROADCAST for February. Another article, describing the Grimes method of reflexing, by Charles Durkee, appears on page 472 of this issue.

Since the introduction of the WD-11 dry-cell tubes and the new coated-filament tubes, designed for storage-battery operation, much of the objection to the use of several tubes has been removed, and we can now operate three of the new 5-volt tubes with less drain on the storage battery than a single tube of the old type required.

The cost of tubes has ever been a factor among those of us who build our own sets, but the cost of several tubes has been more or less overshadowed by the cost and inconvenience of keeping a storage battery well charged. Now, however, these difficulties have been greatly reduced, and it is not surprising to find a rapidly increasing interest in circuits which because of first cost and upkeep, found little favor in the past. With the reduction of operating cost and an economical method of making tubes do double duty, there is a growing tendency toward receivers which are easy to install and easy to operate. Loop antennas, which usually require at least two additional tubes and their accessories to produce a signal equal in strength to that picked up by an average outdoor antenna may be used at comparatively small additional expense.

Of all the receivers the radio art has developed, it is doubtful that any has more possibilities and has received less attention than Armstrong's super-heterodyne. This is especially true in view of the great improvement made in the art since this receiver was developed. The one striking disadvantage of this form of receiver has been found in the great number of tubes required: eight to ten or more, in most of the receivers that really performed well.

Paul F. Godley was one of the first to bring the value of this receiver to the attention of the amateur world by using it to receive American amateur signals across the Atlantic. His experience with the super-heterodyne covers a long period, and an article by him describing its construction and operation appeared in



WITH THIS OUTFIT, A LISTENER IN CHICAGO HEARD STATIONS ON THE EAST AND WEST COASTS
It consists of a two-foot loop, a Grebe tuned R. F. amplifier, tuner with detector and two-stage A. F. amplifier, and Western Electric loud speaker. The R. F. amplifier may be used with any receiver and has a wavelength range of from 150 to 3,000 meters

RADIO BROADCAST for February. One of the simplest forms of the super-heterodyne is shown in Fig. 4.

In describing this invention before a meeting of the Institute of Radio Engineers, Mr. Armstrong said that two stages of resistance-coupled radio-frequency amplification were necessary to bring the signal up to its original intensity after it passed through the first detector tube. Additional stages were then necessary, if any

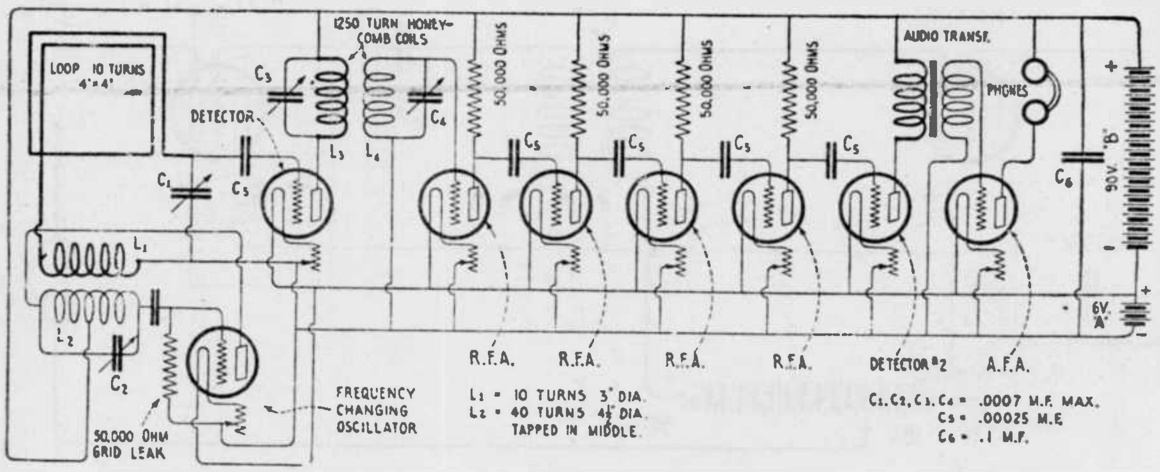


FIG. 4
R. F. amplification of the resistance-coupled variety is employed in this super-heterodyne circuit. (Described by Paul Godley in RADIO BROADCAST for February, 1923)

increase over the original value was desired. That meant the use of a great many tubes.

In a recent lecture before the Radio Club of America, Mr. George Eltz, Jr. told of some very important improvements in the super-heterodyne method and demonstrated an outfit in which but seven WD-11 tubes were used in conjunction with a three-foot, nine-turn, loop antenna and a loud speaker.

His circuit arrangement is shown in Fig. 5. It will be noted that iron-core radio-frequency transformers are employed, and Mr. Eltz explained that they are well warranted because they improve the amplification, per stage, some five to six hundred per cent. over the resistance-coupled variety, thus reducing the number of tubes necessary. The transformers in his circuit are the Radio Corporation's type UV-1716, (Fig. 7) which may be used to cover a very broad band of frequencies. Each stage of R. F. is shielded by rather heavy metal shielding.

Another advantage of the arrangement shown in Fig. 5, lies in the fact that the tuned R. F. coupling transformer (S. T.) which determines the frequency at which the intermediate frequency circuit must function is placed directly before the second detector tube rather than directly following the first detector tube, is as the case in Fig. 4. The construction of this transformer is indicated in Fig. 6. Its advantage lies in the fact that whatever losses are brought about in this circuit may be sacrificed with less ultimate loss after the amplification has taken place.

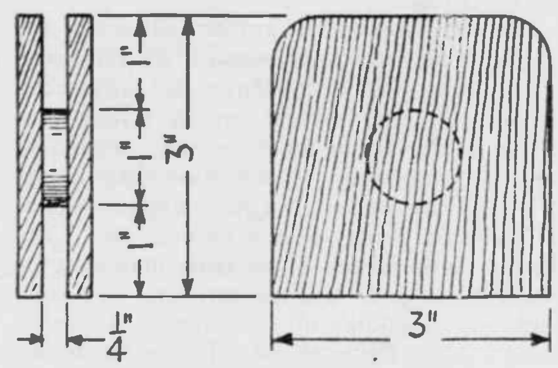


FIG. 6
This special transformer is used to couple the last R. F. tube to Detector Tube No. 2 in Fig. 5, and provides a sharp resonant point for the radio-frequency circuit. The walls of this transformer may be made of bakelite or hard rubber. The primary is wound with 200 turns of No. 29 D. S. C. and is separated from the secondary, which has 1500 turns of No. 36 D. S. C., by several layers of empire cloth

A SUGGESTION

FOR those who would use the super-heterodyne and would care to cut down the expense of its operation, we would suggest a method for reducing still further the number of tubes required. We have not had time to give this method the trial which usually precedes the publication of information in RADIO BROADCAST and therefore refrain from publishing the circuit we have in mind, but there is no apparent reason for any difficulty being experienced with it.

Where such high amplification is used, there seems to be no reason for overlooking a good crystal detector to follow the R. F. amplifiers. That would eliminate one tube.

There seems to be much logic in the Grimes method of reflexing and if Armstrong's contention is true, the current flowing in the first two R. F. tubes is very small indeed. Why not go back to them, then, for the audio-frequency, thus doing away with two more tubes without a great loss in over all performance.

In suggesting this arrangement, we have not lost sight of the fact that a tube used in a reflex arrangement may not be serving at its best as a radio or audio-frequency amplifier, but this loss does not seem to be a very serious matter. For the experimenter who is anxious to produce great volume, the use of three stages of audio-frequency is to be considered. In this last arrangement, however, a great variety of difficulties are likely to arise.

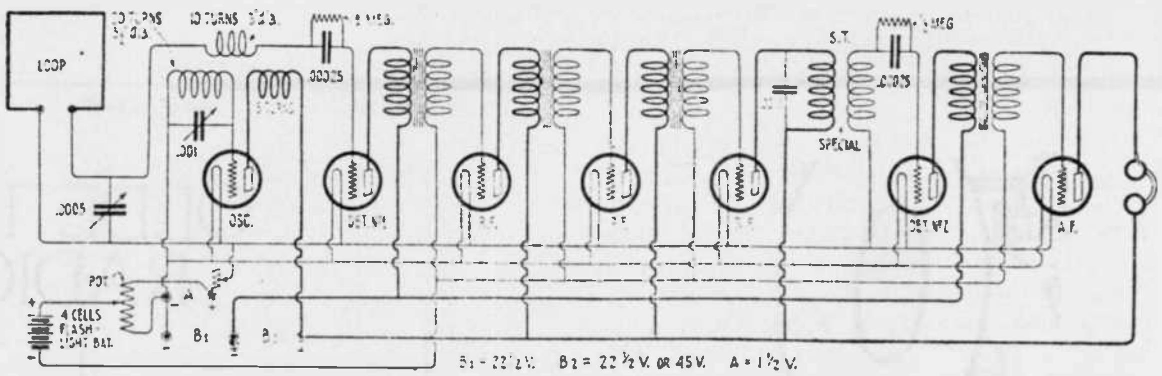


FIG. 5

This super-heterodyne arrangement was described and demonstrated by George Eltz, Jr., before the Radio Club of America. Seven WD-11 dry-cell tubes are employed and the Radio Corporation UV-1716 R. F. transformers are used in the radio-frequency amplifying circuits

The production of uniform tubes for use in amplifying circuits operating on very low filament consumption and amplifying transformers that will cover a great band of frequencies make it possible for us to look for some very marked improvements in reception. To the best of our knowledge these suggestions have not been made before, and RADIO BROADCAST would like to hear from those who attempt to put them into practice.

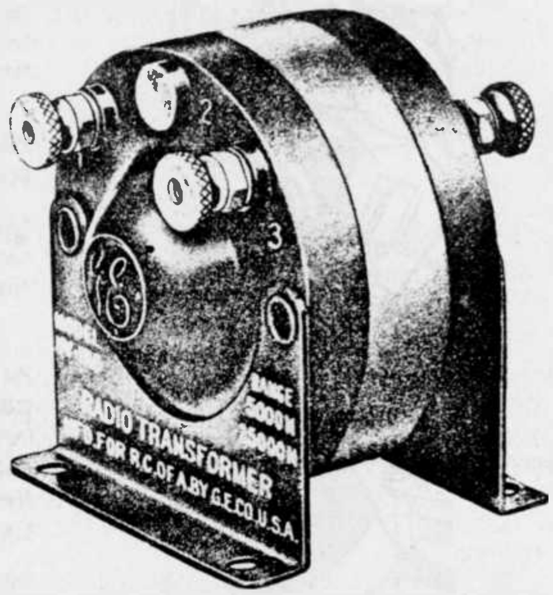
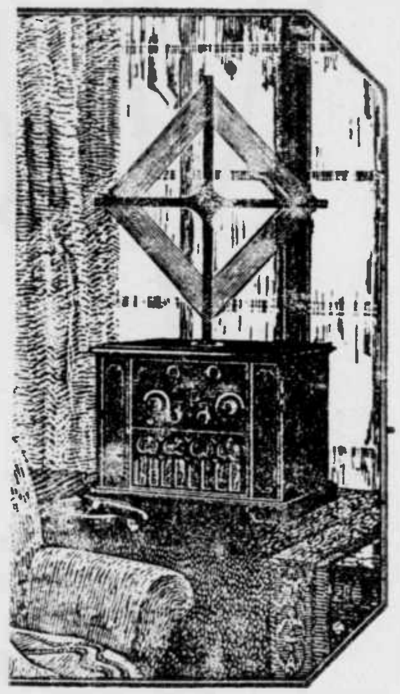


FIG. 7

The UV-1716 R. F. transformer has a wavelength range of from 5,000 to 25,000 meters. It may be used at the frequencies found in the intermediate frequency circuit of the super-heterodyne and produces a much greater amplification, per stage, than is possible with the resistance-coupling

RADIO BROADCAST, APRIL 1923



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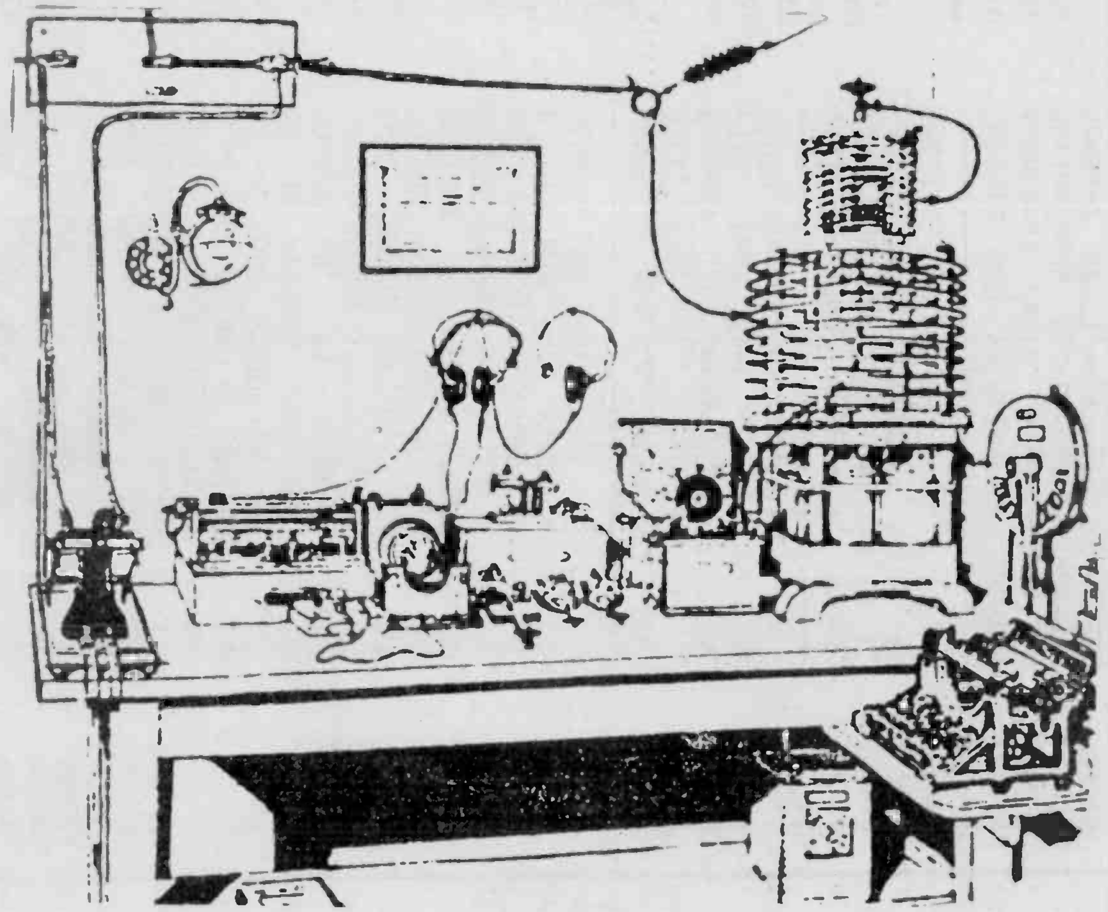

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