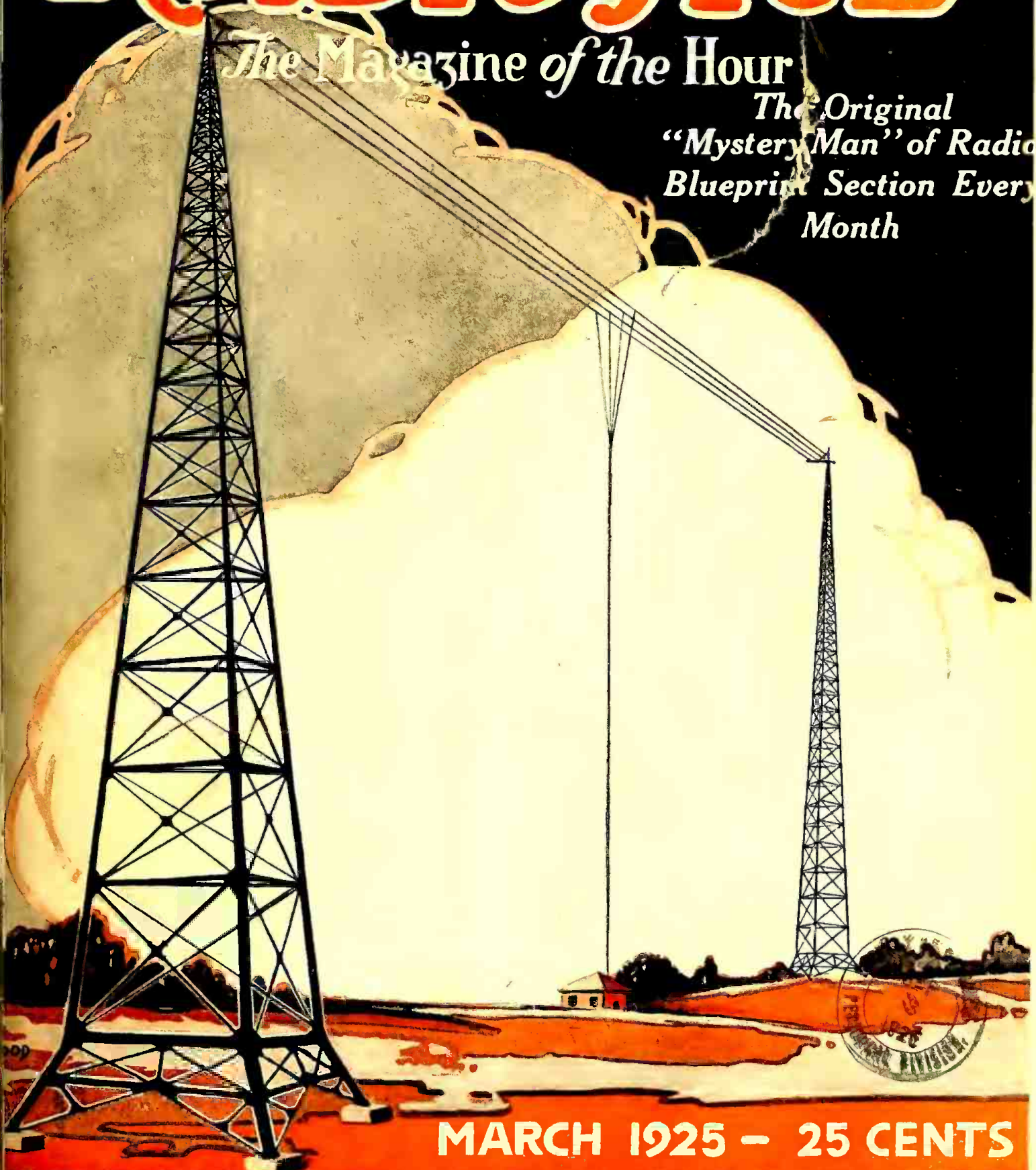


RADIO AGE

The Magazine of the Hour

*The Original
"Mystery Man" of Radio
Blueprint Section Every
Month*



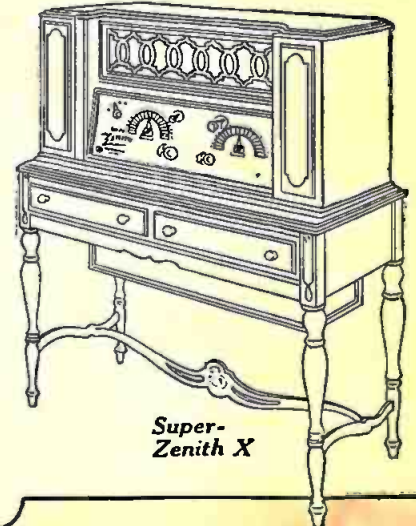
MARCH 1925 - 25 CENTS

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But They Do More

Super-Zenith VIII—
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To choose at will
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one majestic symphony

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332 South Michigan Avenue, Chicago

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With either Zenith 3R or Zenith 4R, satisfactory reception over distances of 2,000 to 3,000 miles is readily accomplished, using any ordinary loud speaker. Models 3R and 4R licensed under Armstrong U. S. Pat. No. 1,113,149. They are NON-RADIATING.

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Thousands earning \$50 to \$200 a week in easy, interesting work. You can do it!

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Without obligation send me your book, "Rich Rewards in Radio," which tells all about the opportunities in Radio, how spare time study at home will qualify me quickly as a Certified Radio-trician so I can get one of these splendid positions, and how your Employment Service helps me to secure a big pay job.

Name.....Age.....
Street.....Occupation.....
City.....State.....

RADIO AGE

The Magazine of the Hour

Established March, 1922

WITH WHICH IS COMBINED RADIO TOPICS

Volume 4

March, 1925

Number 3

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A Chat With the Editor

THE month of March, 1925, will develop a situation of vital radio importance. It will not involve any new or radical change in the construction of receiving sets. It will not have any relation to radio engineering triumphs. It will go vastly farther than either of those possibilities. Unless Radio Corporation asks and gets more delay, the month of March will do much to settle the question as to whether there is a radio trust.

The Federal Trade Commission doesn't seem to care a hoot about who's who. The Commission exhibits, however, a lively interest in what's what. The Commission will hear what eight big corporations have to say in reply to the charge that they have entered into a conspiracy to restrain trade—meaning the radio trade. The eight big corporations say it's all bosh. Radio Corporation not only says "bosh," but it is highly indignant that the United States Government should presume to ask questions of a corporation that admits it was organized with purely patriotic motives.

But what we started to say was that RADIO AGE will be represented at that Federal Trade Commission hearing in Washington. RADIO AGE is going to tell the whole truth about the testimony. It may be that our thousands of technically minded readers will not care to have a few of their diagrams and formulas displaced by the story of a trust battle in Washington.

But we insist that our editorial judgment will be vindicated in the long run. The scotching of an illegal radio combine is a job worth while. It eventually would mean much to the buyer of tubes and the seeker of patents and to the manufacturer who is weary of leaping into shell holes when the heavy trust artillery begins to lob 'em over.

What we want especially to see is a picture of Sarnoff and Boucheron, the R. C. A. twins, in action at Washington. With the whole country watching, it ought to be good. Read our reports on this proceeding.

Frederick Smith

Editor of RADIO AGE.

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RADIO EDITORIALS

THE railroads have taken a kick at radio. They have increased freight rates on radio merchandise fifty per cent in the Eastern and Western territory and one hundred per cent in the South. There does not seem to be the slightest justification for such an arbitrary action. It appears that the railroads believe the new radio industry is not yet sufficiently organized to make a good defense. Cold blooded, isn't it?

The Radio Manufacturers' Association has filed a protest against the increase and is being suspended until the Interstate Commerce Commission shall have had a hearing on the manufacturers' objections. It is expected the express companies will follow the example of the railroads.

A special transportation committee of the RMA is composed of: J. M. Stone, Operadio Corporation, Chairman; E. N. Rauland, All-American Radio Corporation; Frank Reichmann, The Reichmann Company; Arthur Freed, Freed-Eisemann Radio Corporation; Powel Crosley, Jr., Crosley Radio Corporation; A. U. Howard, Dubilier Condenser & Radio Corporation; George A. Scoville, Stromberg-Carlson Tel. Mfg. Company; Walter L. Eckhardt, Music Master Corporation. This committee is being strongly backed by special committees in different parts of the United States, the chief object being the raising of funds to defend the radio industry against the railroads.

Every manufacturer, jobber, wholesaler and retailer in the United States is asked to contribute to the fund now being raised. Checks can be sent either directly to the Radio Manufacturers' Association office or to Mr. Arthur Freed, treasurer of the special committee, care Freed-Eisemann Radio Corporation, Brooklyn, N. Y. The address of the Radio Manufacturers' Association is 123 W. Madison St., Chicago.

The reason we call attention to this situation is that if costs are added to the manufacture and distribution of radio merchandise, the manufacturers will be forced to charge the public more for their goods. That means the radio fan will pay the bill, or part of it. Therefore it is to the interest of every fan to support the opposition to the railroad and express companies.

ANOTHER device for increasing the cost of radio is the proposal in some quarters that a tax be voluntarily assumed by radio manufacturers, the revenue from which may be devoted to the payment of radio entertainers. This would result in an indirect tax on the radio fans. It would work out just as the added freight tax would. The question as to who shall pay radio entertainers has been discussed at length and it seems far from settlement. One important

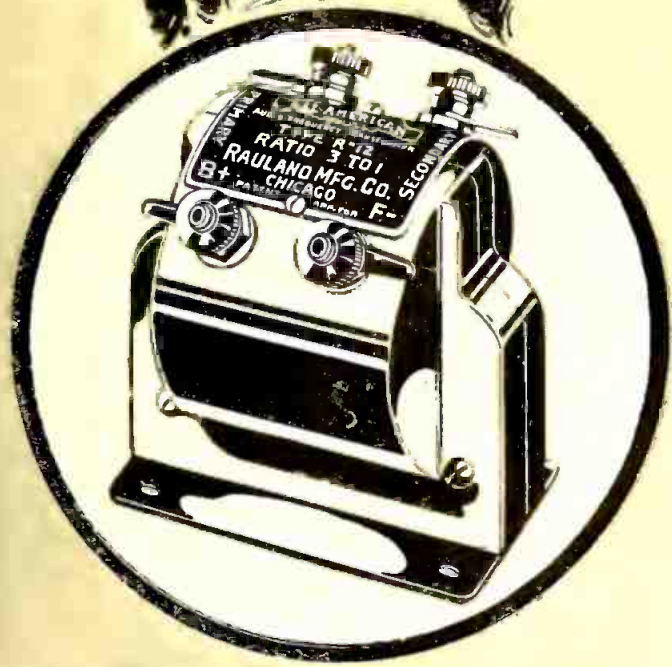
broadcaster tells us he doesn't think it necessary to pay entertainers because most of them are able to get more than full value from the publicity they get from studio announcers and press notices. Many professional musicians and singers demand pay and many are pleased to sing or play without direct remuneration. The American Society of Composers Authors and Publishers has carried on a hard battle against the free use of copyrighted music in broadcasting. The Actors' Equity Society is now demanding that its members obtain pay for their contributions to the nation's entertainment. Some stations in the East are paying their entertainers. It is a problem that the broadcasters themselves will have to settle. It may be found advisable to put a tax on manufacturing and thus indirectly tax the buyers of sets. But some aspects of the demands of entertainers appear to be somewhat extortionate. There is no hurry about a settlement, as the present entertainment is pretty fair.

WHEN will the sale of radio sets reach the saturation point? A long, long time from now. There are said to be 14,000,000 talking machines in use. It is not improbable that the ultimate number of receiving sets will equal that number. In view of the fact that the radio receiver is a more fascinating musical instrument it is likely that the figure, 14,000,000, is considerably too low. There are 17,000,000 automobiles in use. It does not seem improbable that as many radio receivers eventually will be installed. Some observers predict that 20,000,000 will be the ultimate figure. Anyhow it is quite apparent that we are far short of the saturation point. This is more interesting to the manufacturer than it is to the buyers of sets. But it is vastly important to the public. It means this cultural, educational humanizing radio influence is to be extended beyond its present boundaries.

THE CHICAGO Civic Opera Association has closed its season in Chicago with a deficit of \$25,000 more than last year. The managers of the opera are wondering why the music-loving public has failed to respond to grand opera as in former years. Many reasons have been set forth, such as the choice of lesser-known operas, the singing of the operas in foreign tongues, etc. But if we were asked to state our opinion frankly, we'd venture the statement that grand opera in Chicago wasn't a success last season because it wasn't broadcast over the radio. After the 1923 season the Association discontinued its policy of broadcasting three performances a week because it felt radio was "keeping people home instead of sending them to the opera. This year's experience proves their excuse hardly holds water.



What Reliable Radio Means to You



☞ An assurance that, when you try out a hook-up, you can rely on your instruments to give you a fair test. ☞ A knowledge that each part has been put to such searching tests that its proper performance, under any conditions, is assured. ☞ In short, a conviction that each individual part will continue to do its work year after year.

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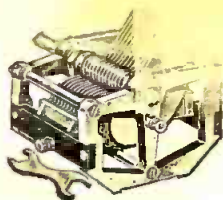
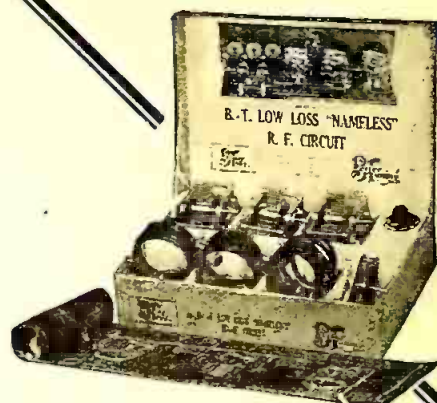
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Consisting of three R-110's, one R-120 and one R-130 \$26.00

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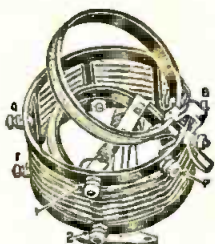
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I have completed your No. 1, using your tuner and condenser. It is the clearest and most powerful regenerative set that I have ever heard. C. F. K.

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I enclose a list of 54 stations received on the B-T No. 2. I find it better than any set I have ever listened to. V. H. S. Jr.

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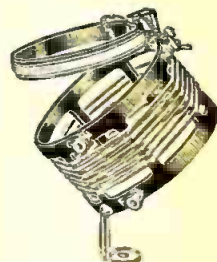
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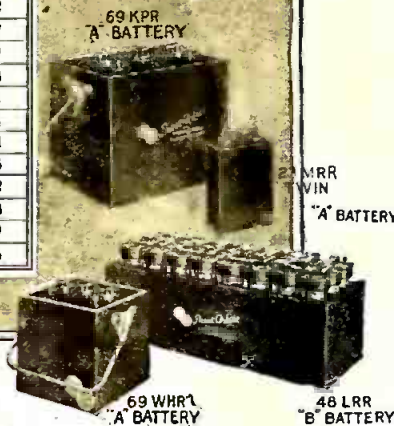
CHICAGO, ILL.

Prest-O-Lite

RADIO CHART

Voltage of Tubes	No of Tubes	Type of Tubes (see foot-note)	Total Rated Amperes Drain	Recommended Prest-O-Lite "A" Batteries		
				Order by following Types	Days between Charges	
5-Volt Tubes C-300 and UV-200 are interchangeable C-301A, DV-2 and UV-201A are interchangeable	1	UV-200	1	69 WHR OR 67 WHR	22 16	
	2	UV-201A	1/2	67 WHR	33	
	2	1 UV-200 1 UV-201A	1 1/4	611 WHR OR 69 WHR	22 17	
	3	UV-201A	3/4	69 WHR OR 67 WHR	29 22	
	3	1 UV-200 2 UV-201A	1 1/2	611 RHR OR 69 WHR	21 14	
	4	UV-201A	1	69 WHR OR 67 WHR	22 16	
	4	1 UV-200 3 UV-201A	1 3/4	613 RHR OR 611 WHR	22 15	
	5	UV-201A	1 1/4	611 WHR OR 69 WHR	22 17	
	5	1 UV-200 4 UV-201A	2	613 RHR OR 611 WHR	19 13	
	6	UV-201A	1 1/2	611 RHR OR 69 WHR	21 14	
	For sets using current at a rate higher than 2 amperes	8	UV-201A	2	69 KPR OR 67 KPR	21 15
					69 KRL OR 67 KPR	22 13
		2 1/4		69 KRL OR 69 KPR	19 16	
		2 1/2		69 KRL OR 69 KPR		

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This booklet gives you the complete Prest-O-Lite Radio Chart—technically accurate recommendations covering both "A" and "B" storage batteries for every type of set.

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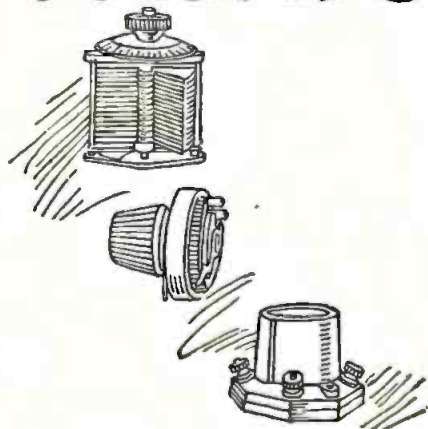




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Devoted to Practical
Radio

Frederick A. Smith
Editor

An Up-to-Date Radio Survey— How SUPER-POWER is Working

By CARL H. BUTMAN

Very Few Complaints Received by Officials

AMERICAN broadcasters have not undertaken what is technically known as "super-power" broadcasting yet, but nine Class B stations have been authorized by the Department of Commerce to increase their power over 1,000 watts, and so far results are satisfactory. Before many months there will be about thirty of these high-powered broadcasting stations on the air, carrying their programs to ever hamlet and farm where fairly good radio sets are in use.

Although some of these stations have been operating for three months, complaints received by the radio bureau of the Department of Commerce are few and are considered as inconsequential.

"The development of increased power in broadcasting to date has been successful, and the Department stands ready to grant further licenses to applicant B stations which are qualified," W. E. Downey, recently appointed Technical Radio Expert, declared to the writer.

"Two more stations have been authorized to make a second step in power," he continued. "WEAF of New York, and KGO, at Oakland, Calif., were successfully operated on 1500 watts without causing undue interference, and recently were increased to 2000 watts without complaint from local or distant fans," he pointed out, explaining the Department's regulations for the use of increased power. Authority is granted only in an experimental way to class B stations, to increase their power to 1500 watts, which may be increased from time to time in steps of 500 watts up to 5000 watts or 5KW, which is also the limit in power of most broadcasting transmitters. But regulations provide—and this is the main point, that the field supervisors of radio are satisfied that no undue interference has been caused with other stations or with receiving set results. Applicants agree to reduce their power if the Department or its representatives deem it necessary in the interest of the public; but not one has been ordered to do so.

Must Be a Limit

TODAY the Department feels confident that the experiment is a success. But at the same time realizes that there is

a limit. If all the B stations increased their power, complications might arise—there would be little doubt of this if all seventy-nine stations of this class went to 5KW and stayed there. Such a situation is not anticipated for some time at least, however.

Such reports as have come in indicate that increased power is causing some interference, although it is not considered as serious. Right here Mr. Downey pointed out that the Department is soon advised when a serious condition arises. It is flooded with telegrams and letters, just as was the case when the fight against increased power was staged at the time of the last radio conference. Thousands of fans, many of whom have since changed their minds, protested against so called "super power," fearing

that a monopoly of the air was planned and that local stations would be blanketed. Some even went so far as to worry about the safety of their own receiving sets, which they feared might be damaged by this "super" bugaboo. Nothing to compare with this flare-up has occurred since the first high-power experimental license was granted to WTAM at Cleveland in November.

An observer on the Pacific coast reports that he doesn't notice any more interference there now than there was on 500 watts, and he has two stations—KGO, Oakland, and KFI, Los Angeles, to test on. Two Florida fans complain of difficulty in separating KFI from stations WCAP and WRC at Washington, all of which are on the same wavelength. This situation is also reported locally in Washington. From New Mexico two other listeners complain that since the increase in power, a Los Angeles and a Dallas station interfere, although they are ten kilocycles apart. These letters are typical, although one other kick is interesting. Some fans in Cleveland and its environs complained of increase in power by WTAM before the increase was authorized and before this station boosted its wattage. This type of complaint is classified along with the "bugaboo chasers," which do not worry radio officials.

Generally, Mr. Downey says that some difficulty is reported in the form of a clashing of side bands, although there is no heterodyne whistle. This effect produces something like the result when two people try to talk over a party telephone line at the same time, or similar to "cross-talk" of some telephone systems. It can be overcome when good sets are well operated, he feels certain.

10 Kilocycles Apart

HERE the official paused, and gave the writer an earful! "All these B stations which have been granted increased power are on wave bands separated by at least ten kilocycles," he said, "and most of them are 500 miles apart. If we authorize increased power to two stations in the same city, they should operate on remote channels, at least 100 kilocycles apart. With this system



(Harris & Ewing Photo)

W. E. Downey, recently appointed radio technical expert of the Department of Commerce

in operation, the reaction of the fans will be in exact proportion to the selectivity of their sets. Those who complain will probably be operating poorly designed sets which are selective, or they will be listeners who can't tune their sets. It is usually this type of fan who complains most bitterly on every excuse. We must face this fact," he went on.

"Two stations on identical wavelengths on opposite coasts, which did not interfere at all when using 500 watts, may interfere and they do in some instances when they use 1500 watts."

This also may apply to two stations only 500 miles apart. Downey expects some difficulty with increased power.

"On the other hand," he pointed out, "it extends the scope of stations tremendously; it overcomes static considerably; it will undoubtedly improve summer-time and probably daylight transmission and will decrease fading. This means a lot to fans all over the country, who will be able to pick up more stations, and even more to the small set owners who previously got only a very few neighboring stations," he concluded.

The nine B stations now authorized to operate at over 1000 watts, with their power and wavelengths are listed as follows:

Station	Owner	Location	Power-watts	Wave-length meters
WEAF	A. T. & T. Co.	New York, N. Y.	2000	492
KFI	Anthony, E. C.	Los Angeles, Calif.	1500	469
KYW	Westinghouse Co.	Chicago, Ill.	1500	535
WBZ	Westinghouse Co.	Springfield, Mass.	1500	333
KGO	General Electric	Oakland, Calif.	2000	309
WGY	General Electric	Schenectady, N. Y.	1500	380
KFKX	Westinghouse	Hastings, Neb.	1500	288
WOC	Palmer School	Davenport, Iowa	1500	484
WTAM	Willard Bat. Co.	Cleveland, Ohio	1500	390

It is understood that there are eight more stations contemplating an increase of power to 1500 watts. Two of them ordered 5KW sets from the Western Electric Co. They are: the Zion Institute station in Illinois, WCBBD, and the Crosley Co., at Cincinnati, WLW. Others reported as planning to install higher-power sets are: WSAI, the U. S. Playing Card Co., at Cincinnati; WCCO, Washburn-Crosby Co., at Minneapolis; KOA, the General Electric Station at Denver; KPO, Hale Brothers, at San Francisco; WEAY, the Iris Theatre, at Houston, Texas; WLS, Sears Roebuck, Chicago, and WTAS, Chas. Erbstein, Elgin, Ill.

In case these stations apply for licenses and are O. K.'d by the Department, there will soon be seventeen high-powered broadcasters on the air. About eight more stations are said to have planned additional power, but their names are not available.

No Power at 2500 Watts

NO station has yet applied for 2500 watts, and no actual super-power broadcasting license is on file, although

rumors have it that the contemplated super-broadcaster of a large corporation in the neighborhood of New York, is to become a reality before many months.

Outside the United States the urge for more power is also felt.

The operation of a set with between 5 and 10 KW power in Canada is said to be successful. A new British broadcaster rated at 25 KW, but capable of 100 KW, is being erected at Daventry to operate on 1600 meters. It is heralded with anything but fear of interference, even in that

fort to reduce interference and to create more channels for the growing broadcasting service. At that time there were 519 broadcasting stations of three classes. They included fifty-seven class B, or higher-powered stations; seventy-eight class A, and 382 class C stations, the last stations on the original broadcast wave of 360 meters. Many more stations were contemplating transferring to a class B status, but wavelengths were getting very scarce in that group, where each station desired and expected an individual and exclusive air route.

Developments in the past year had shown that many stations were reaching a position in type of programs, territory covered and reliability of equipment, which made it desirable to grant them exclusive wavelengths and more power in the interests of high-class programs and public service. This was done gradually and fifty-seven B stations were on the air when the conference met, besides which about twenty more had applied or were preparing to ask for a class B status. After considerable deliberation, the conference laid out a plan for allocation which would provide



The map showing the first distribution of super-power broadcast stations throughout the country. Note that no two are close enough to seriously interfere with each other. KGO and KFI may prove exceptions, for they are not very far apart, but Government officials assure radio fans the air will not be congested by the strong stations.

small territory, compared with the great expanses of the United States. It is hoped that the British super-station will carry programs to crystal-set owners within a radius of 100 miles, which is something for this type of fan to look forward to indeed. France has a 20 KW station in operation.

Here in the U. S. A., officials and most fans are pleased with the development of higher powered broadcasting and look for better transmission and reception throughout practically every state of the Union.

Broadcasting will not become all high-powered, however; some stations, like WHAZ at Troy, are satisfied with 500 watts. WHAZ claims the long-distance record of 10,000 miles and reports regular reception in thirty-two states—the British Isles and Europe. There will continue a need for medium sized and even purely local broadcasters, and certainly there is room for all types.

What's Going on

WHAT Secretary Hoover and his radio force is trying to do with the wavelengths in the broadcast field seems to be a mystery to many fans, despite considerable comment in the press each day. Briefly, he is trying to improve conditions in the broadcasting traffic, and has put every available channel in use.

When the Third National Radio Conference met in Washington last October, a plan for the reallocation of wavelengths in the whole field of radio transmission was proposed, chiefly in an ef-

vide forty-seven separate channels for distribution among the class B stations, some few of which would have to use the same wavelength. Distance and time, it was believed, would make this practical.

But the class B applications began to increase, and when the field representatives of the Department tried to argue with the owners of high-powered stations to split time and shift their channels, difficulties increased materially. The original conference plan had to be abandoned.

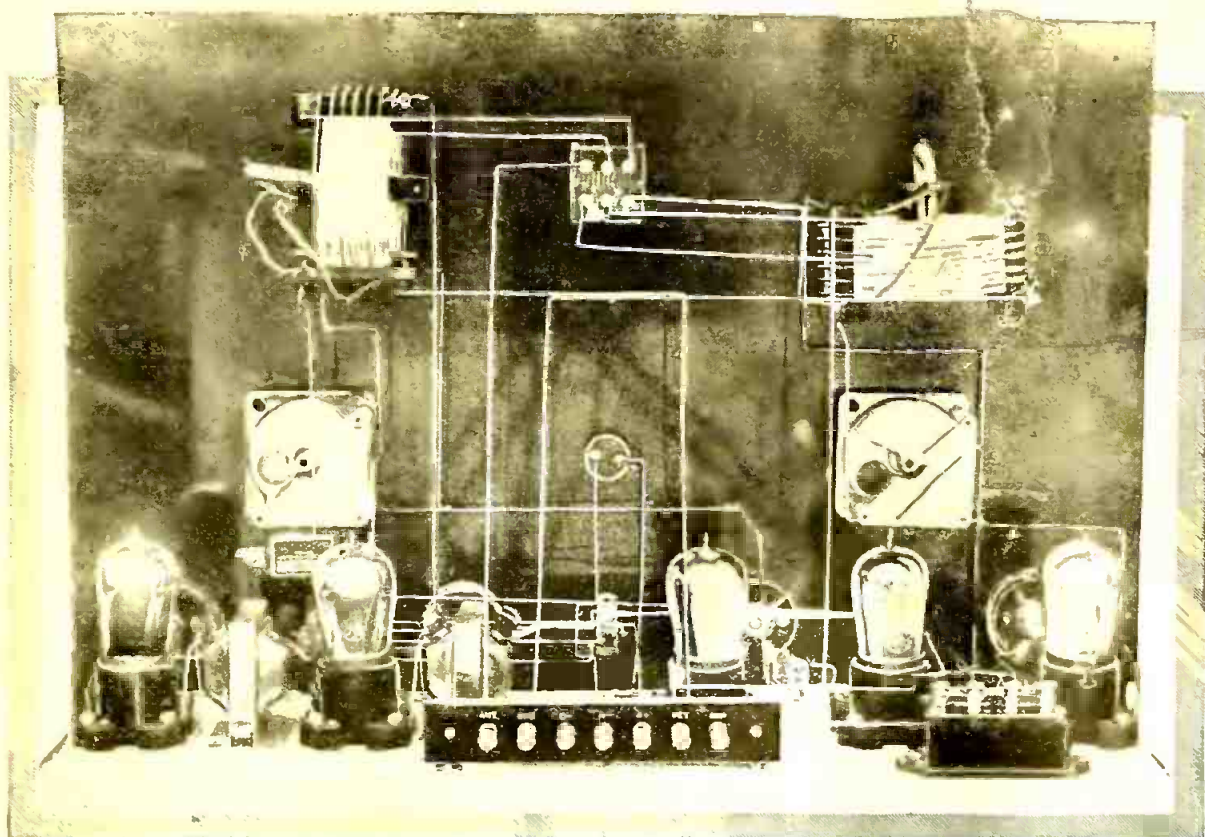
During the past three months, the radio experts of the Department of Commerce have tried out several other plans for increasing the number of channels in the band allotted to the B stations, but to date they have arrived at no practical scheme which insures a satisfactory arrangement between the broadcasters and the fans.

"C" Stations Gone

THEY have eliminated the old Class C stations which have carried on on the 360 meter wave. The others have either transferred to Classes A or B, or dropped out. No more Class C stations are being licensed. This leaves only two classes of broadcasters, except for two stations carrying on experiments under what is termed Class D, or development licenses.

The real problem before the Department of Commerce concerns redistributing the Class B wavelengths without making the interference worse than it is today.

Penetrating Through the "Locals"



From the rear. Two ordinary low loss three circuit couplers and two low loss condensers form the tuning elements of this five tube receiver. Wide spacing for reduced losses is a noteworthy feature and explains the large size of the set. There aren't many parts and it's easy to see where they are placed.

RADIO reception may easily be divided into two main sections—local and distant. Conditions conducive to both are not necessarily the same, and each branch of reception finds conditions not met in the other. Generally speaking, local reception predominates and as far as city dwellers are concerned, ordinarily prevents much DX listening until the nearby stations sign off.

A receiver capable of penetration through local opposition is more or less of a rarity, just because such a receiver is rather difficult to tune and is so very sharp in its dial settings that it is not a simple matter to set the dials just right even for locals. Therefore, it seemed to me that some sort of change-over switch which would very greatly sharpen the tuning when DX reception through locals is desired would meet the problem most effectively.

And to permit of good distant reception, it goes without saying that two stages of radio frequency are requisite. To permit handy tuning, the two-dial method seems superior to the three, inasmuch as nature saw fit to endow us with but two hands and we are not yet sufficiently dexterous with other appendages to call upon them to twist a third control. Therefore, the penetrator includes a stage of tuned radio frequency, a stage of transformer-coupler radio

A Double Duty Set—Twice Tuned and Twice Regenerative

By *BRAINARD FOOTE*

frequency, a detector and two stages of audio—five tubes in all. To yield the very best of sensitiveness, a regenerative control is embodied in both the radio frequency tuned circuit and in the detector.

TO SUIT these specifications, two standard three circuit tuners or couplers are employed; one to tune the R. F. amplifier and another for the detector. In each case it is necessary to reduce the number of turns on the tickler coils to about 15 turns, although otherwise the instruments are used as manufacturered. It is not essential that any particular style of coupler be selected, so long as the low loss type of construction is adhered to. The primary should have approximately six turns of fairly heavy wire and the secondary about 45 to 50, depending somewhat upon the size of variable condenser called for.

The views of the outfit reveal an unusually large size of panel and cabinet—possibly a drawback on account of the increased cost of these parts. The choice of so large a layout was made following tests of spacing between instruments

made throughout the recent transatlantic broadcast tests. With couplers close to the condensers and fairly near each other, although at right angles, volume

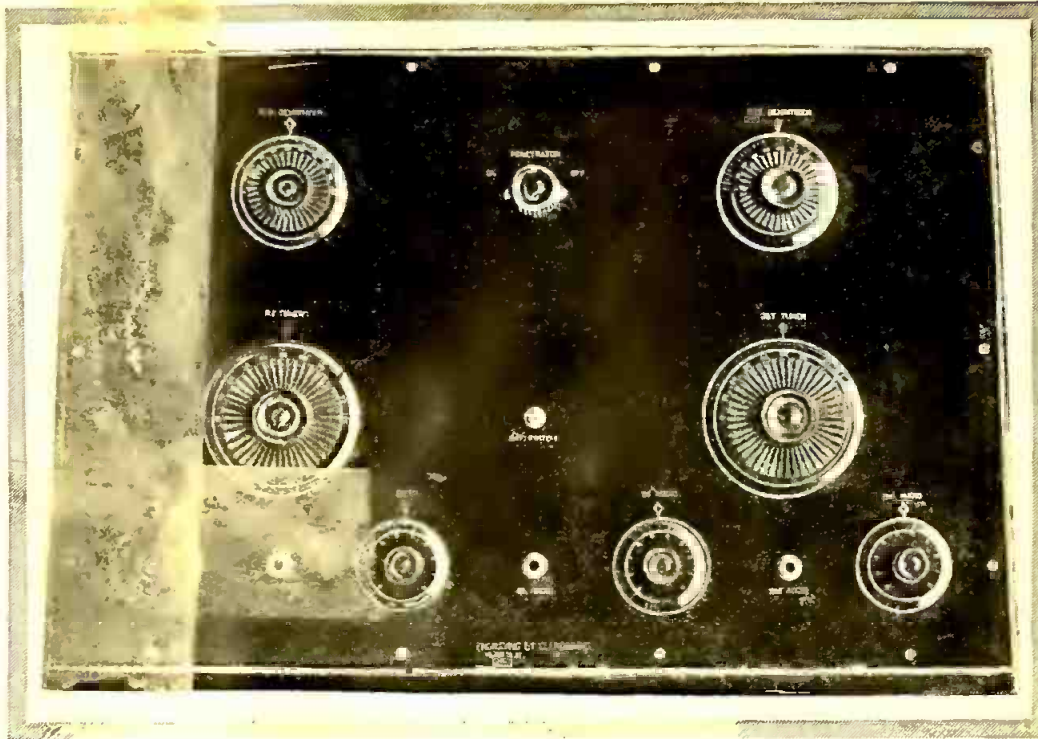
from the stations across the water was fair, but with much wider separation the losses of various sorts were so reduced that very pleasing results were obtained from English, French and Spanish stations. KHJ's transmission was followed in the same manner (in a location near New York) and improved results always followed when the instruments were spread far apart.

The front panel shows quite well just how the various instruments are situated. Along the bottom are four rheostat controls, the first for the two R. F. tubes, the second for the detector and the other two for the two stages of audio. Between them are three jacks, for headphones; one stage for local loud speaker work and two stages for DX loud speaker work. The rheostats are all included to give 100 per cent flexibility of control.

Main Tuning

JUST above these and at the center is a battery switch, whereby all tubes may be turned off without necessitating changes in the rheostat dials, these always being left at the best operating points. The two large dials control the two variable condensers by which tuning

is accomplished. These ought to be of the vernier type unless there are vernier attachments on the condensers. Above each tuning dial is the tickler dial for the particular coupler tuned by the condenser underneath. And between the tickler knobs is found the most important feature of the set in one respect: the penetrator switch. This is a double pole double throw-jack or anti-capacity switch and it is connected so as to reduce the number of turns not only in the antenna coupler



Front panel of the Penetrator. The four rheostat dials aren't touched once; they are set, since the battery switch turns tubes on and off. Two large dials accomplish the tuning, and smaller ones above them control sensitiveness when DX is wanted. A switch alters the coupling in two places to bring great selectivity for DX reception through local stations.

cuit, so that the settings of this dial should be "logged" for reference. The dial readings of the other condenser change a half degree or so when the switch is moved across, but they agree so very closely anyway that the settings of one dial are sufficient for tuning. In the case of the detector dial, the settings can be read to half a degree or even less if one wishes and the elimination of a third tuning dial or a 2 stage R. F. outfit greatly simplifies the matter of dial listing and tuning for a station time

but in the detector coupler primary winding as well. Ordinarily, low loss three circuit couplers are constructed with a six turn primary winding. With the switch, these primary coils are tapped at the second turn so as to change to a two turn primary in each case and in that way gain a remarkable degree of selectivity.

By having the two coupling settings, we are enabled to use the 6-6 setting for local reception, the 2-2 setting for DX reception through locals, and the 6-6 setting for DX reception when the locals sign off the air. Of course, greater vol-

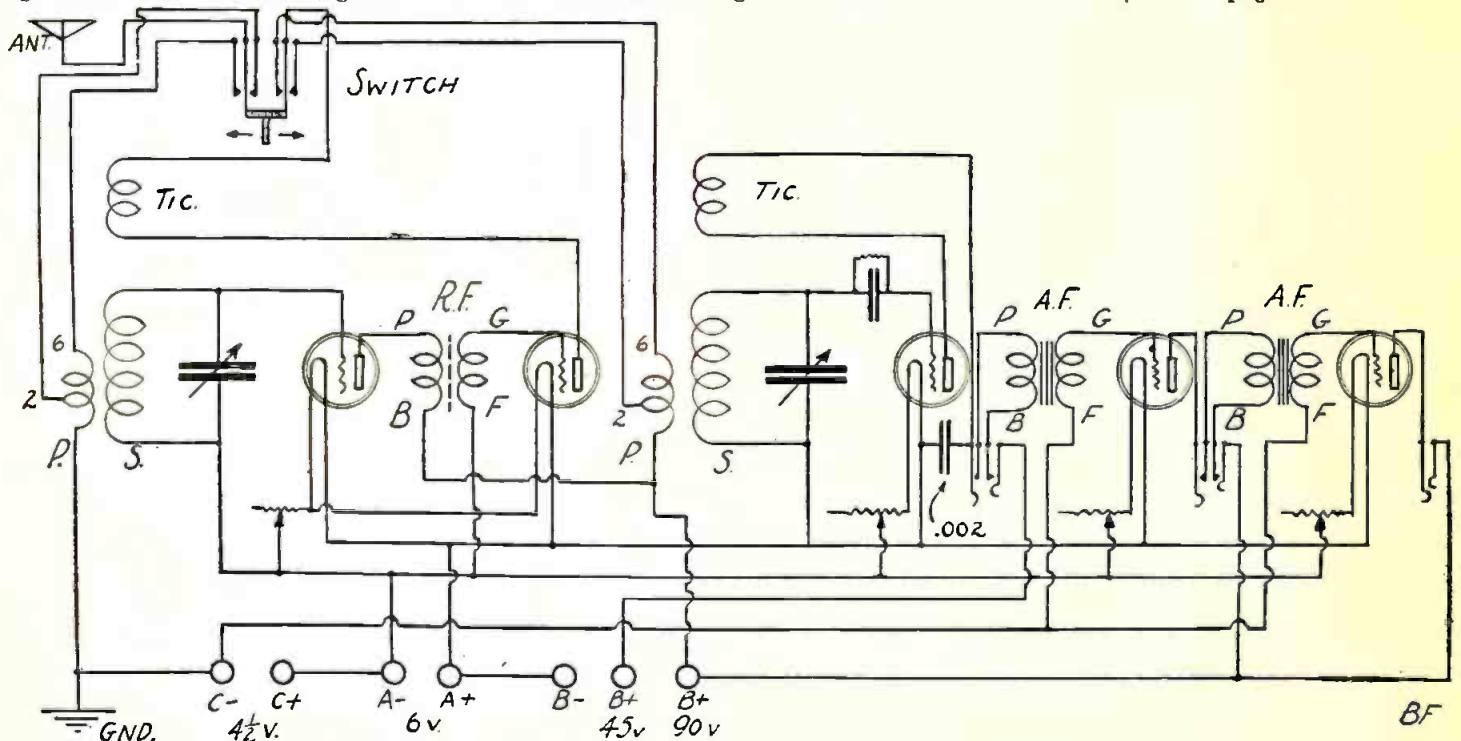
ume is to be had with the 6-6 position of the penetrator switch, but on the 2-2 setting it is possible to hear dozens of distant stations through the locals that would never be gotten at all with any receiver of average coupling. And when the locals have finished for the evening, it is a simple matter to "flop" the switch over the other way and receive the DX fellows with much more volume and with greater ease of dial adjustment.

The alteration in coupling has no effect whatsoever on the dial setting of the condenser tuning the detector cir-

and again.

In the Country

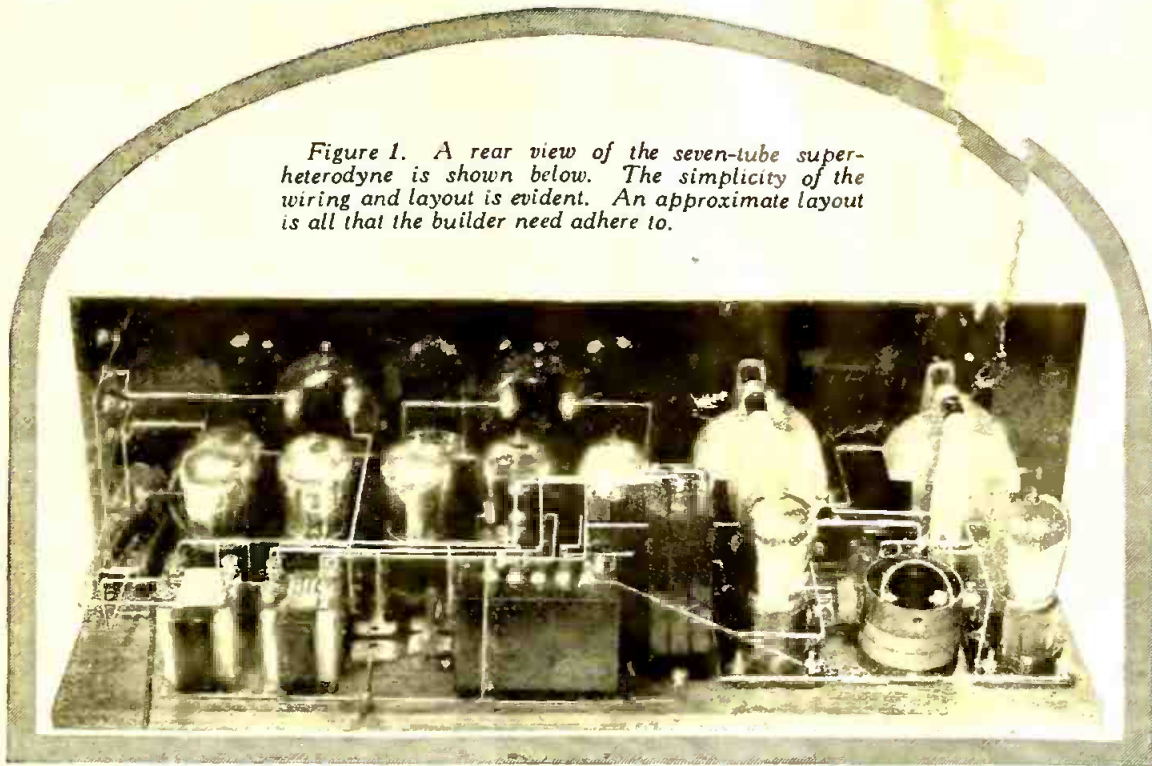
READERS of RADIO AGE who are not included in urban populations where the DX local problem isn't so acute may be interested in the value of the penetrator switch to them. In a location 150 miles south of Washington, D. C., in Virginia, the penetrator was installed with a 6 by 2 foot wire screen ground and a 100 foot antenna about 25 feet high. In a few evenings, over seventy stations were listed (Turn to page 65)



Note how the penetrator switch changes coupling from 6 turns to 2 turns in both coupler primary coils and how the tickler feed-back is accomplished in both radio frequency amplifier and detector. Hard tubes are employed all the way through.

Q A Receiver That Will Serve for Years

Figure 1. A rear view of the seven-tube super-heterodyne is shown below. The simplicity of the wiring and layout is evident. An approximate layout is all that the builder need adhere to.



Embodying the Latest in Radio in A 7-tube Super-Heterodyne

By McMURDO SILVER

DURING the past year and a half the super-heterodyne receiver has come in for an ever-increasing amount of justly deserved popularity, for there is no question but what this receiver is the most satisfactory system ever developed for broadcast reception.

Since the presentation of the first constructional articles on broadcast super-heterodynes, many developments have taken place and the latest type of super-heterodyne bears very little resemblance to its predecessors of a year or two ago. The reasons for this are only the reasons for the gradual improvement which takes place in any type of engineering equipment during a period of years. In this case, developments have taken place very rapidly, for a few years ago little or nothing was known about practical super-heterodyne designs and the method of building each section of the receiver in the most efficient possible manner.

Re-radiation and consequent interference with neighboring receivers has been one of the points upon which the super-heterodyne receiver has been condemned by a great number of enthusiasts, many of them possibly having had no practical experience with this receiver. In a number of tests conducted to determine to what extent this radiation was detrimental to neighbors' reception, several conditions were noticed.

In one of the tests, two super-heterodyne receivers were set up operating

approximately fifty feet away, each on a loop and each tuned to the same station. No trouble was experienced due to radiation from either receiver when the sets were in a condition where the signal was heard. If, however, the oscillator of one receiver was set directly upon the wavelength of the transmitting station (a condition in which a signal could not be heard on this particular set), a slight amount of interference was noticed on the other receiver. As soon as the neighboring oscillator was moved off the signal wavelength and back into the adjustment where it produced the necessary beat, no interference was noticed.

In another test, a super was connected to a seventy-five foot antenna and a 6 tube receiver of a rather sensitive type was set up in conjunction with its loop twenty-five feet away. About the same conditions were noticed; when the oscillator was in resonance with the antenna circuit, radiation was evident, but when it was set at a position to produce the desired beat with the station heard, no radiation was noticed.

Then the antenna coupling of the super was loosened up to a point where only one turn was used between the antenna and ground. The signals retained practically their original intensity, but the radiating effect of the super was cut to a very great extent; in fact, down to a point where it could barely be noticed, using head phones on the output of the r. f. set.

From these and other tests the writer feels it safe to conclude that the radiating proclivities of the super-heterodyne are very much over-rated, and at best they are only disturbing when the oscillator and loop circuits are in resonance.

The average experimenter, when undertaking the construction of a super-heterodyne receiver, wishes to feel that he is building a receiver which embodies not only the very latest advances in the art, but which will continue to give results in excess of other receiving systems over a period of several years, since it is safe to expect no radical developments in radio for some time to come—despite the propaganda to the contrary.

The Last Word

THE receiver to be described may safely be said to be the latest word in super-heterodyne designs and embodies to perfection the five prime receiver requisites of sensitivity, selectivity, ease of control, quality of reproduction and simplicity of assembly.

Every worth-while designed feature found in equipment such as is supplied to the Signal Corps, Navy Department, has been recognized and utilized to best advantage.

The receiver itself embodies seven tubes—a regenerative first detector and oscillator, two intermediate frequency amplifiers and second detector and two

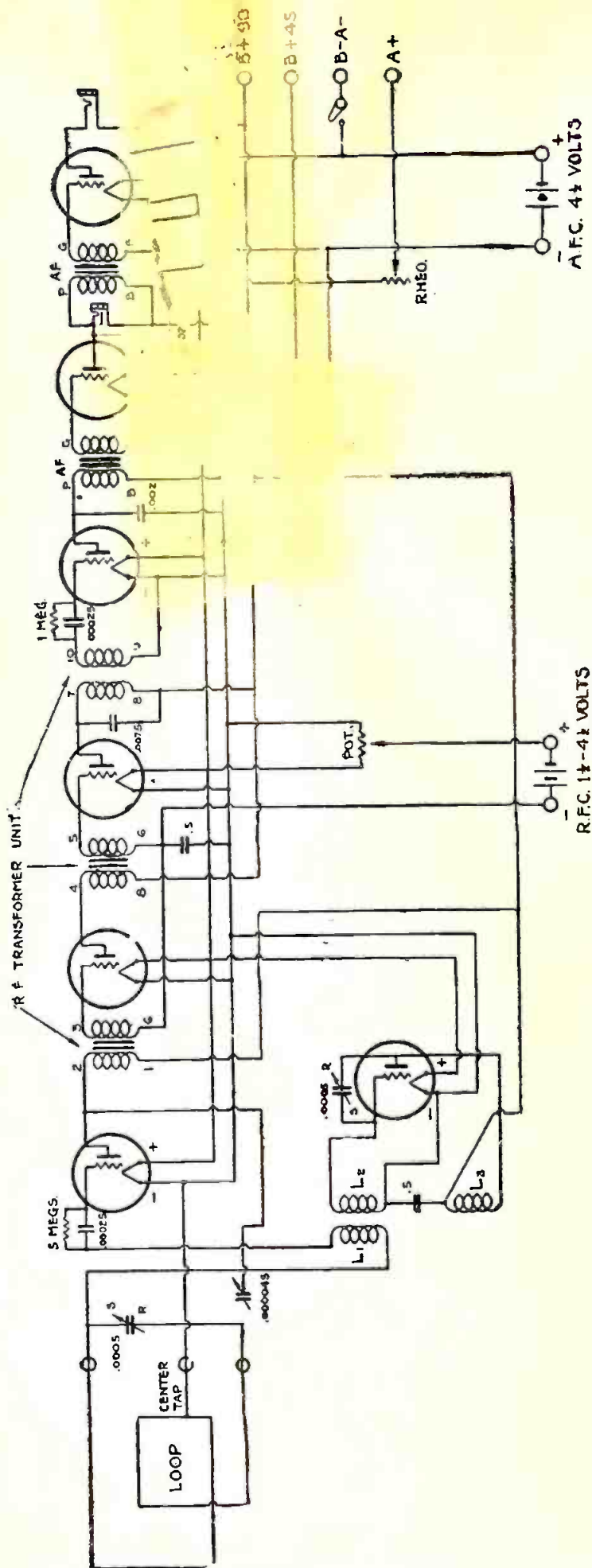


Figure 2. Wiring diagram for the new type of super-heterodyne as described by Mr. Silver in the accompanying article. Note that only one rheostat is used to control the tubes.

audio frequency amplifiers, and will cover a wavelength range of from 200 to 600 meters with a distance range depending upon individual conditions of from 500 to 5,000 miles for loud speaker reception.

The seven tubes used in the outfit may be either dry cell or storage battery tubes of any standard type on the market and are employed in such a manner as to give maximum efficiency in each circuit.

For various reasons the use of the second harmonic principle or other systems of combining the functioning of the first detector and oscillator in one tube will generally result in a decrease in results about equivalent to the elimination of the one tube that is saved by such a system.

The first detector circuit, being regenerative, permits of maximum sensitivity and selectivity. The sensitivity of this set as a whole might be compared to other super-heterodyne systems employing a non-regenerative first detector circuit, as one would compare a non-regenerative tuner to a regenerative tuner. The intermediate frequency amplifier represents a real step ahead in super-heterodyne designing, since but two stages are employed.

The transformers function at a frequency of approximately 60 kilocycles or 5,000 meters, but this will vary somewhat with the tubes. They are of the iron core type with a sharply tuned air-core output transformer, and give a voltage amplification of from 1½ to 3½ times that of any other transformer now available. Two stages of amplification with these transformers are entirely sufficient to get down to the noise level under extremely favorable conditions, and the use of a third stage would not be warranted, especially as it would give practically no increase in amplification. The second detector and radio frequency amplification employ combination circuits and will be found to give extremely satisfactory results from the standpoint of amplification and quality of reproduction.

It is suggested that if the builder desires to make the set with the absolute assurance that he cannot do better, it would be advisable to employ instead of the transformer unit, a combination of two 60 k. c. intermediate transformers and one 60 k. c. filter transformer. These, however, should only be of a type supplied with laboratory amplification curves, the filter being tuned to the peaks of the other two transformers and supplied with the exact condensers for tuning it which have been used to get the peak shown on its curves. The use of these transformers with their individual amplification curves insures a uniformity which cannot be approached by uncharted transformers and reduces the variation in their operating characteristics to the extremely low value of 1% compared to a variation of from 5% to 15% with uncharted transformers.

What About Results?

THE average fan is interested, when all is said and done, in the results that he may expect from the set, and reports on this design have been more than favor-

able. One builder in New York state received KGO (Oakland, California), at a distance of 2,800 miles with loud speaker volume on an 18 inch loop, every night that KGO was in operation for two consecutive weeks. The set he used employed seven 199 dry cell tubes. These results are exceptional, and speak volumes for the set, although it must be realized that they were dependent to a great extent upon location.

However, sets of this type throughout the country have given extremely satisfactory results in practically all cases, bringing in opposite coasts, especially in Chicago.

One set used by Captain Irwin brought in stations on both coasts and Canada with loud speaker volume on a small loop, while being located in Las Vegas, New Mexico. So much for results.

The set itself may be used with either storage batteries or dry cell tubes without a change of any values at all in the circuit or assembly, except that different sockets will have to be used for different types of tubes. The results will be substantially the same with either storage batteries or dry cell tubes, although dry cell tubes (199s, 199s and DV3s) are recommended, as results will be the same as with 201A tubes, and the set will be very much more satisfactory to handle.

The Materials

THE material required to build the set is as follows, and will cost approximately \$64, less cabinet and accessories:

- 2 .0007 Low Loss condensers.
 - 2 4" moulded dials, tapered knobs.
 - 1 6 or 7 Ohm rheostat.
 - 1 150 or 400 Ohm potentiometer.
 - 7 Insulated top binding posts.
 - 1 Two spring jack.
 - 1 One spring jack.
 - 1 R. F. Transformer Unit, or 2 60 K. C. charted transformers and 1 60k. C. charted filter
 - 1 Oscillator coupler.
 - 7 Sockets.
 - 2 Audio transformers.
 - 1 On-Off switch.
 - 3 .5 Condensers.
 - 2 .00025 Mica condensers with leak clips.
 - 2 .002 Mica condensers.
 - 1 .0075 Mica condenser.
 - 1 .000045 Balancing condenser.
 - 1 5 megohm Grid Leak.
 - 1 1 megohm Grid Leak.
 - 1 7x24x3-16" Bakelite panel.
 - 1 7x23 1/2" Oak Base Board, Bus-Bar, spaghetti, screws, nuts, solder, lugs.
- The tools required to assemble this set will be a pair of pinchers, screw driver, soldering iron, one

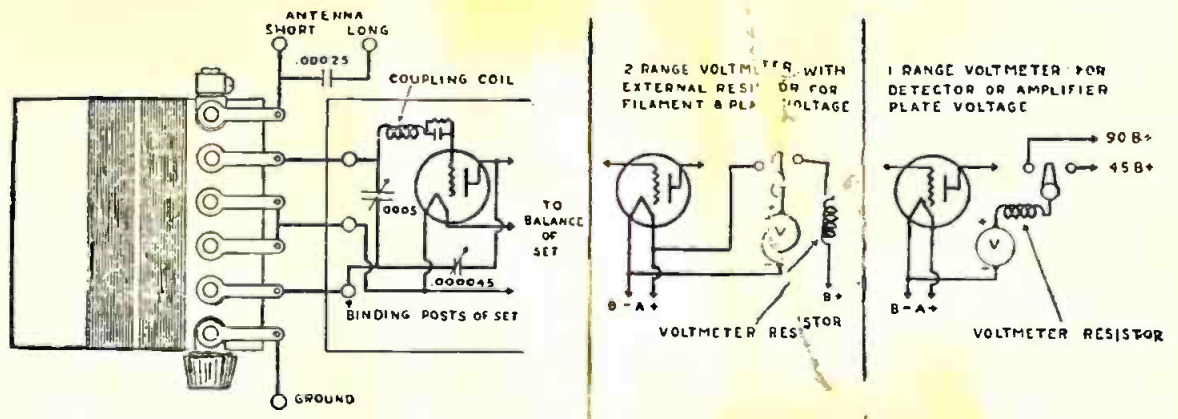


Figure 3. The above diagram shows the method of wiring the oscillator coupler and also the method of wiring the voltmeter to permit of reading the voltage on both the "A" and "B" battery.

drill with drills, and countersink. If a drilled and engraved panel is purchased, this will be unnecessary.

A front view of the set is shown in Figure 4, with a rear assembly view in Figure 1. The voltmeter shown may be used or it may be omitted as desired. Its only advantage is that it permits resetting the tubes at the same operating point each time the set is used and acts as a check on the condition of the batteries. The meter shown is for both A and B batteries. A small key switch is shown below it and the spool attached to this switch is the voltmeter multiplier which is used when reading B-battery voltage.

Laying the Panel

THE panel should be laid out in accordance with the drawing and all holes drilled and countersunk. If the builder desires, it may then be grained by rubbing in one direction only with fine sand paper and oil until all traces of the polished finish have been removed. The condenser, rheostat, potentiometer, binding posts, jacks, etc., should be attached to the panel as shown in one of the figures. All parts should be screwed on the baseboard as shown, using 1-2" or 3-4" wood screws, the holes being first started with a No. 45 drill to facilitate proper location of the parts.

Each individual piece of equipment should be checked over carefully to make sure that all nuts, screws, etc., are tight and that all springs on sockets are bent up and are making contact. If this is done, it will save trouble later on after the set has been completely wired. Lugs should be attached to all binding posts or terminals, to which the wiring should be soldered. The wiring may be done with

either tinned bus-bar or with magnet wire, say No. 20 or 22, with the insulation scraped off, run in spaghetti. The bus-bar wiring makes a neater job, but is a little more difficult. Spaghetti is recommended throughout if magnet wire is used, but need only be employed in bus-bar wiring where there is danger of wires coming in contact and short-circuiting.

If a well-tinned iron is used and each wire and lug tinned separately before endeavoring to make a joint, little or no trouble will be experienced. A very small amount of non-corrosive soldering paste will help materially, and will tend to make very much smoother joints than if only rosin core solder were used. In wiring the set, the panel with its instruments should be wired first and then all wires put in place on the baseboard before the panel is actually screwed to it. This will leave only a few wires to be run between the panel and the baseboard and will simplify this job very much.

If the builder wishes to make the oscillator coupler, it may be constructed by winding the grid and plate coils on a 2 1-4" Bakelite tube 2" long, each section being wound with about thirty turns of No. 30 D. S. C. wire.

The rotor consists of a 1 1/2" tube, 1" long, wound with 18 turns of the same wire, and should be located in the center of the stator tube and arranged so that it may rotate. If it is desired to use other transformer instead of the transformer unit, a good type of charted long wave iron core transformer with a filter may be employed.

If this is done the left hand transformer in the diagram will have its terminals corresponding to the numbers shown as follows: Number 2 will be "P"; Number 1 will be "B-plus"; Number 3 will be "G"; Number 6 will be "A-Minus." The middle transformer will have four equal to "P" five equal to "G," six equal to "A-Minus" and 8 equal to "B-plus." The right hand or filter transformer will have ten equal to "G," 7 equal to "P," nine equal to "A-minus," and eight equal to B-plus. The .0075 condenser shown across (Turn to page 58)

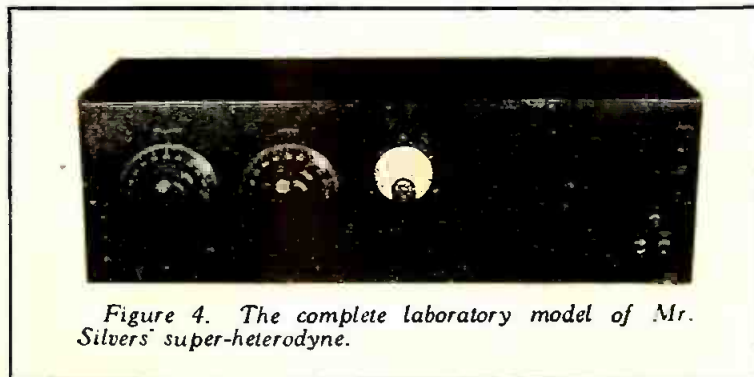
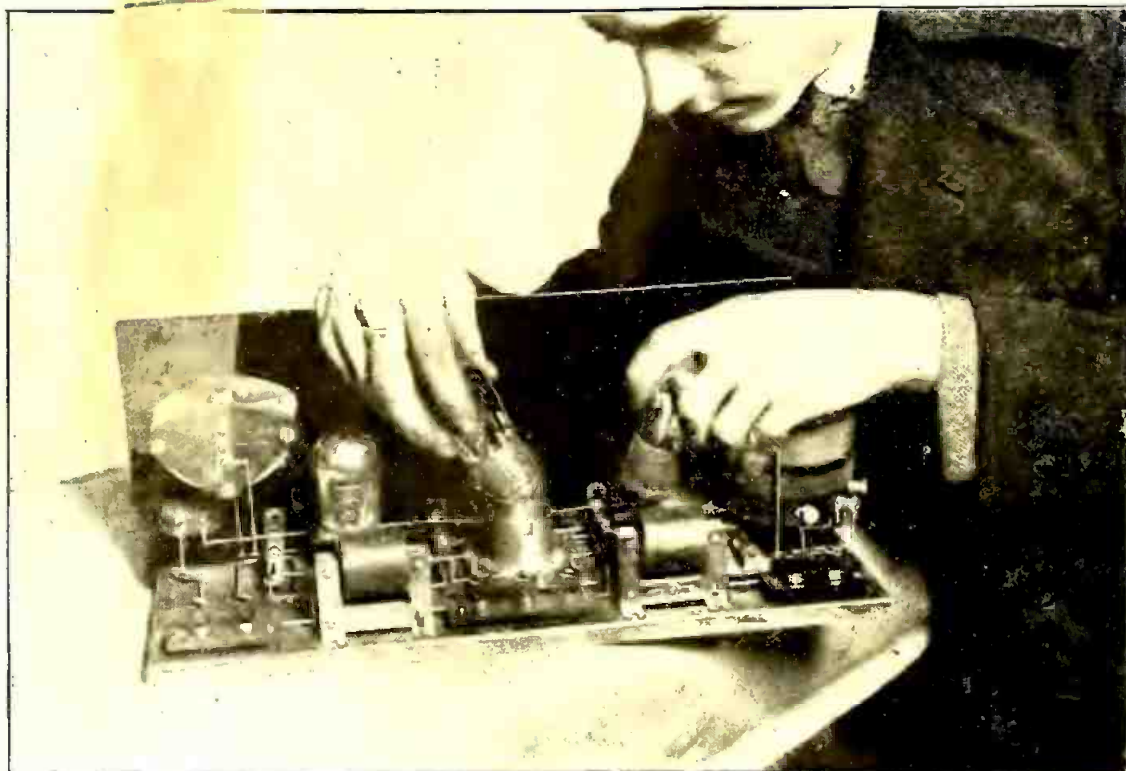


Figure 4. The complete laboratory model of Mr. Silvers' super-heterodyne.

Don't BLAME the HOOKUP

By ROSCOE BUNDY

No set will work if the tubes aren't right. Some tubes are better as R. F. amplifiers, some as detectors and others as amplifiers. Change them around till you find where they work best



In Most Cases the Fault Lies in the Lack of Proper Workmanship or in Poor Materials; Bad Soldering Leads in Causing "Flukes"

THERE is always a tendency toward charging up all troubles to the hookup, but in 99 cases out of a hundred the fault will be found due to errors in construction or to defective materials. Since 1922 the writer has serviced some 500 home built sets and in practically all cases workmanship, or rather lack of workmanship, lay at the bottom of the difficulty.

For those interested in statistics it will be thrilling to note that there is only one man out of one hundred who understands soldering, and as soldering is the basis of a successful receiver, this deficiency stands at the head of the trouble list. Some of the amateur-soldered joints that I have seen would give a telephone man acute hysterics. Joints partly soldered with a cold iron, joints stuck together only by the flux, soldering attempted without any flux at all, joints soldered with acid flux, etc., etc.

In the first place, we must supply sufficient heat by means of the soldering iron to melt the solder to the point where the metal is completely fluid and flows as readily as water. Heating the solder with a cool iron to a stiff paste will not produce an electrically perfect joint.

Secondly, the parts to be joined must be heated up before solder is applied by simply resting the soldering iron on the parts. If the lugs or wires are cold, they will chill the solder and thus prevent adherence. Large screws and nuts require considerable heating before they are hot enough to amalgamate with the solder. A cool iron is only capable of melting the flux and not the solder proper; thus with a cool iron we tend to stick the parts together with flux.

Next in importance comes cleanliness. Solder will not adhere to dirty, rusty, greasy surfaces. The surfaces of the metal must be scraped bright with a scraper or file and must not thereafter be touched with the fingers until the soldering is completed. Finger marks leave greasy spots which will not take solder. In addition to a clean surface and the proper heat we will require some fluid that will chemically remove all dirt not removed by the scraping and which will reduce all oxides that may form after the scraping. Such materials are known as "Fluxes" and are represented by rosin, sal ammoniac, and similar compounds which readily dissolve many of the metallic oxides. The best flux for soldering brass and copper parts is

plain pure rosin. Acids should be carefully avoided as they draw moisture into the connection and are responsible for many partial short circuits as well as producing a noisy circuit.

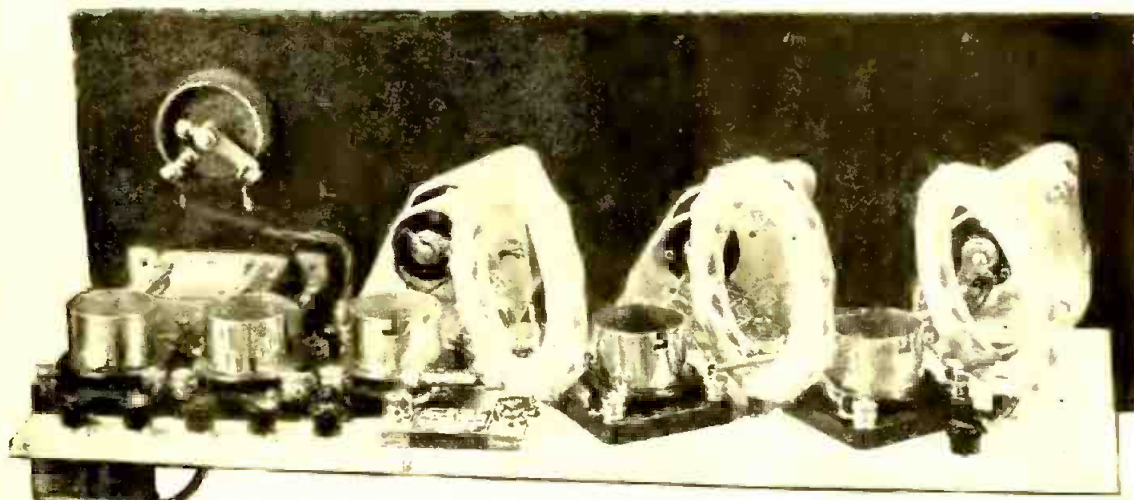
Don't Waste Flux

ONLY enough flux should be supplied to cover the surface completely and no more. An excess of flux makes a dirty-looking job and may flow into the joint, causing an open circuit. Rosin is an excellent insulator, hence if it gets into the joint, it will prevent electrical contact. So much flux is used by many beginners that the wires are simply stuck together by rosin without the solder coming into contact at all. Such joints are mechanically weak and may be detected by giving the wire a good shaking after the solder is applied. If the wire breaks loose, you may be sure that it has simply been stuck on by the flux. Don't be afraid to shake the wires well, with a firm grip. Treat 'em rough.

Next on the soldering subject comes the connections made to fixed condensers. Don't make any solder connections directly to fixed condensers in such a

(Turn to page 68)

For Coast-to-Coast Reception— A Compact FIVE TUBE SET



Back panel view of the "non-oscillating" set described in this article. The coils should be mounted at the angle shown to prevent of interstage coupling.

ALMOST daily the author of this article has been approached by fans in quest of information on how to construct a good coast to coast receiving set, which is not too complicated for the general run of set-builders, not too expensive for the average pocket-book and not as big and bulky as the average five-tube receiving set.

This was by no means an easy problem to solve. However, after much shopping and not a little engineering, accompanied by the usual disappointing results, the five-tube "de-luxe" receiver to be described in this article was produced, giving the desired range and volume and mounted on a panel as small as seven inches by eighteen inches at a total cost of only \$16.45, including a fairly good cabinet. Accessories, of course, are not included.

The circuit is of the tuned radio frequency type and is non-oscillating. A "DX getter" of the first order, with lots of volume and producing features similar to the neutrodyne type of circuit without the troublesome task of neutralizing or balancing the set.

Weak Signals Amplified

BY TUNED radio frequency, we mean a type of circuit which amplifies the incoming signal at radio frequency, before it is applied to the detector tube and changed to audio

By H. FRANK HOPKINS

Here's a DX Set of the Tuned R. F. Type

frequency, or the frequency at which reproducers (head phones or loud speakers) will respond. This feature makes possible the reproduction of signals otherwise too weak to operate a detector tube when applied directly to that tube, thus increasing the range of the set in proportion to the radio frequency amplification applied, which in this set is two stages.

The non-oscillating feature is the elimination of squeals and disturbing noises caused by the tubes oscillating when too much current is applied to the filament. This circuit is also free

from the customary whistle or sound produced when tuning the set to receive a program. It is absolutely quiet and free from sending out on the air the troublesome noise produced by sets of the regenerative type.

Construction of the set described in this article is reasonably simple. The placing of the parts proved the most difficult task and a word on this point will not be amiss at this time. It must be borne in mind that the inductive field produced by radio frequency currents, when applied to coils or transformers, is very sensitive to interference, and any force or body entering upon this field will induce counter currents or variations foreign to the proper functioning of these coils, producing very distressing results such as noise, loss of volume, distortion or even the failure of the set to reproduce signals at all.

To overcome the danger of such interference, the parts should be placed so

that the magnetic or inductive field of one piece will not overlap that produced by another piece. This is attained in the small space available in this set by mounting the radio frequency transformers on four inch centers and each on an angle of about sixty degrees, and by placing one audio frequency transformer on the under side of the shelf and the other at right angles



Here's a front view of the panel of Mr. Hopkins' non-oscillating radio frequency receiver. Note the lack of complicated controls. The tuning is accomplished by the three dials and the remaining control regulates volume. It's as simple as it looks, too.

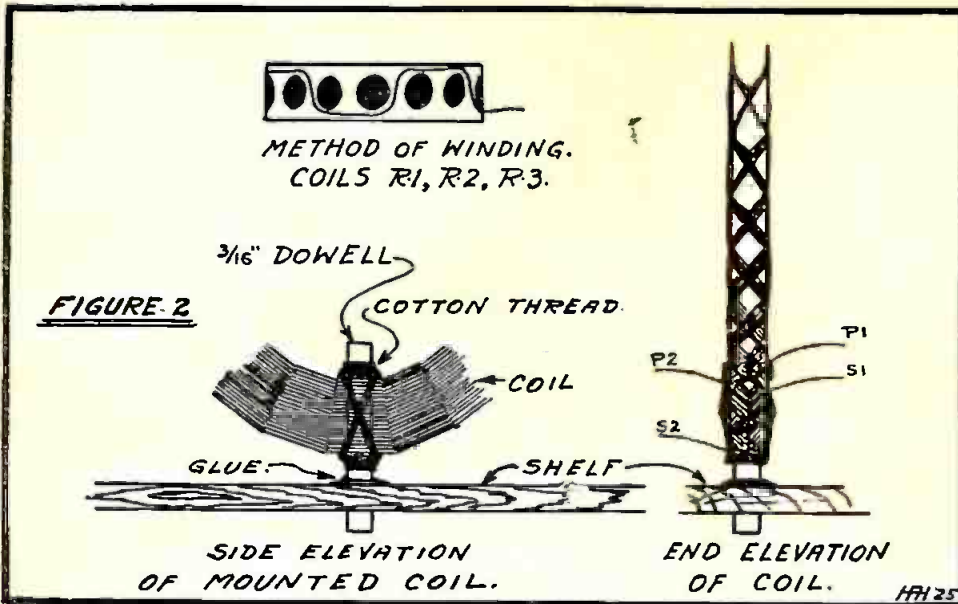


Figure 2. Showing method of fastening coils to sub-panel. In the upper part of the drawing is shown the winding of the wire on the wooden form.

to the first, and on the top side of the shelf, the latter transformer will then be at or nearly at an angle of sixty degrees from the radio frequency transformer (R-3) thus keeping outside of the field of this coil.

Parts to Build the Set

ALL of the parts used in this set are clearly marked with a designating letter or number throughout, and on the drawings, in order to better enable the builder to distinguish properly and place each part in the circuit and to more clearly describe them in the following paragraphs.

- 1 Composition panel 7" x 18" (A)
 - 3 Thirteen plate variable condensers (C-1, C-2, C-3)
 - 3 Three inch composition dials for the variable condensers
 - 3 Radio frequency transformers (R-1, R-2, R-3)
- (The construction of these transformers is described in this article.)
- 5 201 type tube sockets (M-1 to M-5)
 - 1 25-ohm rheostat (R)

- 2 Unmounted, audio frequency transformers (T-1, T-2)
(The ratio of these transformers can be either 3, 4 or 5 to 1.)
 - 1 Two circuit jack (P)
 - 1 Open circuit jack (S)
 - 1 Mica grid condenser and grid leak mounting
capacity .00025 mf. (GL)
 - 1 Tubular grid resistance 2 1-2 megohms
 - 6 Binding posts (A, —, G, A+, BD, B+)
 - 1 Wood shelf 6 1/2" x 17" (B)
- Terminals, wood and machine screws, wire solder and miscellaneous raw material.

It would be well to secure all of the parts necessary to build the set before starting. Any standard piece of equipment will suffice, providing it is not too bulky. However, care should be exercised in buying, as a cheap piece of equipment sometimes will turn out to be rather expensive in the end.

When the parts are all at hand, they should be placed on the shelf (B) in the relative locations shown in the pictures of the set. Be careful to get the coils (R-1, R-2, R-3) and transformers (T-1, T-2) spaced and placed on angles

so that they will not fight one another as just described. Next, mark the holes for mounting the parts and drill the shelf. The same procedure will take place with the panel (A) and the necessary holes drilled. It would be well to drill the holes for the shafts of the three condensers (C-1, C-2, C-3) about three-eighths of an inch in diameter or even one-half inch to prevent these shafts from binding against the panel when the condensers are mounted. If these shafts should bind, it would cause the condensers to turn hard, making it difficult to tune critically.

The shelf can then be mounted to the panel by passing three number four round head wood screws through into the edge of the shelf. These screws will be about three-quarters of an inch long. We will now set the shelf and panel aside until the radio frequency transformers (R-1, R-2, R-3) are constructed.

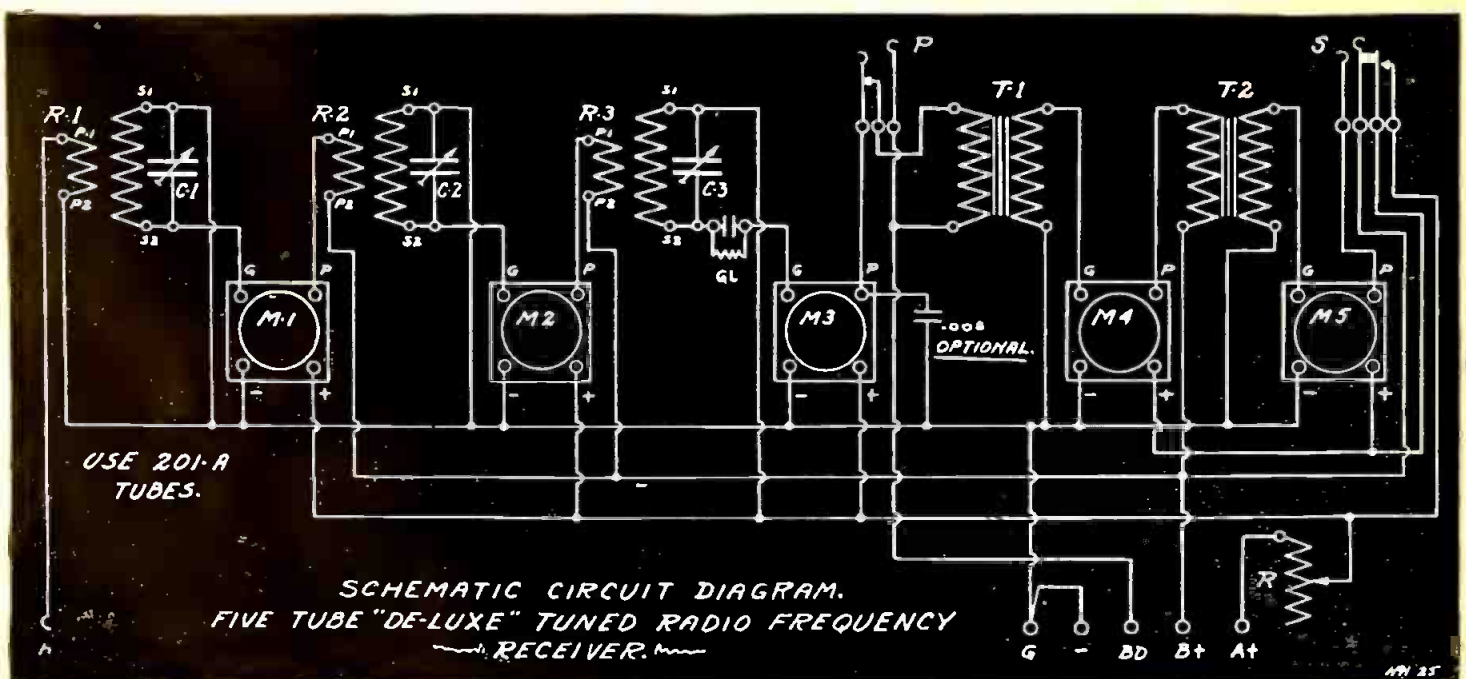
Construction of R. F. Transformers

THE radio frequency transformers to be used are of the spider-web type. The ones shown mounted in this set have had the forms or frames removed and are mounted by a three-sixteenth inch wood dowell pin passed through the lower part of the coil and made fast with cotton thread. This makes a truly low loss coil.

If desired, the coils may remain on the frames and be mounted in a like manner, except one of the spokes of the frame is used in place of the dowell pin as shown in Figure 2. This will not make a low loss coil, but the difference will be rather slight and may not be noticed if the balance of the set is properly assembled.

One seventeen-spoke spider frame will be required for each coil if the coils are to remain upon the frame. If the

(Turn to page 61)



Wiring diagram of the "De luxe" receiver described in this article. Note the location of the ground wire, and the position of the filament rheostat. The usual potentiometer has been left out of this circuit, as it was found by experiment that this control was not necessary.

THE interest of the radio fan has been given mostly to more efficient hook-ups, and many experts have invented circuits which were merely modifications of well known hook-ups. In most cases they had only the disadvantage of being more complicated than the original ones. More recently the interest has been centered on the reflex circuit which affords a better utilization of the tubes, their efficiency being increased practically 100 per cent.

The advent of the double grid tube must be considered as important an achievement as the reflex idea. The new tube affords a means of improving greatly the efficiency of the receiving set and of reducing the expense by enabling one to use very low plate voltage.

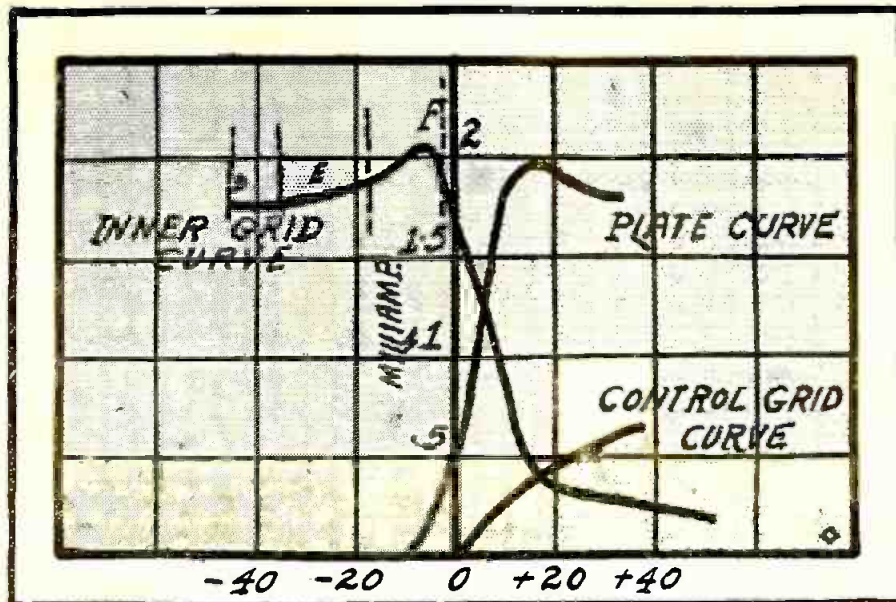
The internal resistance of the three-electrode tube which limits the value of the plate current and obliges us to use a high positive potential on the plate, is due to the presence of a cloud of electrons around the filament, which repel the newly emitted electrons which have not enough velocity to reach the plate.

It will be understood readily that the addition of a grid close to the filament and impressed with a positive potential will neutralize the negative charge of the cloud of electrons and thus reduce materially the internal resistance of the tube. This modification is the only difference of the double grid tube with an ordinary "audion."

"The Inner Grid"

IN the following explanation, the grid closer to the filament will be called the "inner grid" and the other grid the "control grid." The voltages impressed on the inner grid and the plate were only 12 volts, the voltage and current on the filament being respectively 3.9 volts and .35A.

Curves of Fig. 1 were obtained under these conditions. As soon as the filament is lighted, it emits electrons. These carry a negative charge of electricity. When the voltage of the control grid is between 50 and 35 volts negative, a certain number of electrons is attracted to the grid, which is 12



The above chart demonstrates very clearly the current curves of the double grid tube. These curves were obtained by using only 3.9 volts to heat the filament with only 12 volts impressed on the plate and inner grid. The current consumption of this tube is very small, only .35 amperes per ampere hour.

by the negative field of G is less important, since the negative field has decreased in intensity; more electrons go to the inner grid and its current increases slightly.

The control grid repels all electrons in the space from the inner grid to the plate so that we have no other current than the increased inner grid current.

How Current Increases

WHEN the negative potential on the grid G is between 20 and 10, more electrons go to the inner grid and its current increases for the same reason as above. A few electrons reach the plate and a small plate current is obtained (Fig 1, f.) With a positive potential applied to the grid, the control grid current appears, less electrons reach the inner grid as more and more are attracted by the control grid and the plate. Consequently, the inner grid current will drop more and more and the control grid and the plate currents will increase, the latter as fast as the inner grid current decreases.

The above theory having been grasped, the reader will understand readily the following hook-up. If the plate circuit is used alone, the hook-up is very alike to a three-electrode tube.

For detection, the hook-up of Fig. 2 is to be recommended. Detection is obtained with the grid condenser and grid leak. Regeneration is obtained as with an ordinary tube and any regenerative hook-up may be equipped with a double grid tube with very little work.

The control grid must be at a potential of about two volts positive, as regards the negative end of the filament; for this reason a 400-ohm potentiometer is to be used as shown, the movable arm being connected to the grid. A high resistance rheostat is recommended for the tube filament circuit (a 30-ohm one will do nicely) as accurate control of the filament temperature will help in getting the best results. Detection may also be obtained without any grid condenser and grid leak by using the great curvature of the plate cur- (Turn to page 60)

Using Low Voltage With a Double-Grid Tube

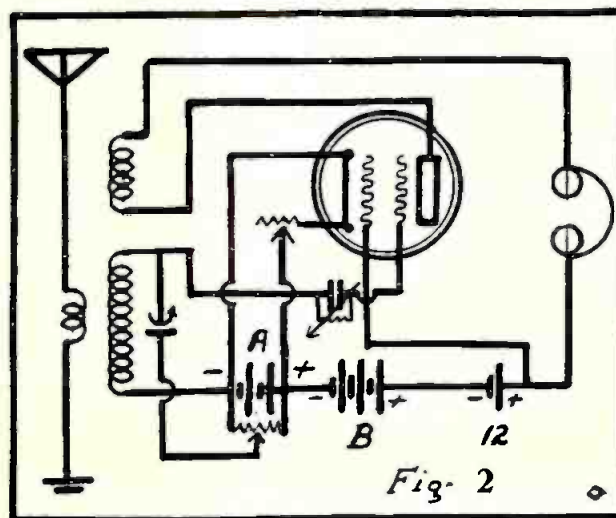
Use of Inner Grid Only Helps Cut Resistance

By C. R. BLUZAT

volts positive. We know that opposite charges of electricity attract each other, while like charges repel each other.

The high negative field has the effect of weakening the positive field of the inner grid and of repelling all electrons going to the plate.

We have a high current inner grid-filament and no other current, (part d of Fig. 1). The potential of the grid being between 35 and 20 negative, the neutralization of the positive field of Grid G1



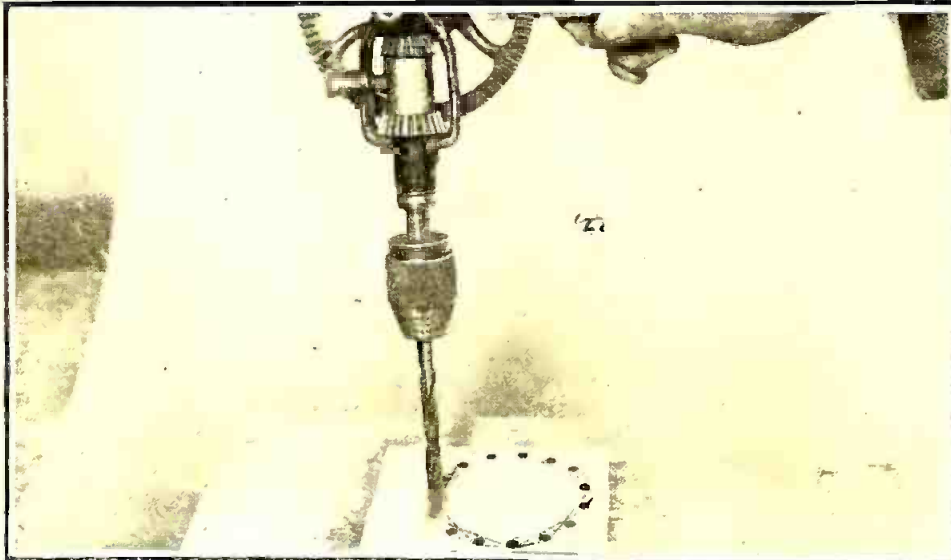
Showing the method of using the double grid tube in the regenerative circuit. Note especially the method of placing the low voltage "B" battery in the circuit.

How to Wind a LOW LOSS Coil that Gets DX

Good Low Loss Coil Easy to Make And Yet It's a Vital Factor in a Well Built Set

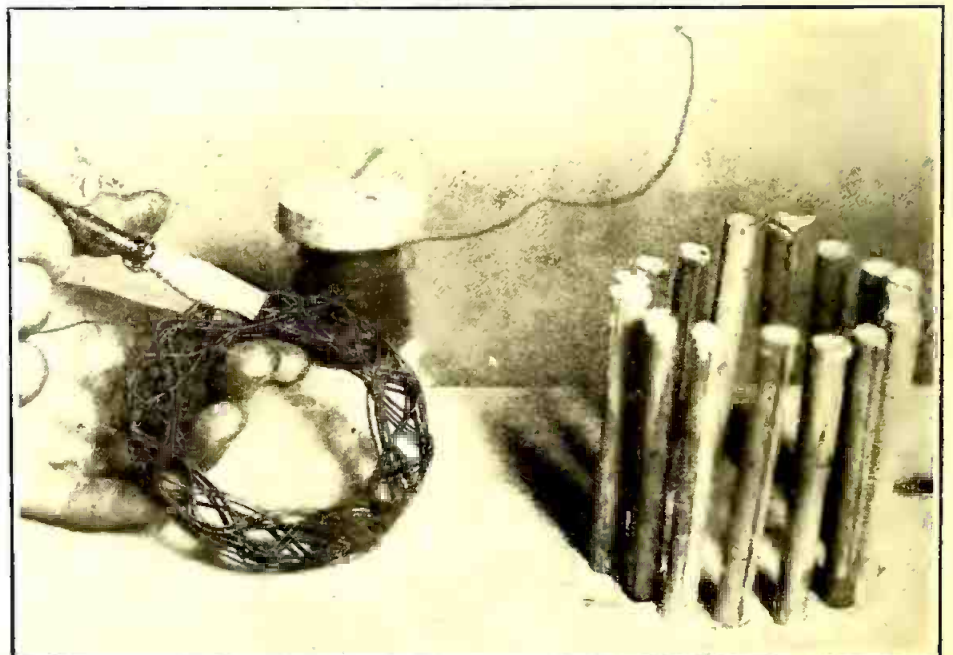
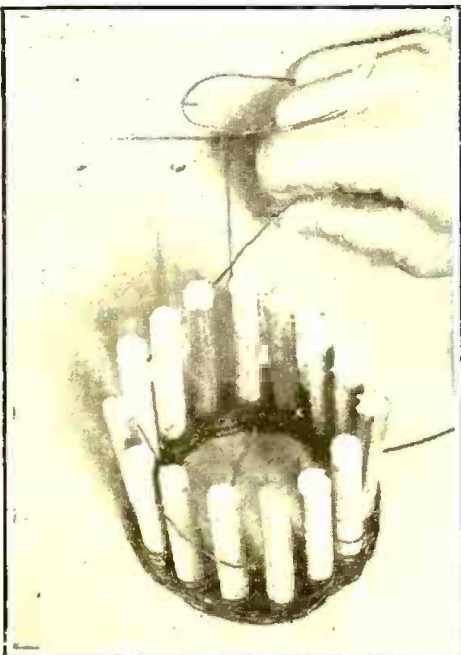
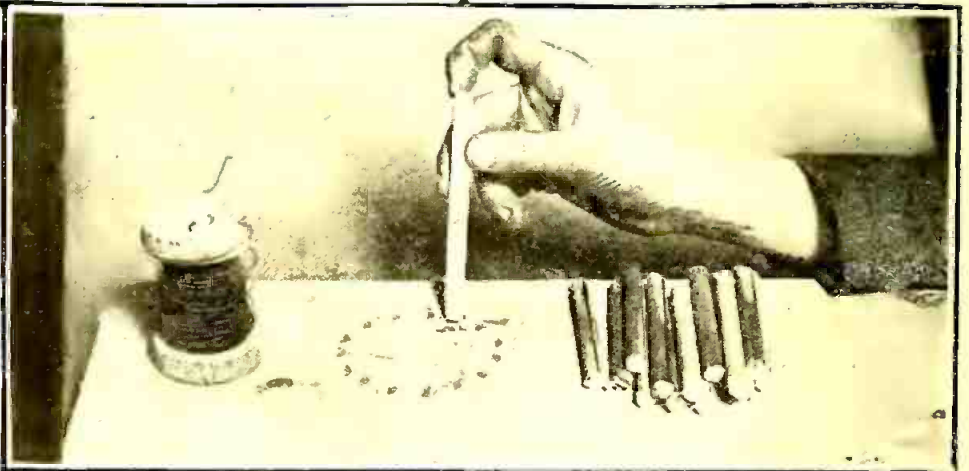
Contrary to the belief of many radio fans, a low loss coil is very easy to make. A paper template, a drill, some dowell pins, or long steel bolts, and an ordinary piece of board or bakelite (if the steel bolts are decided upon), are the only paraphernalia required, aside from the wire itself.

The photo at the left shows the manner of laying out the paper template on the base. The lines between the black dots, that represent the dowell pins, illustrate the method of winding the wire.



After the base has been drilled, insert the dowell pins in the manner shown at the right. Be sure that they are perfectly straight and start to wind the coil as shown in the first photograph. The shape of the coil will be determined by the manner in which the wire is wound in and out of the dowell pins, or steel bolts. The pins should be well fastened to the base, so as to prevent their bending in at the top and thus not giving the coil a uniform appearance.

However, the "over two, under two" style of winding is generally used. This means that the wire goes over two of the dowell pins, and under the two dowell pins immediately following the first two. A finished coil using this style of winding is shown at the lower right. The coil pictured contains both a primary and secondary winding.



The photograph above shows the winding of the coils, using No. 20 DCC wire. The winder is using the "over two, under two" style of winding.

After the coil is completely wound, remove it carefully, by the simple method of loosening the dowell pins or steel bolts. A small amount of collodion or glue can be used to hold the ends together, while you weave a string or thread between the sides to hold it together. Be careful in applying the collodion, and use it very sparingly.

WHAT THE ECLIPSE MEANT TO RADIO

Event Proves that Daytime Reception Has Many Advantages, But They Are Offset by Distance Possible at Night; Darkness Stabilizes Long Waves

EVER since the discovery of radio communication, many inexplicable sounds and noises have been found to cause considerable interference to the clear reception of distant signals, and especially was this noticed during the hot Summer months. During the colder months, when the nights were clear and the air was crisp and snappy, communication was established between stations several thousands of miles apart and the interfering noises, while still apparent to some degree, were so decidedly reduced as to be practically of no consequence.

Just why the hot weather reduced the signal strength as compared to the cold, or why the signals would gradually fade away at almost clock-like regularity and return again to normal strength, has been somewhat of a mystery. Various theories have been advanced for these peculiarities, but none of them has ever been actually proven, although experiments have shown that the sun has much to do with the case.

Variation in Signal Strength

ONE thing, however, has been conclusively proven; that is, that night reception is practically ten times as good as daylight reception. Distant reception of the broadcast wave is not expected during the daylight hours, for experience has shown that the short waves used for this work do not cover any great distance during the daylight hours, but after the sun has dropped below the horizon, conditions are entirely different.

Just why these conditions apply has been explained in the following way. First, it is believed that electromagnetic waves travel through a layer of atmosphere next to the earth's surface.

By FRANK D. PEARNE

This layer extends from the earth to a mere matter of thirty or forty miles in height, and above this the atmosphere is of very low density and is called the heaviside layer, which is supposed to be a film of highly ionized air. This ionized layer of air has a tendency to reflect the radio wave in about the

same way in which a light is reflected from a mirror. This, in combination with the rays of the sun, increases the conductivity and the radio wave rebounds in such a way that a receiving station located at a distance of 100 or more miles from the transmitting station will not only receive the direct wave, but also the wave which is reflected back from the heaviside layer.

This wave is alternating in its nature, being first positive and then negative, these reversals taking place a million or more times in one second. If the receiving aerial is cut by both the original and the reflected wave at the same instant, and they are both at the same polarity at the same instant, then the signal will be quite strong; but if one wave happens to be at maximum and of a positive polarity, when the other is at maximum at a negative polarity, then the result of the two waves will be zero and no signal will be heard. The farther the two waves vary from the same phase, the weaker the signal will be, and the nearer they are to the same phase, the stronger it will be. Here then, we find that we have not only the absorption of the wave energy to consider when it travels a great distance, but also the effect of the reflected wave. This theory explains to some extent why a distant station several hundreds of miles away from the transmitting station may hear a signal which is not heard by a receiver which is not so far away. It is easily seen that the height of the heaviside layer will determine the phase difference between the two waves and consequently the signal strength. Now, because the height of this layer varies considerably during the night and is practically stationary during the day,



(Kadet and Herbert)

How the recorder makes a record of radio fading. Few fans know that even local stations fade. The record on the strip of paper shows how uneven some distant stations are received in New York. If the reception was consistent, a perfectly straight line would show.

we find one great advantage in daylight reception, although it may not be so good in other ways.

Cause of Fading

IT means that the varying of the height of this heavyside layer will vary the phase relation of the two waves, so that at one time the signal may be strong and in a minute or two may fade away, coming back to full strength again when the layer again reaches the proper height to set them in phase again. This causes the effect of fading signals, which is seldom noticed in the daytime but is quite common at night. On the other hand, the effect of the sun on daylight reception is supposed to be such that air is ionized to some extent, thus increasing its conductivity, which would naturally reduce the efficiency of the transmitted wave.

When the sun is on the other side of the earth, its ionizing effects are not present and the efficiency of radio transmission is greatly increased. The line of sunrise or sunset when it comes between two distant stations will almost entirely prevent reception. Another advantage of daylight reception is that during the morning hours very little static or atmospheric disturbance is noticed. This is attributed to the fact that thunderstorms seldom occur in the morning, or at least do not occur as often as they do in the afternoon, and then too, the daylight transmission of these atmospheric disturbances meets with the same difficulty experienced by the radio wave and therefore has less effect than it would have at night.

Experience then shows us the difference between daylight and night reception to sum up in the following manner: First, that signals travel much farther at night than in the daytime and the fading of signals, when one is fortunate enough to pick up the distant signals in the daytime, is almost unknown. This gives one factor in favor of each.

Second, we find that atmospheric disturbances at night are far more pronounced than during the day, which is another factor in favor of each. In any event, the great increase in the distance covered by night transmission more than offsets the advantages of that of daylight transmission. If the theories which have been advanced by the greatest engineers of the day are really correct, then it is very apparent that the sun has a great deal to do with the matter, but as before stated, this has never been actually proven.

Eclipse Offers Opportunity

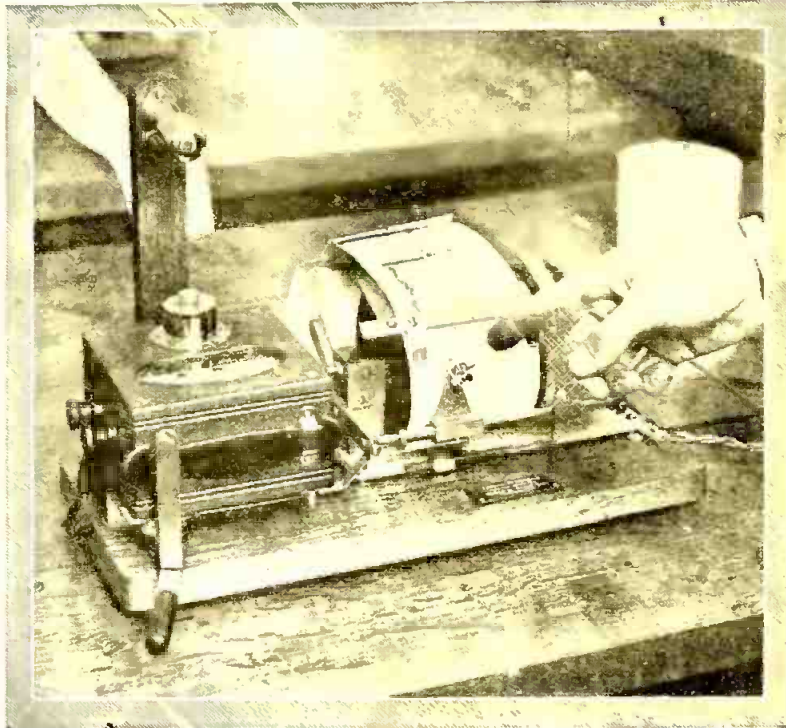
THE coming of the eclipse on January 24th presented the opportunity of a life-time to prove or disprove these theories. In certain parts of the United States a total eclipse was to occur. Here, then, we should have the ideal condition to determine whether or not the blotting out of the sun's rays for a short time would affect the daylight reception. If it were found that messages could be transmitted and received during the time when the moon cut off the rays, equally as well as when the sun was on the other side of the earth,

side of this zone would probably not receive as well.

Nature had been kind enough to give the opportunity and man was not slow in taking advantage of it. All prominent universities prepared for it. Scientists traveled hundreds of miles to be able to be at the most advantageous locations to record the results, but alas, Dame Nature was not so kind to some of them, for in some of the best locations for making observations great banks of clouds prevented many of the most interesting features of the eclipse from being seen by those who had traveled far in the hope that something of great importance might be accomplished. However, this did not happen everywhere and some interesting facts were recorded.

Some of the Results

MEMBERS of the American Radio Relay League, who were scattered around in the band of totality, were not able to get much definite information. Engineers making tests in New York and along the Atlantic seaboard obtained some facts which were worth while. Their experiments proved that a short wavelength follows the sun and also that static interference is not caused entirely by any local condition, for the reason that it was affected by general conditions. Long waves which were very irregular before the eclipse were noticeably regular during the time that the sun was totally obscured. It will be remembered that the eclipse started



(Kadel & Herbert)

Here is a view of the recording apparatus used to test the effect of the eclipse on radio reception. Two radio receiving sets were used; one to receive waves below 100 meters and the other for the longer waves. Instruments capable of showing minute fluctuations of fading, etc., were coupled to the sets. The tests practically proved that short waves lose strength at night and reach maximum efficiency during the day.

then something worth while would be accomplished.

Radio engineers and scientists from all over the world looked forward to that day as one which would go down in radio history. Great preparations were made in all parts of the country, some selecting that position where a total eclipse would occur and others taking up positions of less advantage. Many of the large broadcasting stations made arrangements to come on the air before and during the period of totality so that any change in signal strength might be noted. Broadcast listeners everywhere were asked to co-operate and report immediately any changes which they might note. In fact, the stage was set so that at some point at least something might be learned which would do much toward clearing up the mystery of radio reception.

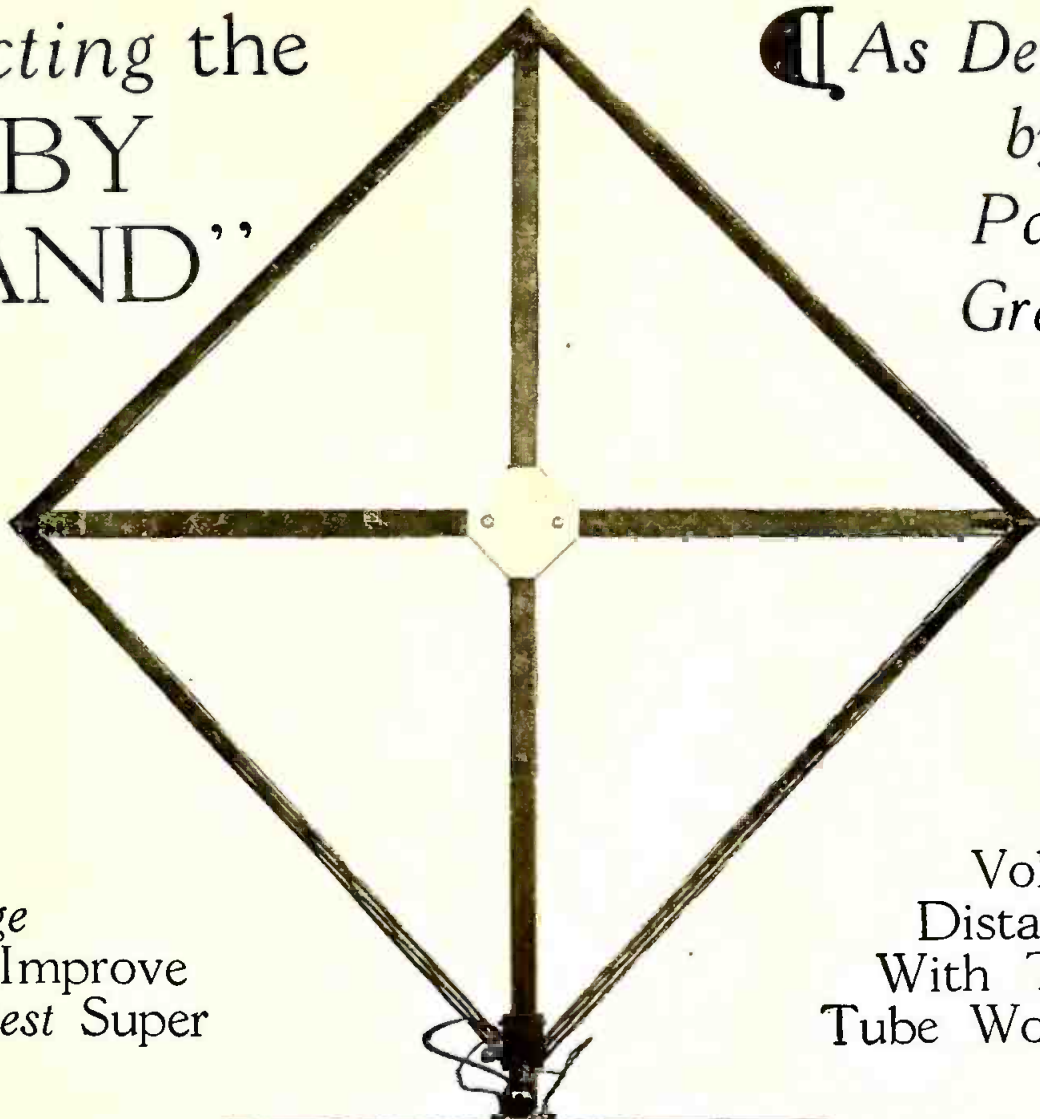
If the theories were sound, it might be expected that two stations which were located within the zone of totality could transmit and receive with nighttime efficiency, while those located out-

just at sunrise. Short waves of seventy-five meters that could not be heard before sunrise began to come in faintly and as the sun appeared grew stronger and stronger. While the short waves were increased the static was also increased. When the sun became entirely obscured, the short waves were entirely blotted out, showing exactly the same conditions as before the sun rose. As the moon slowly passed from in front of the sun, the short waves and the static reappeared and gained in strength as the sun appeared. Longer waves of 380 meters which were irregular before the eclipse became regular as the sun disappeared behind the moon and when the sun began to appear again the wave began to be irregular and the static returned. In other words, the long waves were stabilized by darkness.

Dr. Goldsmith, who conducted the tests, described the conditions as generally favorable, being about half way between those of the best day and those of the worst night. In these tests a "fading recorder" was used.

Perfecting the "BABY GRAND"

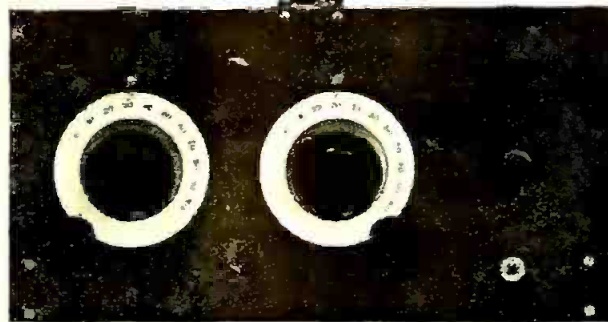
As Developed
by
Paul
Green



Recent
Tests by
Radio Age
Readers Improve
This Latest Super

8-Tube
Volume and
Distance Easy
With This Six-
Tube Wonder Set

IN A recent article on the "Baby Grand" Super-heterodyne, Paul Green described the circuit in its several modifications. Radio, like everything else, is a product of evolution. All of the best circuits have undergone numerous changes before reaching their final stage of near perfection. Yes, we said near perfection; anyone would be foolish to call a radio set perfect. The "Baby Grand" appeals to all who have seen and heard it as one of the most perfect things they have encountered in radio up to the present time.



Front view of the "Baby Grand" Super-heterodyne, with the loop antenna, mounted on the top of the cabinet. This shows the result of careful design, in laying out various parts.

IT IS two months now, since the first of this series of articles appeared describing the Baby Grand. The readers of RADIO AGE have been of considerable assistance in helping to develop this circuit. It has now reached a stage of perfection which is little short of astonishing.

There was a time, and not so very long ago either, when eight tubes were the least that could be used on a super-heterodyne and still bring in so-called super-heterodyne results. At that, the eighth tube was usually ineffective. By eliminating the losses that have occurred in previous circuits, particularly as regards the input and output coils, it is

now possible to condense the circuit to six tubes, and yet secure approximate eight tube volume and distance.

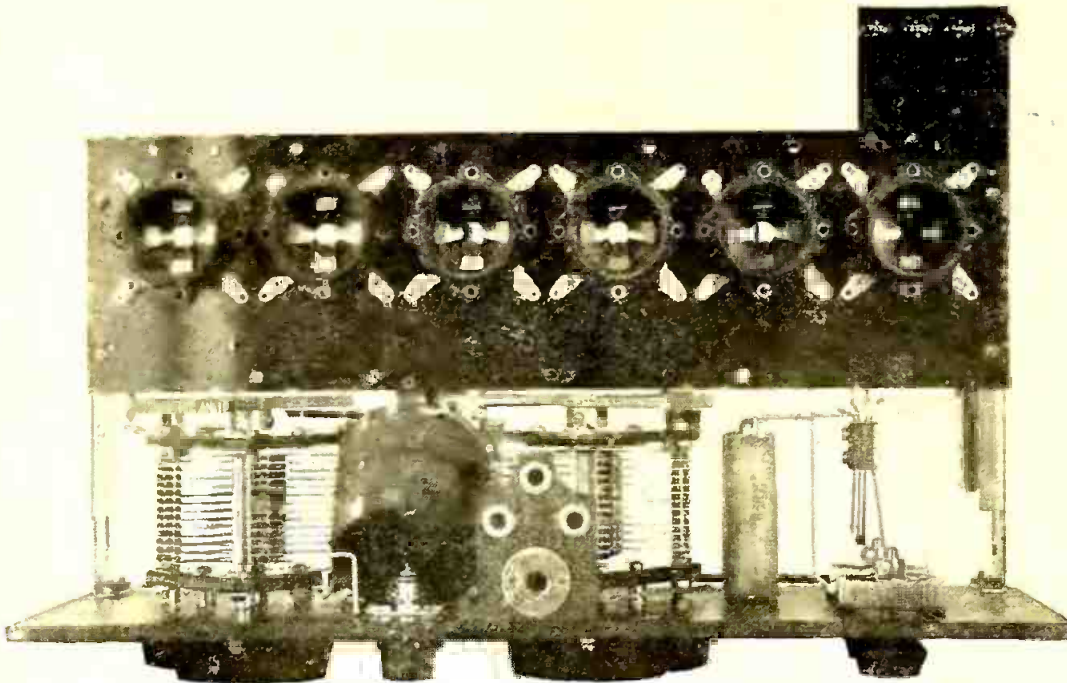
We can all recall the time when air core transformers were thought to be absolutely the only transformers that could be used in the super-heterodyne circuit. We were taught that iron core transformers were broad, and that a greater degree of amplification could be secured by using air-core transformers. That these theories have all been proven merely theories goes without saying. To build an entire super-heterodyne using iron core transformers throughout would have sounded like the height of idiocy to our super-hetero-

dyne forefathers; however, that is exactly what we do in the Baby Grand in its present form. In the previous installment, we were still using the air core filter. Experiments revealed that we were encountering a loss in this air core transformer which was keeping the volume down. Substituting an iron core input coil of the same make as the intermediates has solved the problem, and not only that, but it is not necessary to tune this transformer. A graph of the three transformers working together reveals the fact that the

peak is very high and as sharp as it reasonably can be expected to be and still include the effective band of frequencies.

Condenser Layout

THE panel dimensions for previous layouts were 7x18". The present design calls for a panel of 8x15½". It will be noted that a sub-base is employed and that it rests on top of two end brackets. This permits of placing the transformers on the under side of the sub-base with the tubes and sockets on the upper side. All of the leads between tubes and transformers are extremely short. The base panel is 4x15"



The above photograph shows the upper part of the "Super." This will give one an idea as to how the tube sockets should be mounted, so as not to interfere with the oscillation coupler or variable condensers.

and provides ample space for all apparatus.

The loop is mounted directly on top of the set, so that the loop leads are only a few inches in length. The loop is of the bank wound type and is 19x19 inches. As the overall depth of the set, exclusive of binding posts is 8 1-2, it can readily be seen what a wonderful layout this is from the standpoint of portability.

As in the previous circuit, the first detector tube bias battery is omitted and in its place a grid leak is used. It is found that this has a tendency to keep the circuit very quiet, while at the same time eliminating the "C" battery. It will be noted that very good judgment has been exercised in the selection of variable condensers, dials, rheostats, loop, transformers and, in fact everything which in any way can affect the operation of the set.

The base of the loop is provided with a 5-16" brass pin of 1 inch in length. The top of the box or cabinet has a hole of slightly larger dimensions to receive this pin. The loop terminals engage in imp jacks which should be mounted in a piece of hard rubber or bakelite on the top of the cabinet and kept from touching the wood of the cabinet. The leads of these jacks run directly to their respective connections in the circuit.

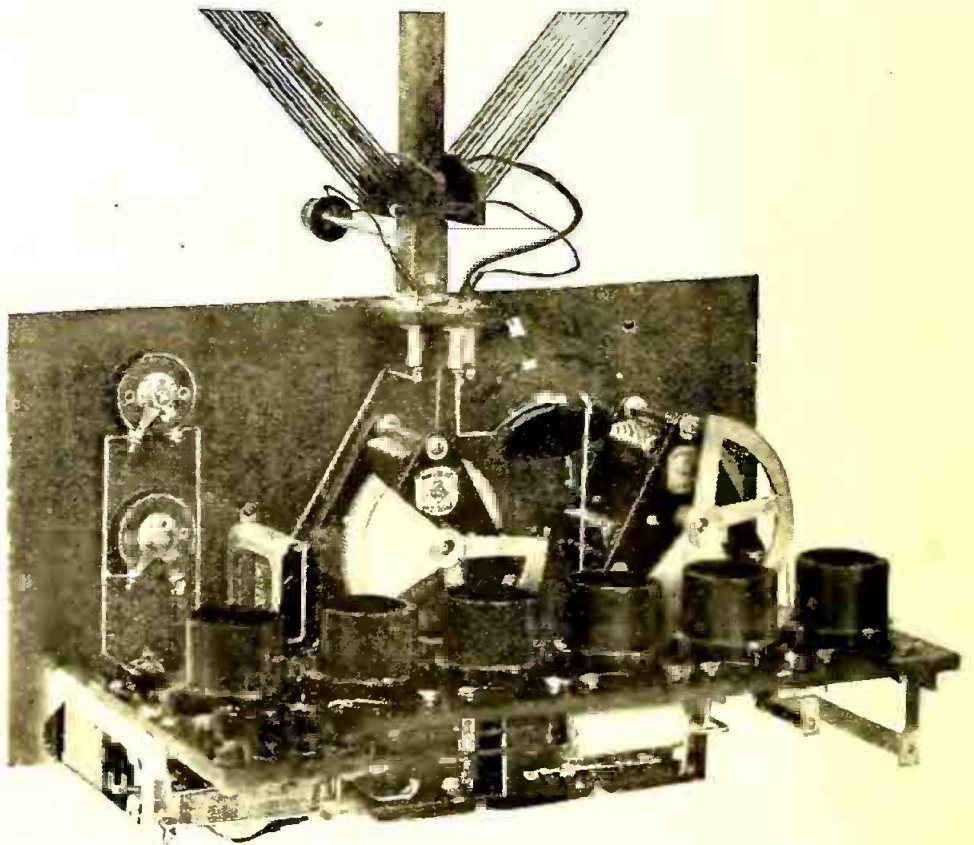
Under-Side of Sub-Base

THE intermediate transformers, being of the iron core type and shielded, can be placed very close together without any symptoms of inter-stage reaction. If it were not for this fact, it is doubtful whether it would be possible to build a practical 6-tube super-heterodyne. The audio transformer is of the same make as the intermediates and occupies very little space. The two by-pass condensers included within the oscillator circuit are found just back of the input transformer and are connected in com-

mon to the negative "A" return, through the filament rheostat.

The other side of each of these condensers is connected to the positive "A" battery return and the plus "B" battery return respectively. Not using a bias battery permits of placing the rotor of the oscillator in the circuit so that the circuit leads from positive "A" return through the rotor to the middle tap of loop, through loop to stator side

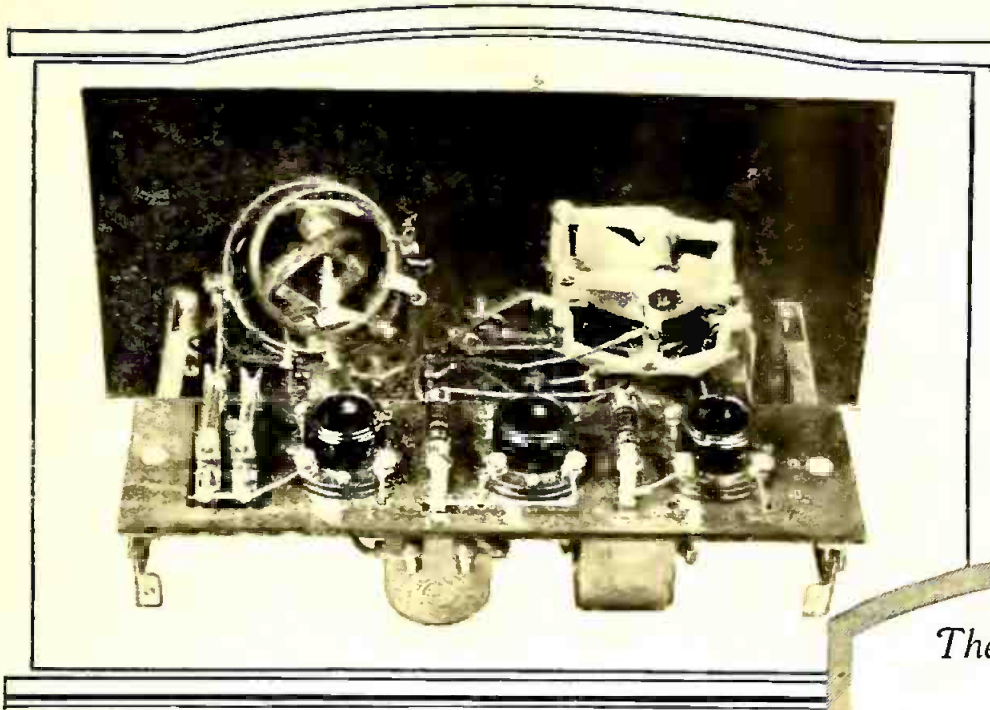
for running the longitudinal wiring and keeps it well out of the way. The by-pass condenser across the primary of the audio transformer is usually found to work best if it is about .004 capacity, although this capacity can only be determined by experimenting, as characteristics of individual sets will vary somewhat. However, it is extremely important that this capacity be right, otherwise, the best (Turn to page 66)



A view of the "Baby Grand" Super-heterodyne from the rear. Note especially the method of mounting of the long wave transformers directly under the radio frequency tubes. This method provides for exceptionally short connections.

of the loop condenser, to grid leak, through grid leak to grid of first detector tube.

Heretofore, when using bias "C" battery, it was placed with its positive side connected to the negative "A" return in common with one side of each of the by-pass condensers. The rotor of the oscillator was then placed in the position now occupied by the grid leak and grid condenser. Further examination will reveal that the cases of the two intermediates are grounded in common, on the plus "A" battery lead. The by-pass condenser across the positive "B" and detector "B" is fastened to the side of the supporting bracket. The transformers are mounted on top of a narrow piece of one-quarter of an inch bakelite, so that the transformer as a whole stands one-quarter of an inch away from the underside of the sub-base.



At the left is a back view of Mr. Dillion's short wave receiver. The simplicity of the wiring and the efficient spacing of the apparatus is evident.

The Latest Thing in Radio

The men who know what's what in the world of radio are predicting that the broadcasting of the future will be done by means of short waves, which are now being used by only a few broadcasters such as KDKA, WGY, and KFKX. In the accompanying article RADIO AGE presents to its readers for the first time a construction article for those fans who wish to build a simple short wave receiver. All the parts are standard and there are no "tricks." It will be great sport indeed to hear broadcast programs on 84 meters or thereabouts. We shall be pleased to hear from readers regarding clarity of reception, and other results obtained with this receiver.

Experimenting with Short Waves

By C. HAROLD DILLON

THE average radio fan of today "builds his own." Truly, he apparently is never satisfied and always has an idea that the manufactured set is better than his own product. And what is a fine circuit this week is, apparently, cast into oblivion the next.

This is as it should be. For, not only is he satisfying himself regarding the value of the various circuits, but he is doing considerable experimenting for the radio industry in general. It is in this manner that new circuits are developed and perfected.

How many times have you noticed that a circuit will be heralded as the best and most desirable, only to find that after a short period, improvements will be announced? Check up on these improvements and what are they? A fixed condenser added here, a reversed connection there, and the perfected circuit will be many times better than the original. These things are not found by formula, but rather by experiment. Hence we look on the radio set-builder as an experimenter.

Take, for example, one of the fundamental circuits of radio reception, the "old reliable" three-circuit receiver.

New Tuner Tested

UNTIL a few short months ago, what was looked upon as ideal equipment consisted of a vario-coupler and a pair of variometers. These are in themselves admirable pieces of apparatus. But how much more efficient are the small skeleton-wound three-circuit tun-

ers, all mounted on one small bakelite frame! Not only are they more efficient electrically, but they are much more convenient mechanically.

No formula was directly responsible for their development. It was accomplished by experiment. So we must consider the man who builds his own, not as a "dabbler" but as an experimenter who very frequently contributes something to the science for our own common good. So much for the experimenter.

Almost all of us have by this time advanced through the maze of crystal, regenerative, neutrodyne and reflex stages, and are looking around for new and more fertile fields in which to try our hand. Such being the case, it is time we considered the most recent addition to our already broad field—short wave reception.

Before we go any farther into the subject, it might be well to explain that by short waves we mean those waves whose bands are below those covered by the amateurs and broadcasters.

For the past two and one-half years much has been said and written concerning short waves, and most of these explanations have called for a good deal of special apparatus. Most of us, after reading a few such reports, surrendered the subject to the scientist, and went back to problems nearer home.

Many of the larger stations of this country such as WGY, KFKX, KDKA,

etc., are using short waves with regularity, and it only remains for the fan to construct a set capable of tuning low enough that will enable him to receive these short wave signals and put him in the front rank of radio experimentation.

The set to be described will consist of a detector and two stage audio frequency amplifier. It is very easy to construct, and the wiring has been simplified by using soft wire in place of the usual stiff bus bar style of connection. The tuner is particularly efficient, being quite small and carrying no dead end losses. It covers the wave band on which it is to be used, fifty to one hundred and ten meters, very nicely. The primary is adjustable and untuned, thus permitting it to be adjusted to meet your own particular requirements. Selectivity can be secured by increasing the coupling between primary and secondary, a small bracket being supplied for that purpose. The tickler or feed-back coil has a 180-degree variation and is wound with the lowest essential number of turns to secure perfect action of this control. It is wound in such a manner as to insure low capacity effect against the secondary. The secondary coil itself is low loss,



Front panel view of the completed short wave receiver. The dial to the left is the wavelength control, while the one on the right controls the tickler or regeneration coil.

space wound. This means that the turns of wire do not touch one another, but are separated by a slight "air gap" about as wide as the wire itself.

Now Used for DX

FOR some time it has been known that short waves could be used for transmitting purposes. However, until quite recently they were not considered satisfactory for long distance work.

Heinrich Hertz, the German physicist, used them in his experiments. By their use he was able, with the aid of apparatus he had perfected, to be the first to measure a radio wave. While he was experimenting with short wave transmission, he devised what is known as the "Hertzian oscillator" which is used today in connection with short wave experiments.

After Hertz's experiments, short waves were forgotten, as they were thought to be of no practical use. During the war they were used to a small extent, and quite recently Marconi did phenomenal work in transmitting signals from England to Australia, on a 100 meter wavelength, with remarkably low power.

What are the advantages of short wave transmission? The one big advantage is the high radiation efficiency gained. For the same input power, stronger waves will be sent out from the antenna, the shorter the wavelength used. Another advantage is the elimination of static to a large extent. This latter advantage can be accounted for in a great measure by the comparatively small antenna used at the receiving end.

So much for explanations; now for the construction details. To build the set you will need the following parts:

BILL OF MATERIALS

- 1 Short wave tuner,
- 1 Condenser, variable, to match tuner,
- 1 Panel 7"x14"x $\frac{1}{4}$ ",
- 1 Sub-panel 12"x3 $\frac{1}{4}$ "x $\frac{1}{4}$ ",
- 1 Set of brackets for mounting sub panel,
- 2 Audio frequency transformers,
- 1 Grid leak, 1 to 2 megohms,
- 1 Grid condenser .00025 MFD,
- 1 Single circuit jack,
- 1 Double circuit jack,
- 1 Filament switch,

3 Vacuum tube sockets,
1 Rheostat, resistance to be determined by the tube used as a detector.

2 Fixed resistance cartridges, for controlling filament heat on the amplifier tubes.

7 Binding posts,

2 Dials,

— Wire, screws, etc.

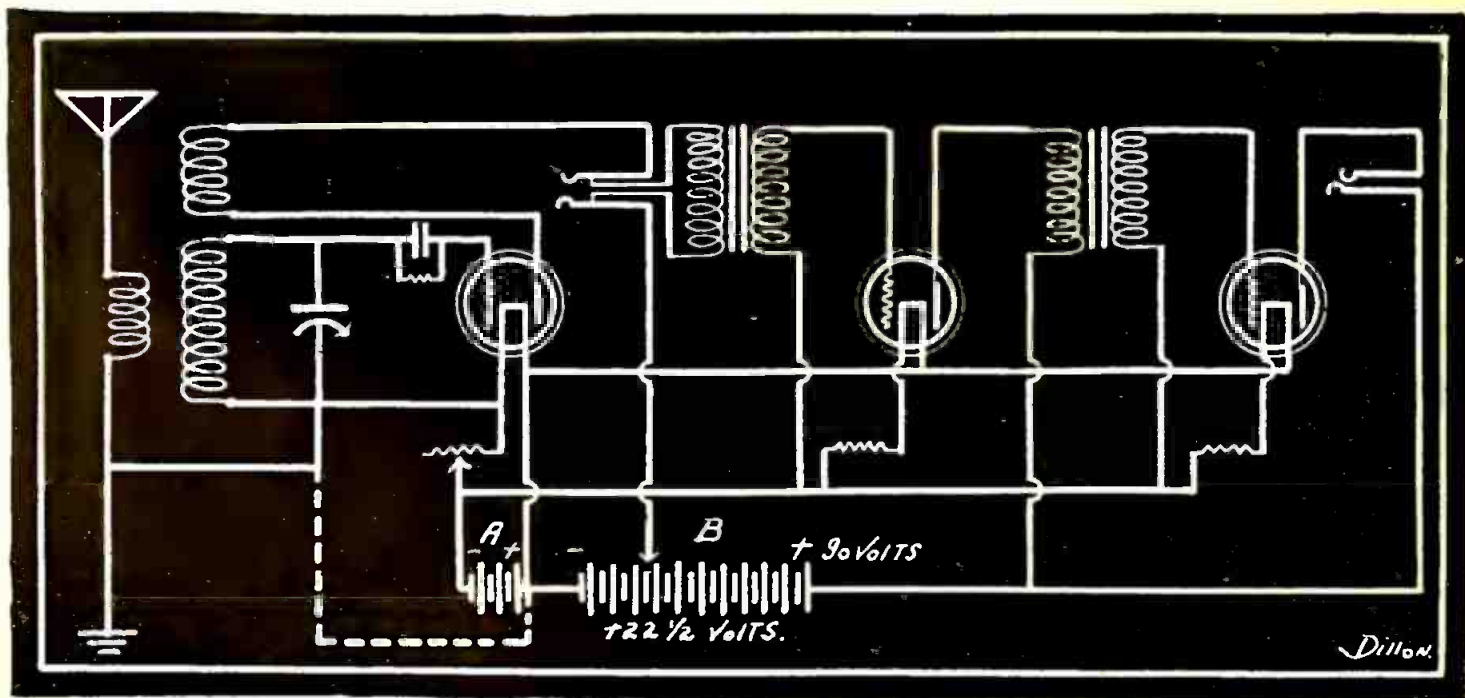
For receiving short wave, high power transmission, as this set is designed to pick up, you should employ an antenna whose length should not exceed eighty feet of wire from the farthest point to the point connected to the set. This is in accordance with the principle that short antennas give greater selectivity and less interference from static. Keep the antenna as far as possible from metal roofs, gutters, down spouts or wire lines.

A high capacity antenna may result in raising the wavelength of the antenna circuit to a value within the broadcast range, thus causing interference from local or nearby stations of low wavelength, regardless of the position of the adjustable primary. This may be easily remedied by placing a fixed condenser in series with the antenna. The condenser should have a capacity of between 100 and 500 MMF.

You should be sure of a good ground connection. The usual water pipe installation has proven very satisfactory.

As the circuit itself is a tried and proven one, I will not go into construction details regarding it. A few hints concerning the wiring will suffice. Avoid all angular bends, using a wire about the same size as standard bus, but more flexible.

Upon completion of the set, the advanced experimenter may plunge himself into this, the newest field of radio research. And let him remember, that the engineers of the industry are all predicting that the next few years will find all broadcasting done on short waves.



Wiring diagram of the three-circuit short wave receiver, described in the accompanying article. The dotted lines at the left hand side of the diagram show how the grid return is placed if a hard tube is used as a detector.

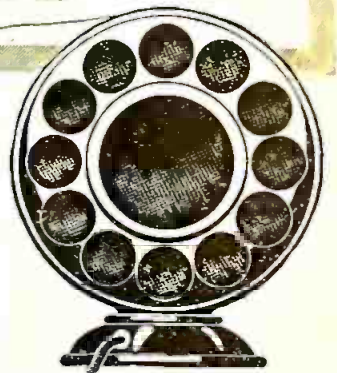
Where is Radio Leading Us?

By EDMUND H. EITEL

WILL Radio Change Our Ideas of Life and our Very Philosophy? Possibilities and Fundamentals of "Radiant Energy" Explained for The Beginner About to Study Ethereal Secrets; Easy Hookup Shown.



Whither are we going? What mysteries will the radio of the future unfold? Only the figurative "Lady Quanta" pictured above can tell.



The unimposing microphone will play an important role in the political and educational life of the future, this author believes.

WHAT is radio going to do to us? I do not mean, How will it change our lives by introducing new pleasures and new conveniences; it will do much more than that.

A tremendous question to consider is, will it not in the long run change our very thinking—will it reform our way of looking at life; in other words, our philosophy?

Before radio is done with us, it may cause a revolution in thought as radical perhaps as that which occurred when Darwin presented his theory of evolution.

Knowledge is "Evolutionary"

DARWIN stated all life evolves from simpler forms through a process of the "survival of the fittest." After his pronouncements, we soon had a new way of thinking—a new way of looking at life. Systematic knowledge has been rearranged since Darwin according to the point of view of evolution. Biology and zoology, for example, have been reclassified according to evolutionary progression. We study history as evolution. We have the evolution of art. We even have evolutionary classifications of such diversified things as chemistry, philosophy and religion.

Is it possible that radio may bring such a profoundly new and revolutionary conception of life? Will radio, and what it essentially signifies, revise our thinking?

It is not at all improbable that radio may bring about that very thing. We may be on the threshold of new ideas of life. To begin with, radio is making millions, young and old, think in a new way. It is a tremendous educational force for science. As it dawns on these inquiring minds what radio, or radiant

energy, really is, and what it means, the world will look different to some people.

Exactly what radio is alone is a significant question. Have you not often put that problem to yourself as a beginner? When you get that question adequately answered, you will have a different set of values of life than you ever had before.

What, then, is radio? What is this force which flies over thousands of miles at a speed of 186,000 miles per second and passes through your body and mine all unknown to us; even through brick and stone, unimpeded? The scientists tell us that it is akin to the gamma rays of radium, to X-rays, to the actinic rays of the sun; to light and to heat; and they call it "radiant energy."

Radio A Ray

FIRST of all, Einstein, Planck, Bohr, Milliken, Michelson and other painstaking scientists have in unlocking the deepest secrets of nature proved that radio is not a wave as popularly supposed. It is a ray consisting of well-nigh infinitesimal particles.

To make you comprehend how amazingly small these particles are, I must tell you about these molecules, atoms and electrons. You know that when matter is divided and subdivided further and further that you finally reach a particle which can no longer be divided without changing its nature. This is the molecule.

For example, divide a molecule of water and you split it into an atom of oxygen and two atoms of hydrogen, these atoms being gases.

Atoms are most incomprehensibly small. They have been measured, and the atom of helium, for example, is one-

fifty-millionth of a centimeter in diameter. This means that if a centimeter were stretched out until it became as long as the diameter of the earth itself and used to measure the helium atom, the diameter of the latter would be but $9\frac{1}{2}$ inches.

But a centimeter is a centimeter, which means it is approximately two-fifths of an inch. So the atom is small indeed. And yet, small as it is, the atom is a vast system in itself, resembling the solar system more than anything else. For the atom has a nucleus, or "sun" as its center and around this from one to about ninety "planetary" electrons revolve.

Professor Milliken says that Professor Wilson has with a series of ingenious photographs indicative of electronic paths, given us "the most convincing evidence that the atom is a sort of miniature stellar system with constituents which are unquestionably just as minute with respect to the total volume occupied by the atom as are the sun and planets and other constituents of the solar system with respect to the whole volume enclosed within the confines of the system."

But minute as the atom is, and infinitely more minute its constituent electrons, there is something still "minuter." That is radio or "radiant energy." Electrons have the ability to migrate

along an electrical conductor—a wire for example—and such a current of electrons is what constitutes the current of electricity.

Let us alternate this current in a transmitting antenna. This means we will send the electrons surging first in one direction along the wire and then in the reverse direction. Each time we reverse the current of rapidly surging electrons, particles still smaller than the electron or "electron dust" are jerked loose and sent flying in all directions in straight lines. This "dust" consists of minute "bags of energy" designated by Professor Max Planck as "quanta."

"Quanta" Does It

It is this infinitesimal "quanta" which carries the radio message at the speed of 186,000 miles per second from the transmitting antenna to the receiving antenna, which may be a thousand miles away.

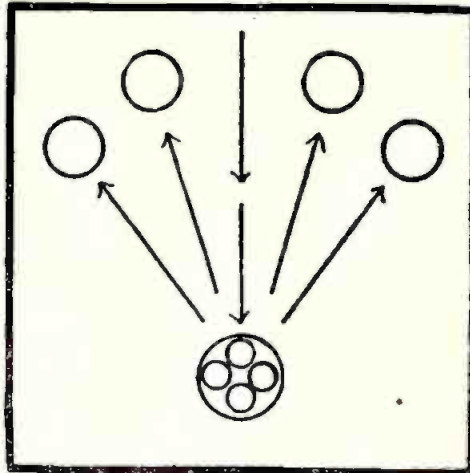
This brings us to the significance of radio or "radiant" energy." It is that which we know as "matter" or the material world, that is not so solid as we had supposed. "Solid" matter is extremely thin and nebulous. In fact, it is no denser than the solar system with its far-flung planets. Matter is only made apparently dense through the motion of its constituent particles. A scientist has shown this with a striking example. He has calculated that all the battleships in the world, if the motion of their electrons were stopped and every particle were crowded tightly together, would occupy but one cubic inch.

What, then, is the human being? If even steel is so thin, that if iron is, after all, nebulous or like air, what a poor thin substance is man! We are like ghosts indeed, having virtually no real substance at all—only apparent substance. We may indeed be spiritual manifestations; and although this term would not mean anything to the scientist, we may speculatively press him with it and ask him to explain what the "quanta" consists of and whether this and mind may not be the same or composed of at least one fundamental substance underlying everything.

Neither can the scientist answer yet what consciousness is, or what thought consists of, or whether thought may not be transferred like radio. Sir Oliver Lodge believes it can be.

Furthermore, all that we see and experience is but a small fraction of reality. Our eyes are "tuned" to receive light rays only. Now radio rays are the same thing, except they are slower in "frequency." If our eyes were properly tuned, we might see radio rays and the world would appear vastly different. Or, if our eyes were tuned differently still, we might plainly see heat rays, or the ultra-violet rays of the sun, or X-rays. Or about a radio coil we might see the magnetic rays or "fields of force," whirling and boiling. All this is just as real as anything we do see.

How differently is the man of the future going to conceive of the reality of the world, of life? Hasn't the immaterial and the invisible grown in great significance because of radio? Have we not become dimly conscious of the vast-



Showing how an electron composed of several atoms throws off the "quanta," which carries the radio message at a speed of 186,000 miles a second from the transmitting aerial to your receiving set.

ness of the unknown world toward which scientists are headed like new Colum-buses?

Not only is the solidity of this material world facing to the new sight of science, but mind is ascending by aid of radio to new peaks of power and dignity. A man, the President of the United States, for example, may speak today and his message can be conveyed to the ears of everyone of the 110 million souls in America, if sufficient receiving sets were provided. Similarly it would be possible as soon as sufficient sets were on hand, for one man to address every being on the planet. Some great man of the future; some Clemenceau, Wilson or Lloyd George—some modern St. Francis or Luther, some new Caruso or Beethoven, some future Einstein or Pasteur, on some great occasion might address virtually all mankind from pole to equator, from metropolis to jungle.

While such a thing would be spectacular, it would have a deep significance, too. It would signify that just as distance has been annihilated, so matter has been virtually conquered also by mind. One hundred ton engines and heavy trains are no longer needed to complete communication. The spirit of men has become the master of all this. That spirit has come into dominance and it follows that mind and spirit will take on a new importance, a higher valuation in our regard for life.

And this will be all the more true when radio makes its next and imminent contribution, which will be vision at a distance.

For the benefit of the "green" beginner in radio, we are publishing herewith an unusually simple hookup that will explain itself as it is put together and operated. It is the construction of such simple sets as this one that will lift the veil surrounding radio for the average reader.

The circuit I am about to describe to you is the simplest of all radio circuits. It consists of a simple coil of wire, fifty or seventy turns, wound on a cardboard or bakelite tube, three inches in diameter.

A honey-comb coil can be used in place of the homemade coil.

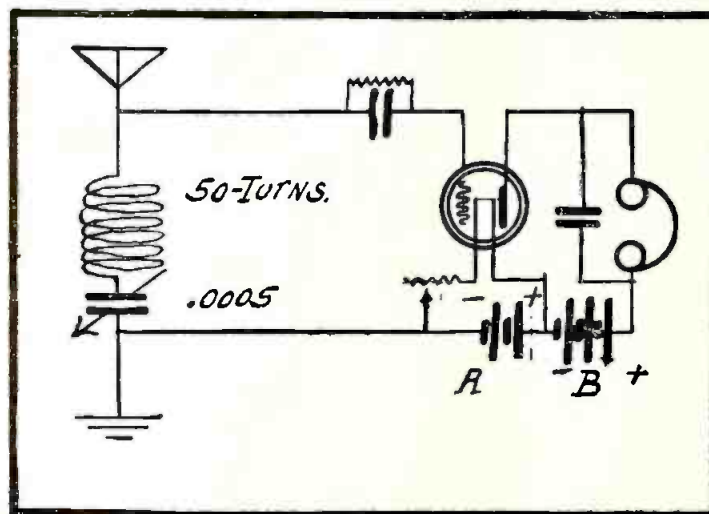
Procure from your radio dealer a variable condenser, having a capacity of .0005 mfd. (microfarads), a grid leak having a resistance of about two megohms, a grid condenser with a capacity of .00025 mfd., a rheostat having a resistance for the kind of tube you will use as your detector, a vacuum tube socket to fit the tube you have on hand or prepared to purchase, and a small fixed condenser for the head-phones, having .001 mfd. as its capacity.

Supposing that you have already installed your antenna, which should be a single wire about 125 feet long from the farthest end to the end that is connected to the set proper.

The next thing to do will be to connect one end of the coil to one terminal of the grid leak. The other terminal of the grid leak is connected directly to the grid connection on the vacuum tube socket.

The other terminal of the coil is connected to the stationary plates of the variable condenser, while the movable plates are connected to the ground circuit. By consulting the wiring diagram, you can readily determine just how the balance of the set is wired.

The positive side of the battery used to heat the filament is connected to the negative side of the battery that supplies the plate current, or "B" battery. A wire from the negative side of the "A" battery is connected to the rheostat, while the positive side goes directly to one of the filament prongs of the tube socket.



The simplest form of a radio receiving set is shown above. It is of the type that is commonly known as a single circuit receiver and is excellent for a beginner's experiments.

The Sleuths of Honeymoon Camp

How Three Couples of Newlyweds Set a "Radio Trap" for a Couple of Burglars

By
FRANK
HONEYWELL

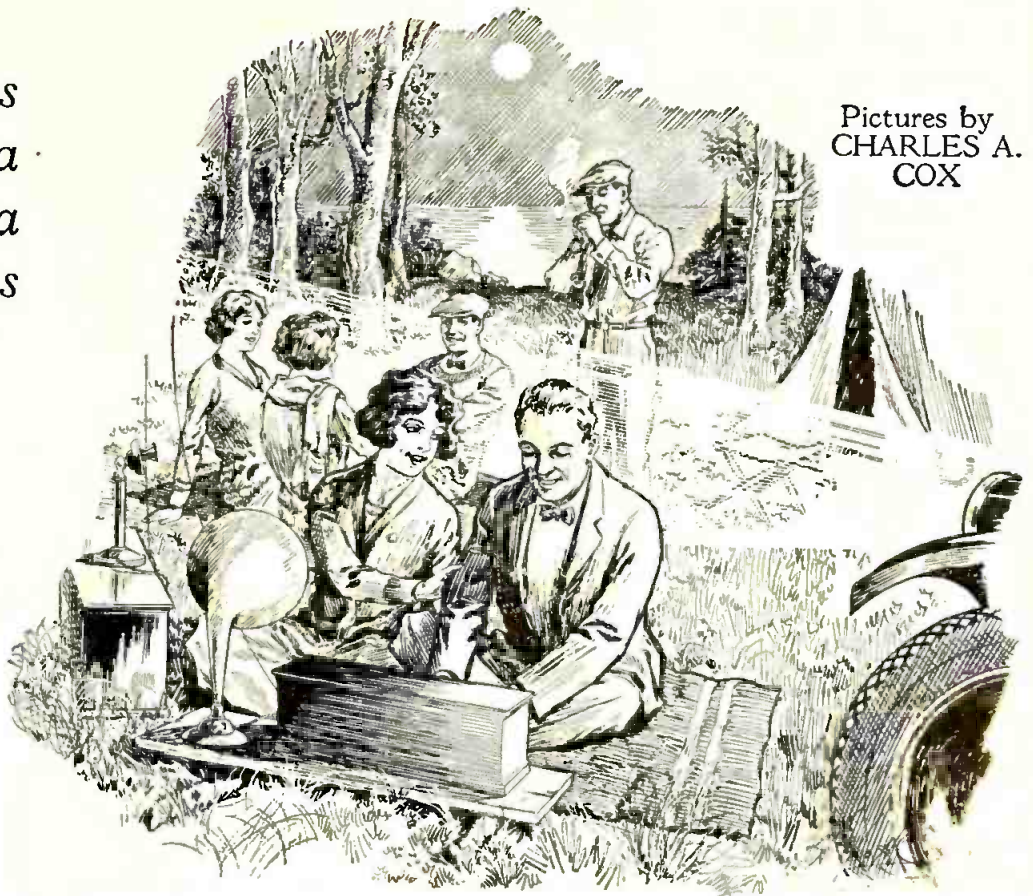
AT LAST! The tandem trio of honeymoon couples were in "honeymoon camp." Their planning for this event had not been so long, but it had seemed long. They had planned intensively, and when folks do things with this big word, time is measured with instruments of magnitude. That is where we get the expression "big time."

All these three couples had been married in tandem succession in one month, and weeks before the first of their weddings they began to plan their honeymoon together. Several conferences were held, and the whole gamut of mid-year recreation was discussed. In imagination they pictured themselves going all the way from the Adirondacks to the Pacific coast and from Niagara Falls to the woods and lakes of northern Wisconsin. Finally they decided to economize money, time, and distance and go camping fifty-four miles from home.

They went in Billy Rumford's seven-passenger touring car and Jerry Anderson's sedan, leaving behind them a much peeved community. The young husbands were so much in love with their brides, and the brides were so proud of their husbands, that they just simply didn't seem to have any use for anybody else. It was the "talk of the town;" that is, the society end of things. Everybody was "good and sore." Several of their outraged friends, among them Charley Patterson, Burt Morris and Steve Mayfair, organized themselves into a "Punishment Club," boldly announcing the vengeful purpose of their constitution and by-laws before the departure of the "tandem trio."

Billy and Helen

BILLY RUMFORD and his bride, Helen, a girl of plain appearance, but compelling wit and spirit, sat in the front seat of the Touring car. Behind them and on the running boards was packed an amplitude of tent canvas.



Pictures by
CHARLES A.
COX

"What's this? Listen . . ." exclaimed Billy.

"Finest silverware you ever saw," one of the voices in the loud speaker was saying. "Wonder if there's not some diamonds here too."

"Ray's broadcasting burglar alarm is working!" Alice cried. "There are burglars in the house!"

folding cots, folding chairs, poles, ropes, kitchen utensils, canned and cured foods, vegetables, and, by no means least of all, Billy's locally famous radiophone outfit of 50-watts power, for the removal of which he had a special permit. In the sedan rode Jerry Anderson with his pretty bride, Alice, and Carl Frisbee with his timid but naively brilliant wife, Marie.

All went well until about five miles from their camping destination, when the engine of the sedan began to balk. The three young husbands worked on it for an hour, but were unable to locate the trouble. At last Billy said:

"Let's give it up and tow her the rest of the way. It's getting late, only three hours till sundown, and we've got the tents to pitch, supper to get, and the radio to hook up."

This was agreed upon, and a tow was arranged with the skid-chains of the two machines. In this manner they reached their camping place on the shore of a small lake in a wilderness of woods, with the nearest house half a mile away.

Then began the real "speed job" of the day. Two of the recent bridegrooms pitched the tents on an open, grassy plot near the lake and extended a single-wire antenna between two trees on opposite sides of the 150-foot clearing, with insulators beyond the reach of

the branches. The other husband, Carl Frisbee, built two fireplaces with stones, placing over one a metal broiling grate and suspending over the other a kettle from a stick-in-a-crotch crane for boiling water. Meanwhile, one of the young wives aided in unloading the touring car, setting up the cots in the tents, and in the distributing the camp furniture, while the other two prepared supper.

Half an hour after sundown the camp was "in shape" for the night, and a steaming supper was on the folding table, constructed for six "in a pinch." In the illumination of the automobile headlights, they ate the repast, while a smudge near-by served well to keep the mosquitos away.

A Home-made Outfit

AFTER supper Billy completed the hook-up of his radiophone. Then he jacked up the rear end of the touring car, took off the rim and tire of one of the wheels, and substituted a rim without a tire. A few feet from this improvised sheave wheel, he anchored his voltage generator and connected them with a power transmission cable. Then he started the automobile engine and soon was generating a voltage sufficient to broadcast a hundred miles or more.

These preparations complete, Billy began to tune for some preliminary

musical entertainment. The first he got was a bit of vaudeville, broadcast from a Chicago station. A song of mock-sadness was sung, and then a comedian began to broadcast some "wise cracks," which were answered naively by a character introduced by the joker as Mr. E. Z. Mark.

"When is an automobile not a frog, Mr. Mark?" asked the fun maker.

"I don't know, Mr. Smart," replied the other. "When is an automobile not a frog?"

"When it is towed," replied Mr. Smart, whereupon there was a roar of stage laughter from a group evidently stationed before the microphone to produce the applause of an "appreciative audience."

"Oh, don't give us any more of that," protested Jerry, owner of the towed automobile. "See if you can't find some opera music that will harmonize with the voice of nature around us. I resent that slur on my sedan. Listen how beautifully the frogs are singing by the lake, and the crickets and the katydids—"

"Yes, and the tree toads," interrupted Jerry. "Hear that one off there?"

"Off where?" demanded Marie, tipping her head first to the right and then to the left in listening attitude.

"You can't tell directions of the 'voices of the night'," said Helen sharply. "Didn't you ever try to locate a cricket by its voice?"

"Yes, I have," Marie admitted; "and it's just about as hard to locate as a katydid."

"Or a frog, or a tree toad or a whip-poor-will, or any sound broadcast out in the open country, particularly in or near the woods," said Carl. "All these noisy animals and insects are broadcasters, don't you know?"

"Yes, and you need a radio compass to find them," suggested Helen.

"Two or three in widely different positions to determine their latitude and longitude," suggested Billy with the expertness of an experimenter.

"They make me think of—of—burglars," said Marie with characteristic timidity. "Do find us some real nice music, Billy; something that will drown out all these ghostly noises."

"Well, we don't want any burglarous shivers and shudders round here," Billy decreed. "I'll see what I can find," he continued as he began to twist the dials.

"First, see if you can pick up any of our friends at home," suggested Alice.

"Are you homesick already, Mrs. Anderson?" demanded Helen.

"Not at all, Mrs. Rumford," flashed back the challenged bride, smartly; "but maybe some of the folks in town are talking about us."

"Oh-ho, Miss Vanity—Mrs. Vanity, I mean! You know the old saying about people who listen secretly to what people say about them."

"Hold on," interposed Jerry with mock challenge in his voice. "When you call my wife Mrs. Vanity, you call me Mr. Vanity."



"Gee, this is some find!" a heavy voice from the loud speaker said. "It's father's home! Alice cried with a picture of two rough characters in her mind."

"Shame on you, Jerry," put in Helen. "You're an ideal husband, you are. That's what I call real vanity. Why don't you forget yourself and defend her?"

"Here we are—stop your quarreling," announced Billy. "I don't know what I've got, but I've got something. I tuned to get your brother at your folks' home, Alice, but there are strange voices here."

"Why, my folks are away," Alice replied. "You can't get anybody there. They've gone to Lake Geneva. I thought I told you that."

"Is that so? Well, listen here. My goodness. What's this? Listen."

A Voice in the Dark

Even before he finished his excited utterances, the voices in the loud speaker were becoming more and more distinct, with awesome foreboding.

"Yes, these are real stuff, solid silver," one of the voices was saying. "Finest lot of silverware you ever saw. And look at this pitcher—solid stuff, Bimbo, and these trays. What a silver mine! Wonder if there's not some diamonds here. Ought to be. We'll take a trip to Europe or the Sandwich Islands on this haul, Bim."

"What does it mean, Jerry?" Alice gasped, seizing her husband's arm. "Billy, that isn't father's home, is it? It can't be, it surely can't be."

"I'm afraid it is," Billy replied.

"There's no other way to explain that sort of talk."

"Then Ray's broadcasting burglar alarm is working," Alice screamed. "There's burglars in the house. Oh, my, oh, my! What will we do?"

Chapter II

The Microphone Bullet Eater

GHOST-LIKE silence hovered over the camp for several moments after

Alice's panicky declaration. Helen was the first to break it.

"Oh, you must be mistaken," she said, addressing both Billy and Alice. "They wouldn't be so foolish as to broadcast a confession of their guilt to the whole world."

"They're not doing it purposely," Billy replied. "But maybe you don't fully understand Ray's invention."

"Oh, yes, I do," Alice insisted. "He's described it to me several times, and I can recite it off like a book. He's in Washington now perfecting his patent and consulting with government radio officials on his automatic shift for sending and receiving, which makes it possible to call a station when the operator is not listening in. He has this in operation at home in conjunction with a burglar alarm, which is heard by every listening amateur in range of his transmitter if burglars break into the place."

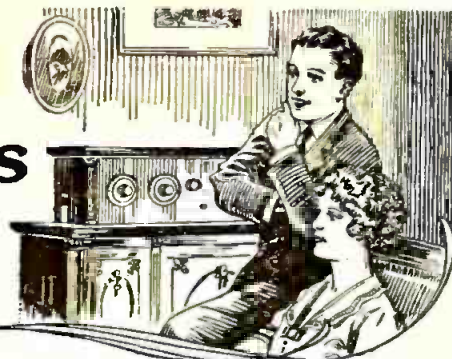
"Yes, and he's had the device in operation only a short time and hasn't explained it to any other amateurs, except me, so far as I know, for fear his patent be stolen before it is perfected," said Billy. "So we're the only ones of all those now listening in that will understand that alarm or the burglars' conversation."

"The device is simple, but ingenious. An electro-magnetic wave of given length and impulse serves to kill a magnet

(Turn to page 70)



What the Broadcasters are Doing



Graduation Held Over Radio at WCCO

GRADUATION exercises over the air—that is the latest feature from the Gold Medal Station, Minneapolis-Saint Paul, WCCO. Wednesday, January 21st, at 2:00 p. m. the graduates of the first Gold Medal Radio Cooking School received their diplomas, listened to the Baccalaureate address by Betty Crocker, who directed the school, and heard the valedictorian and salutatorian.

The first Gold Medal Radio Cooking School opened on November 4th. Classes were held every Tuesday morning over the air, when Betty Crocker, Home Economics Specialist of the Station, instructed. Approximately 2,000 women from fourteen states registered for the course, which was completed December 23d.

In order to graduate and receive a diploma, it was necessary that certain recipes which had been given in the classes be worked out and reports made on them. Although the school ended at a busy time just before the holidays, 250 women from five Northwest states qualified for graduation.

It was impossible for all of them to come to Minneapolis to receive their diplomas during the graduation exercises at the Gold Medal Station, so an effort was made, Miss Betty Crocker stated, to have at least one representative from each state there.

The graduation exercises were similar to those conducted by the average schools, with special music arranged by WCCO artists. That these exercises aroused a large amount of interest among the women who participated in the course is evidenced by the letters received, it was said.

One Wisconsin woman wrote in that she and several of her neighbors had taken the course and met in her home on January 21 to listen in on the graduation exercises, and said she had a new dress made for the occasion.

The oldest student in the class was an 82-year old Minneapolis woman. She wrote to Betty Crocker that she was particularly interested in completing the work and graduating, as she had never before graduated from anything in her life. She completed all of the work assigned and received her diploma.

Two blind women were also among the students. They stated that the course had been of particular value to them because they could not read magazines and get the suggestions of which other women make use.

Movie Star Meets Doom Before "Mike"

J. WARREN KERRIGAN, widely known motion picture star, has faced thousands of movie cameras without flinching, but he admittedly met his Waterloo lately when he faced the microphone of Station WGN, located on the Drake Hotel, Chicago.

Mr. Kerrigan was scheduled to appear on one of WGN's afternoon programs and to tell of his experiences while engaged in filming "The Covered Wagen," of which he is the star.

Before he was able to get launched into the topic of his talk, he moved his arm and unintentionally shut off the microphone. He talked for fully five minutes before it was discovered that his words were not travelling farther than the confines of the velvet-lined studio.

Mr. Kerrigan was told to start all over again—which he did. "But," he explains, "from then on I was all upset. I stuttered, gasped and said things never meant to be said. Finally I told Quin Ryan to shut off the juice. The microphone had licked me."

(The photo of Mr. Kerrigan above is copyright by the Drake Studio.)



(Drake Photo)

Kiutus Tecumseh, a full-blooded Indian, prides himself as the "radio representative of the Red Men," and in their cause he is travelling among the big radio stations, singing famous Indian melodies and telling their romantic history. He is now appearing from WEA, New York.

WGY on Air 1630 Hours During 1924

A REVIEW of the year's operation of WGY, the Eastern station of the General Electric Company at Schenectady, N. Y., shows that the station was on the air 1,630 hours during 1924, an average of about four and one half hours per day.

WGY is not on the air Wednesday evenings except on very rare occasions, under special permit from the radio supervisor, and Monday evenings the station leaves the air promptly at 9 o'clock, at which time WHAZ of Troy, N. Y., is licensed to hold forth. In 1923 the total of operating hours was 1,106.

The increase of operating hours for WGY from 1923 to 1924 is due to the expanding activities of the station and also to the broadcasting of the national conventions of the Republican and Democratic parties, as well as several campaign speeches by the presidential candidates.

Efficiency is High

The efficiency of the station, during the period it was on the air, was 99.99. This record speaks well for the watchfulness and expertness of the radio engineers who are responsible for the operation of the station. These men who are never heard by the radio audience are responsible for the quality of the transmitter signals and on their alertness depends the continuity of the program.

During 1924 there were seven suspensions of broadcast service from WGY due to apparatus trouble and five of these breaks in program came during daylight transmission. The total time lost was thirty-six minutes. On one occasion, lightning struck the antenna and induction burned out meters and condensers. Service was suspended fifteen seconds, the time required to bring spare parts into commission.

Tiny Station Shows 'Em

Dreams of the undergraduate members of a little class in radio at Knox College at Galesburg, Illinois, of establishing a Class "A" broadcasting station were fulfilled during February as a result of their own efforts when WFBZ, the Siwash station, took the air for the first time and broadcast a Knox-Monmouth basket ball game to nearby States with an outfit costing but \$175, which made a good showing within a radius where there were many stations costing from \$10,000 to \$60,000 sending forth their programs.

Down the Corridors of Time

A Breath of Old-World Romance from SBR, Belgium

YOU do not need to get your thrill of Old World romance out of pictures, tales or travels nowadays. Just tune in on 265 meters one of these unstatic evenings and listen to a musical instrument that was built centuries before you or I or our granddads were born. Tune sharply and listen carefully and you will hear M. Marcel van Loust de Borkenfeldt announce that it is Station SBR, Brussels, Belgium.

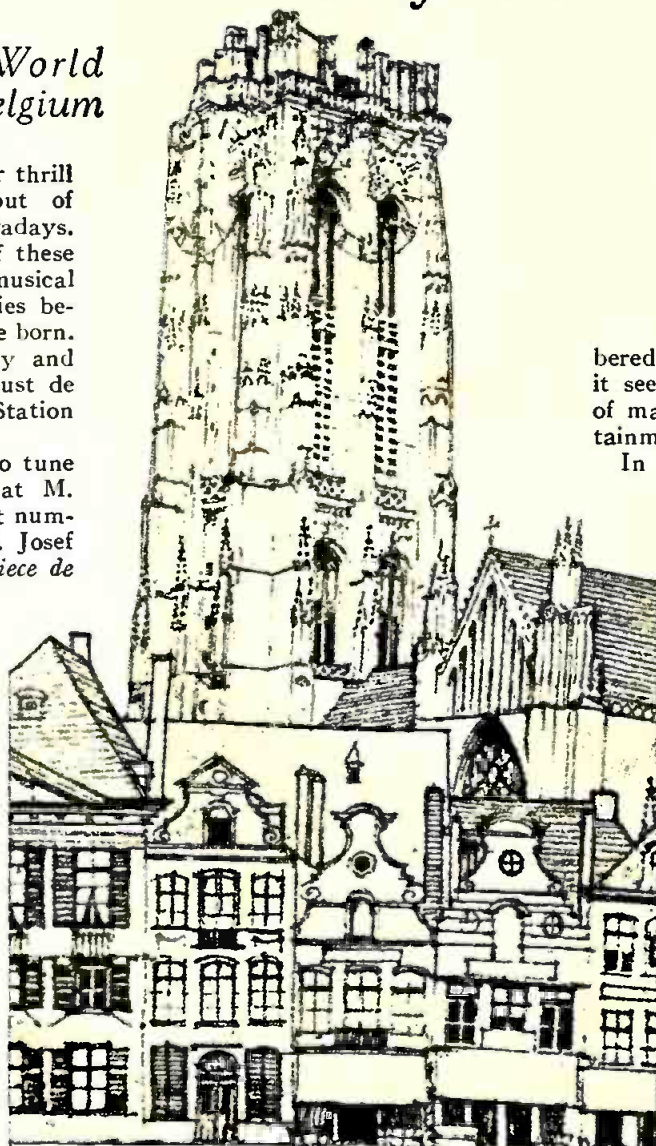
Lucky are you if you chance to tune in on one of those evenings that M. Borkenfeldt tells you that the next number will be a carillon solo by M. Josef Denyn. For that will be the *piece de resistance* of old country radio broadcasting. M. Denyn is the master of the bells in the ages-old tower of the cathedral at Malines. Malines is the historic town, north of Brussels, where Cardinal Mercier served his God and his country and delivered his memorable Phillipic against the warriors who executed Edith Cavell. Malines made its voice heard throughout the world eight years ago because it chanced that the German gray-blue hordes passed that way into France and, in passing, left a scar

Like Days of Old

BUT the war is over now and Belgium is the old Belgium of the days when the cafes were athrob with music, when the Grand Place at Brussels was a rendezvous for the volatile good folk and the gardens were merry with wine women and song.

But the carillon. In the belfry at Malines are stationary bells which are "played" by M. Denyn, in much the same manner as one would play an organ or a piano, except that the musical contrivance is on such a gigantic scale that no ordinary finger-board is sufficient to exploit it. The *carillonneur* must use a keyboard, called a *clavier*, and instead of running his fingers lightly over the keys, he must pound them lustily with his fists. An old authority has laid down the rule that a "*carillonneur* must have good hands and feet and be free from the gout."

The carillon at Malines was famous before the advent of radio broadcasting. But it is much more famous since radio carried the rich, deep music of the enormous bells across international boundaries and virtually across the seven seas. M. Borkenfeldt was too much of a radio artist to overlook the value of the Malines carillon, and when I visited him in his broadcasting station in Brussels last Summer, the one thing about which he



Here is an excellent view of the Malines Cathedral, at Malines, Belgium. The chimes broadcast through SBR from the tower of this ancient structure have literally crossed the seven seas. (Drawing of cathedral by Briant Poulter by courtesy of "The Architect," London.)

By FREDERICK SMITH

was most enthusiastic was his plan to broadcast the bells of Malines. He told me he would do it—and how astonishing has been his success!

Crossing the Atlantic

IN the recent international tests the bells of Malines were heard as far west as Salt Lake City, Utah. They have been heard on the fringe of the burning sands of Algeria and in the winter of Helsingfors. M. Denyn has good hands and no gout. There is but one broadcasting station in Belgium. M. Borkenfeldt is very proud of it. It is owned by the Radio Belgique Stock Company. When I was in Brussels, the directors told me that the radio listeners who paid their government licenses to listen in numbered 8,000 to 9,000, while those who stealthily tuned in on unlicensed receiving sets num-



M. Borkenfeldt, director and announcer of SBR, Belgium's only radio station.

bered 30,000 to 40,000 more. Belgium, it seems, has the Old World policy of making the fan pay for his entertainment.

In days now almost prehistoric, the carillon was limited to three or four bells, but the number of bells has increased until a good *carillonneur* must have reached the highest point of efficiency. M. Denyn, for example, is known as "The Liszt of the Bells." He has a repertoire that includes not only Flemish music, but old English folk songs, Scotch airs, the national anthems of several countries and many selections from operas.

M. Denyn is a good deal of a "Roxy" or a Jerry Sullivan or a Harry Snodgrass, if you will. He is invited to go to one country and another to play the local bells, and every season he is as regular in his appearance at Dorset as are American tourists in the so-called Sign of the Cheshire Cheese in dear old Lunnnon.

So keep an ear perked up for M. Borkenfeldt. You may hear him announcing from "Bruxelles" that M. Denyn is about to stir the echoes in the ancient belfry and send you a romantic mo-

ment all of time.

Doing Fine, Thank You!

THE question has often been raised concerning Belgium's confining itself to only one radio station. M. Borkenfeldt explains this by asserting that his countrymen are so enthused about Station SBR that they haven't the time or the inclination to grow dissatisfied.

His innate ability to prepare varied programs that appeal to not only Belgians, but listeners in all the surrounding European countries, is one of M. Borkenfeldt's outstanding accomplishments. Not only is he an expert program director, but a keen student of technical Radio as well.

Truly, he is one of the few predominating radio figures that have sprung up in Europe since the advent of broadcasting on the Continent.

“Zez”
Confrey
Wrote
“Kitten
on the
Keys,”
But
Here’s
the Girl
Who
Can
Play it!



How “The Girl
With the Sum-
mer-Resort Name”
Bowled Over
the Radio Fans
in New York!

And here’s Vee, the girl
who opened a radio station
all by herself—and in New
York, too!

Gotham’s “Radio Queen”

AN INTERVIEW BY WILLIS ARNOLD

NEW YORK:—The baby-queen of Roxy’s Gang, the regular Sunday night spectacle of rhythm and artistry broadcast from WEAf, New York City, has no greater admirer—and a secret one too—than Joe, the night elevator man of the Capitol Theater Bldg., where the studio is located.

Of course, Joe has his ups and downs, but he’ll tell the world that Vee Lawnhurst, “The Girl With The Summer-Resort Name,” knows jazz from J to Z.

It would be a shame to say that Vee played the piano! She’s got a natural born gift of sitting down behind the keys and making every little do, re, mi, trill out a Jolsonian “Mammy” that would make Al turn crimson under his make-up. Zez Confrey wrote “Kitten on the Keys” —but little Vee plays it! Indeed, Irving would go back to Berlin if he wrote a staff of syncopation that Vee couldn’t execute to the delight of every charter member of the Iwantadance Club.

Ask the average radio or theatrical star her age and you get in return either a

scowl or a misinterpretation of the truth —but again—it’s different with Vee. “I’m nineteen” she’ll smilingly reply.

“And never been kissed?” you’re just aching to ask her—but don’t dare!

Her First Attempt

“OH, THAT first time before the mike,” Vee will tell you, “was the best and the worst. It was 2 o’clock in the morning, and they had just finished Station WGBS here in New York. It was the first testing program, and never a word had been ushered through that microphone before. I was announcer, singer, pianist—guess I was the whole show that early morning!”

“But I was just as scared as could be! I could just picture millions and millions of people all over the world as well as my own circle of friends located near the station making fun of my tongue-tied antics.

“That sure was some exciting morning! This is err . . . Station W . . . WGBS . . . err . . . a test

program’ were the first words that I stuttered and faltered through. But one sudden and happy thought saved the day. I announced myself as ‘Laura Lawnhurst’—even said that she would favor us with a piano solo. Then I hustled off to the piano and played—miserably! Next I announced some other tricky name and said she would sing. Well, she didn’t—though honestly she tried awfully hard. And so went the little monologue on and on, for ages it seemed!

“It was a test program—and some test too! Such a test it has never had since, I’m sure.”

But Vee is inclined to be a six letter word meaning reserved, as the Cross-word Puzzler would say. Modesty is a prized virtue, but especially so when Father Time has only nineteen short years chalked up against she who is modest.

Yet, two years ago, when Vee was only seventeen, she was the star jazz pianola roll maker for Ampico and other leading companies. That’s nothing! She’s

(Turn to page 73)

*The Boys Who Rose to Vaudeville
Fame Are Now Real Radio Headliners*

The LOOS BROTHERS Tell How They Do It

*Unbroken Partnership with Real Understanding,
Responsible for Success, "Ernie and Billy" Say*



Ernie Loos, who can sing three octaves without flinching.

IT WAS New Year's Eve—that night of nights when radio stations vie to put on the biggest "show" of the year; and on this occasion the place was the crystal radio studio of Station WEBH, located on the Edgewater Beach Hotel, Chicago.

A tour of stations throughout the city and vicinity revealed that nearly everyone was going full blast at midnight, with a galaxy of stars that rivaled those to be found on the most pretentious legitimate stage. Every station had its "exclusive" artists, doing their best to keep that station on the air till the wee, small hours of the New Year.

The Edgewater Beach Station had a group of sober yet peppy artists there, under the direction of Studio Director Dean Remick and Station Director Robert Boniel. The guests at the hotel viewed the radio artists through the glass studio with the eyes of persons who were used to such things and thought them perfectly commonplace.

The Awakening

BUT shortly after midnight people began to talk. Did you see those two immaculately evening-dressed men—not youngsters, but youngish looking men, who just entered the studio? Later

they sang together for the orchestra, and then they hied back to the studio, and, seated cozily in front of the studio piano, they reeled off crooning jazz ditties such as have never been heard before. Noses were pressed against the glass wall to get a better view of these veteran entertainers "in action" before the microphone.

Questions revealed the information that the two distinguished-looking gentlemen were brothers—Ernie and Billy Loos. Ernie is the big fellow, who rolls his eyes when he sings those southern jazz melodies. Billy is the little one who tickles the ivories and harmonizes with a deep baritone with his brother's bass, or tenor—for Ernie's equally adept at either.

Ernie and Billy appear at WEBH regularly. They have appeared on RADIO AGE programs from that station with great success. Their advent into radio entertainment is only recent, but for that reason radio fans should not get the idea that the Loos Brothers are new to American music lovers.

On the contrary, they are one of the best known "brother" pairs on the American vaudeville stage. Strange as it may seem, the Loos Brothers are really brothers. Their respective physiognomies, which may be compared to advantage, prove that. And again, strange to say, these brothers have remained together for nearly two decades without a rift in the ranks. That is indeed an accomplishment.

Ernie and Billy Loos began their careers singing illustrated songs for their father, one of Chicago's first motion picture exhibitors. However, they soon outgrew their father's direction, and branched off for themselves. They landed long-time contracts with the old Sullivan and Considine vaudeville circuit and later became a permanent institution with Keith's circuit.

Going the Rounds

THEY have appeared during the last ten years at nearly all of New York's big cafes and theatres, and until recently they were "fixtures" at the Marigold Gardens, Rainbo Gardens and with Isham Jones' orchestra in Chicago. Now they are devoting most of their time

to entertaining by radio for big song publishers. Sooner or later they expect to be back in vaudeville, for as Ernie says, "It's in the blood."

Ernie Loos sings three octaves in tenor and bass, and some persons believe there are more than two singing when this pair start their vocal contortions. Billy plays the piano and sings a rich, full baritone that has won him wide commendation. Of course, they show to the best advantage on the stage, but even the curtain of the ether fails to shut out their dominating personality when they start such melodies as "Too Tired," "Broadcasting Mamma," (one of their own ditties) and "Oh, Mabel!"

So popular have they become that persons visiting the Edgewater Beach Hotel insist that the Loos boys come out of the studio and sing to the gatherings in the Marine Dining Room. And of course "the boys" do it.



Billy Loos, who can sing a baritone and play the piano, too.

Hazel and Her Tantalizing Fiddle

By LERA MCGINTY

THOUSANDS of people throughout the broadcasting area of radio station WBAP at Fort Worth, Tex., adjust their headphones and tune in their loud speakers each Sunday night for the midnight concert, knowing that unusually good entertainment awaits them.

Are they disappointed? If you have ever heard Miss Hazel Boyer and her "tantalizing fiddle" at this period, you can easily answer that question for yourself.

To play effectively to a countless number of people time after time, never failing to bring wires and long distance telephone messages from almost every state in the Union, to say nothing of the great quantity of mail received each week, is an achievement that few can boast of. Judging by the applause received by Miss Boyer, she is without doubt the most popular radio entertainer in the Southwest.

At an Early Age

AT THE age of five Hazel began her career as a violinist under the able teaching of her mother. Unlike most little girls of that tender age, she did not take her dollies to bed with her, but instead she religiously carried her violin up to her room each night and went to sleep with it hugged tightly in her arms. Her mother would slip quietly to the bedside and remove the fragile instrument.

One year later, she made her first public appearance in recital before friends. She was warmly received by fellow musicians at that time and a successful future was predicted for her. When she was still a child of ten, she attracted the attention of serious musicians who assured her of a future of success and brilliance if she would only work to that end.

Miss Boyer entered the professional world by playing at the Union Gospel Mission of Fort Worth, where she played for some time. The public gasped with astonishment at the skill the child-wonder showed in handling her instrument. This engagement brought forth offers from various sources outside of her own city, some of them in vaudeville. All were refused. She preferred to remain in Fort Worth with her mother and play for the people who knew and loved her.

Has Own Orchestra

SHE played engagements at the most prominent clubs and at the theatres of Fort Worth, later organizing her own orchestra and playing at the Metropolitan hotel. She is playing this season at the Crazy Hotel, Mineral Wells, a Texas health resort where her concerts are broadcast by remote control.

This Charming Girl Violinist Got Her Start by Taking a Fiddle to Bed with Her Instead of a Doll; Now She's the Most Popular Radio Entertainer in the Southwest; Here's Why



Miss Hazel Boyer, with her violin, which can radiate jazz and classical airs with equal dexterity. If you doubt Hazel's popularity, just read her mail for one week!

Most of Miss Boyer's radio entertainment consists of that much-talked-of "American Folk Music"—jazz. That is because her audience demands it and not because it is the only class of music she can play. Hers is a rare gift that

few are blessed with, for she is so versatile as to play also Mendelssohn concerts with the ease and artistry of a genius. She has often been told by artists of world fame that she has the makings of a Maud Powell.

To be talented alone is wonderful, but to be beautiful, talented and the possessor of a smile that is never forgotten, is indeed a gift. It is an established fact to those who know her that her ever-present smile and pleasing personality have won for her as many friends as has her playing. Just how gracious she really is may be judged by the following remark, made by another woman musician of ability: "Hazel has had praise heaped upon her from her friends, her fellow musicians and musicians of note, yet she is unaffected and the same sweet Hazel of childhood." She also laughingly confided this, "You know as a rule that praise goes to one's head, especially to heads of temperamental musicians." Possibly some of the rest of us might have thought this, but would never dare to say it. The spokesman, being a musician herself, however, makes it all right.

THE question was asked as to whether or not Miss Boyer expected to attain greater things with her violin than she has done. The answer was not very definite. She said home ties were stronger, but her secret ambition seems to be to do concert work some day.

According to artists who should know by experience, she has no cause to fear the struggle experienced by many unknown musicians just beginning the upward climb, because she is a genius, and a genius is soon recognized and claimed.

Besides playing her "tantalizing fiddle" Miss Boyer likes to dance, swim and read radio mail. Of course, she cannot acknowledge all of the letters received, for who would play the fiddle if she did?

We radio fans are particular who substitutes for a favorite artist, and they tell her daily she has no equal. Therefore she wishes to take advantage of this opportunity to tell you that her mail is a never-failing source of delight to her and how much she appreciates the generous response accorded her each Sunday night by her listeners.

Although midnight is a fairly late hour to start a radio program on a Sunday evening, Station WBAP announces that judging by the number of requests that come in after midnight, a large portion of

the radio audience is awake and listening at that hour. WBAP is particularly popular at this time on Sundays, in view of the fact that the majority of the stations throughout the country "sign off" about 10 o'clock.



Miss Ramona M. Nelson, a soprano of note and incidentally one of the reasons why WBZ is popular among the males from coast to coast.

SPRINGFIELD, Mass.—WBZ was a great cheer-maker in the land where it's always WBZ—"Way Below Zero," said the sailors from the U.S. S. Patoka when they arrived in port at New York recently. They had just come from the land where the Esquimaux squat in their snow tepees up in Arctic waters.

They were referring to WBZ, the Westinghouse Electric Station in Springfield, Mass. Part of the programs which they heard had come from Boston, where the Herald-Traveler operates a remote-control studio in the Hotel Brunswick.

"It was great," the crew said, "to listen in to the ship's radio after swabbing the decks with chunks of ice and thawing out our beards with oxy-acetylene torches. We got a great many stations, for in that land of white-washed bears and cheap snow, static is almost nil during the winter and concerts came in loudly. But the best station was WBZ. It came in as clear as champagne and the programs were great."

It wasn't long after WBZ got this message from the thankful "gobs" before they heard from the state of Washington, where lumber-jacks in the fir-camps had heard them.

A Big Event

THIS happened in Independence, Washington, where one of the radio bugs ran through the town shouting that he had heard voices from the East. Immediately the town council voted this as

"The busiest person in the studio" is the title deserved and held by A. F. Edes, chief announcer, program director, host, etc., of WBZ. But he treats his work like play.

one of the town's most exciting moments since Lincoln was shot.

No wonder, either, that it caused a great furor in the land of trees, for the days are dull and the nights lonely. The husky jacks, many of them from brilliant Broadway, found great solace from their loneliness in radio, but for a long time they heard only the western stations. It was conceded by them that an eastern station would be a God-send, and when WBZ's thousand watts came flowing in they all sat down and wrote in to the station.



WBZ— The Station of Good CHEER

A Picture from Life
By MILTON LIEBERMAN

One reason that the sailors and lumber jacks so greatly appreciated WBZ was because through this station they received a greater variety of programs than through any other station in the country. It has thirty-two special wires and two permanent remote-control studios.

The two permanent ones are at the Hotel Kimball, Springfield, Mass., and in the Westinghouse studio of the Hotel Brunswick, Boston. Boston, incidentally, is one hundred miles from Springfield, and a two-way wire connects it with Springfield, where the antenna towers are located.

In Springfield, programs are broadcast by special wires from the Capital Theatre, Springfield Auditorium, State Theatre, Poli's Theatre, Court Square Theatre, Springfield Union, Cook's Butter-



A great help to digestion and a substantiation of the popularity of "Music While You Eat" is the Westinghouse Philharmonic Trio which plays several times a week from the Kimball Hotel studio of WBZ, at dinner-time. Gustave LaZazzera, cellist; Mrs. Eleanor Turner LaZazzera, pianist, and Gaetano Misterly, violinist.

WBZ May Mean "Way Below Zero," But Its Programs Have Warmed the Hearts of Arctic Explorers and the Men Far Away from Home

fly Dance Palace, Eastern States Exposition, National Institute of Musical Art, Church, and South Congregational Unity Church. In Boston, wires are run to the Boston Arena, Boston Opera House, Chickering Piano Building, Colonial Theatre, Convention Hall, Copley Plaza Hotel, Estey Organ Factory, Hotel Lenox, Hume Music Company, Jordan Hall, Kieth's Theatre, Majestic Theatre, Mechanics Building, Plymouth Theatre, St. James Theatre, Shubert Theatre, Steinart Hall, Symphony Hall, Tremont Theatre, and the Wilbur Theatre.

This, as you see, gives the radio public a glimpse of sedate Boston in all its moods. Jazz and sermons, concerts and prize fights,—all are tapped by WBZ.

If WBZ had been in operation in the old days, you probably would have heard a first-hand account of the famous Boston Tea Party. Let us picture William S. Tilton, one of the announcers, standing before the microphone on the evening of December 16, 1773.

"This is the Herald-Traveler studio, WBZ, broadcasting from the Hotel Brunswick, Boston, Mass. There was a little party here in Boston, folks, and we really wish that you were in on it. Especially you lovers of the well-known tea leaf. Mr. Lipton, who is famous as a tea farmer, and at times yacht racer, sent a supply of tea on the schooner Gaspee.

IT RAN aground off Providence, and some of our leading citizens, dressed as Indians in their charity ball costumes, went aboard and took possession. Amid great gayety, and occasional exclamations, such as 'haven't we got fun,' they tossed boxes of the tea overboard. The reason for this was that the Boston

taste for coffee was being violated by the balmy British, who insisted that we take their tea. Their insistence that we also pay the tax on it, without due representation in the British Parliament, was irritating, to say the least. If we were privileged to inflict our beans upon England, perhaps feeling would not have run so high."

Undoubtedly, also, WBZ would have broadcast a running account



A. L. S. Wood, dramatic editor of the Springfield Union, shares his extensive knowledge of the American stage and literature with radio fans regularly from WBZ, where he pours authoritative data into the Hotel Kimball studio microphone. When you hear it announced that you are going to be taken around to the theaters and introduced to this or that stage celebrity, you know "Al" is going to be your guide.



E. W. Bach is an announcer at WBZ, but on a moment's notice, as shown above, he can step before the microphone and sing a breath-taking baritone solo.

of the landing of the Pilgrims on Plymouth Rock, if they had been in existence at that time, for the WBZ boys do insist on getting "scoops."

However, it is a shame to complain that these events were not broadcast, when they have such excellent programs now. They are announced by Thomas H. McNally, and Alwyn E. W. Bach, besides Mr. Tilton.

George H. Jaspert is director of the station, and other members of the staff include A. F. Edes, the Herald-Traveler representative, and C. M. Burr, Westinghouse announcer. J. B. Coleman is the engineer in charge; V. A. Breglio handles the publicity

at Springfield, and A. S. Eisenmann is the associate director. John L. Ingram is chief operator, and his helpers are R. F. Bloom, Roger Houghton and H. R. Dyson. At the Kimball is E. G. Graton, and P. W. Harrison is in charge of operations at Boston with P. J. Robinson and G. W. Lang assisting.

WBZ was claimed to be the most consistent transmitting station in the United States by the Bureau of Standards, which found during thirteen measurements that there was absolutely no deviation from its assigned frequency.

During the Winter WBZ broadcasts educational courses, which include lessons in modern American Literature and appreciation of music. The courses are put on the air from the Hotel Brunswick in co-operation with the Massachusetts Department of Education.

Robert Emmons Rogers, professor of English literature at the Massachusetts Institute of Technology, conducts the course in modern American literature and delivers lectures every Monday at 7:30 p. m. Professor Stuart Mason of the New England Conservatory conducts the musical appreciation courses every Friday at 7:30 p. m.

A feature of which WBZ is very proud was the broadcasting of an interview with Jackie Coogan at a Kiwanis luncheon. It also broadcast the arrival of the round-the-world fliers at Boston, and every year sends the Conference of New England Governors on the air.

"Whit" — The Mystery MAN of Boston

By Oliver
JENKINS



Who wouldn't be an interviewer if he could have such charming ladies to interview as Betty Bronson? "Whit" is here shown prying all sorts of secrets from the popular movie star.

STATION WEEI, the Friendly Glow, Boston. The next feature on our program will be a radio interview by "Whit'."

And forgetting all about the DX records for the time, the million and a half listeners which WEEI figures as its average unseen audience at any given time when its program is on the air, settle back comfortably, whether in chairs of mohair or pine, anticipating a half hour of unadulterated enjoyment. Needless to say, their anticipations are always realized.

The radio interview originated with "Whit." It is a popular feature, for although the Boston station has been on the air only four months, stations all over the country have grasped at the idea and the radio interview is now a prominent attraction on many programs.

"Whit" has interviewed statesmen, actors, editors, cartoonists, radio experts and big business magnates—and even a ghost! Readers of RADIO AGE have already read something about this extraordinary event, but the subject simply can't be passed by without the mention of an interesting incident in connection with it.

Who's the Ghost?

THE "Ghost" was impersonated by no other than Charles Burton, the superintendent of the station. It isn't a simple matter to play the part of a ghost; it requires a little thought. But no problem, however difficult, can baffle "Burt" and "Whit" when they put their heads together. A handkerchief was thrown over the "mike" and the rest was easy. Telegrams poured into the studio all the night of Hallowe'en and many of the senders apparently thought the ghost might have been real, even in this Twentieth Century!

"Whit's"—we are going to shatter the secret now—"Whit's" real name is Lewis S. Whitcomb, and before entering the radio field, he was a newspaper man in Boston. He is today Assistant Superintendent of WEEI. How such a change took place within a few days is unusual, to say the least.

How Station WEEI is Putting the Friendly Glow Into Its Broadcasting by The Simple Process of Interviewing "Celebrities" for Its Million And a Half Enthusiastic Listener-Admirers.

Six months ago "Whit" was getting along very nicely as radio editor of the *Boston Post*, and within a few blocks of him was his old friend, Charlie Burton, radio editor of the *Boston Herald*. The two met frequently, quite often spending the lunch hour together, during which time they would exchange stories of radio and news interest. The men on the *Post* and the men on the *Herald* are supposed to be bitter rivals, but these two refused to be.

One day a rumor went the rounds of a possible new radio station which was being planned by the Edison Company of Boston. The next day, both of the friends went around to the office of the company and applied for the job of announcer. Neither one knew that the other had done so. Meeting a few days later, Burton casually mentioned the fact to "Whit" and "Whit" mentioned that he had done the same thing.

"There's not much chance of both of us getting the job," said Burton. "One of us is going to be out of luck."

So "Whit" attempted to withdraw his application, but the company refused to allow it.

"I'll tell you, Charlie," said "Whit." "I've got an idea. It's been running around loose in my mind for days. We newspaper fellows interview people, don't we? Then, why not try the same thing over the radio? Interview interesting people. It ought to go over big."

The Problem Solved

"**I**T'S a humdinger of an idea," agreed Charlie, "and that solves the problem. If I get the job, I'll spring the idea and

let you do the interviews. If you get the job, you do the same with me."

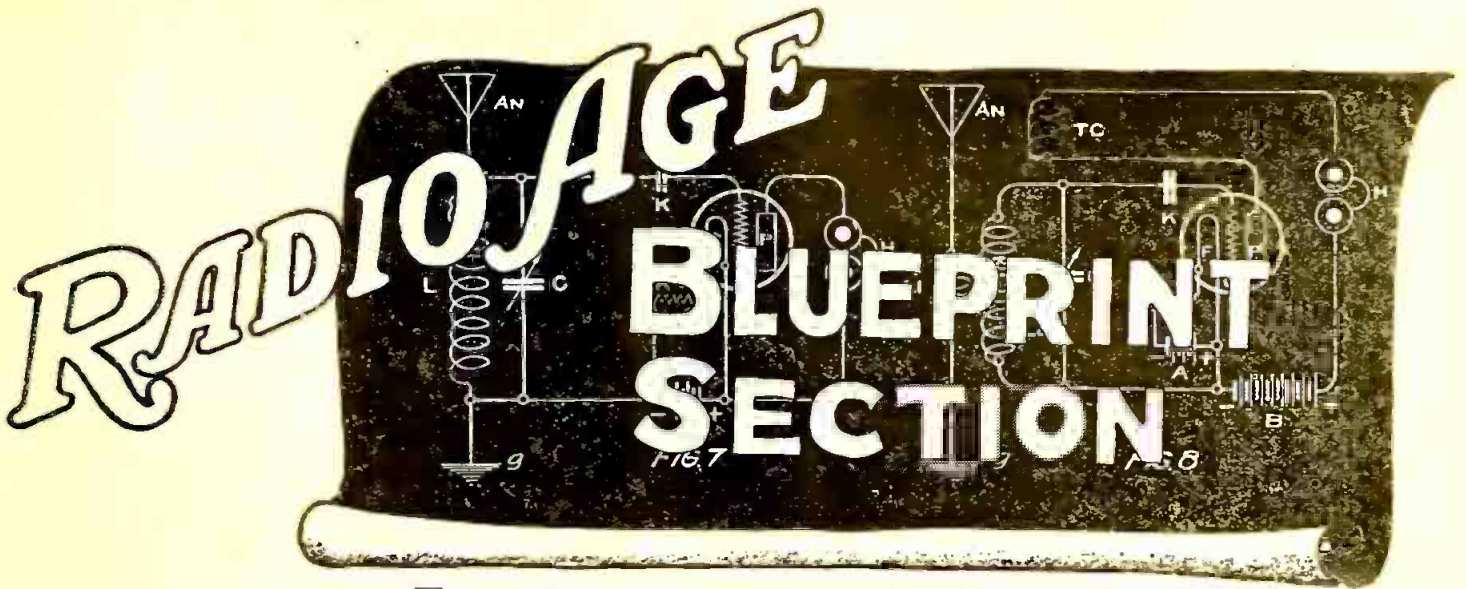
The agreement was made on the spot. Everything was fine, after all. Neither guessed that things were going to be even finer. Two days later both of them received letters offering them positions with the new station. Burton went on as superintendent and "Whit" as assistant. The station had been running only a week when "Whit" put his interview idea into action. As the theatre people say, it was a "riot."

Some people are swamped with ideas. "Whit" is one of these people. The interview notion did not end things. "Whit" has decided that radio can pay. That, of course, is one of the big questions of the hour. Well, can it?

"Whit" says yes. He's going to prove it. Within the past few weeks he has already put the station on a partially paying basis. His venture is just in its infancy, however, and the time has not yet come to tell whether it is practical or not. But, knowing "Whit," we haven't any fears.

One of the newest stunts to be tried by him is "Moving-pictures in relation to the radio station." The pictures show the workings of the station, the various studios hooked up with it, and some of the millions of people who listen in. The picture is woven around a charming story of love and adventure, and will be shown soon in Boston theatres. Of course, this is in a way an advertising stunt, but it is one that any station might use profitably, and after all it is interesting as well as educational.

(Turn to page 72)



For Maximum Tube Mileage
A Two-Tube Ultra Audion
 By JOHN B. RATHBUN

Copyright: 1925

*A New Version of an
 Old Reliable Hookup*

OF the twenty-eight radio receiving circuits known as ultra-audions, there is one simple circuit that is most commonly known to the radio novice. This is the Gibbon's ultra-audion, alias the "Little Wonder Circuit," alias the "Radio Demon," alias the "Ultraphone," alias the "Gibbon's Oscillator." It has also paraded under the peculiar cognomen of the "Carpet of Bagdad," which however, has nothing to do with the photoplay of that name. In fact, every time that any dealer wishes to bring out a simple, cheap and efficient distance getter, he drags out the old Gibbon's and labels it with his pet name. Results are about as certain with this little outfit as is possible with any simple combination of variable condenser and single inductance coil; hence it is ideal in its own sphere of usefulness.

One thing that appeals particularly to the poor hook-up editor is the fact that you have twenty-eight chances of avoiding a mistake in connecting it up; in fact, it is almost impossible to get it hooked up so that it will not percolate to some extent unless you should get the "B" battery across the filament of the tube. Confidentially, it can also be used as a transmitter over a short range by connecting a microphone in the ground circuit. This statement will probably bring down the united curses of entire neighborhoods on my head for bringing it to our readers' attention, but I thought you ought to know it. Radiate? I'll say she does. When the village pest starts twisting the dials of this outfit you will see your neighbors climbing up to the house tops taking down their aerials.

But It Works!

IT may be noisy and it may radiate, but it certainly gets the DX. Like every other circuit having distance getting qualities, it is noisy, unstable,

and not particularly selective where there is much strong local, but it will reward you by pulling in stuff that you would otherwise only read about. Dollar for dollar, and tube for tube, you can cover more mileage with the ultra-audion than any other set I know of, and it is on this basis alone that I recommend it. For a single circuit receiver it tunes quite sharply, and is selective enough when

fifty miles or more away from a broadcasting station, but in congested local traffic it is not much good, and in Chicago it is practically useless except on silent nights.

In Chicago, the complete set of parts have been sold retail for \$6.75 for the single tube ultra, and from \$10.00 to \$12.00 for the two tube set. This, of course, does not include headset, tubes or battery. This is not so much greater than the cost of building a crystal set, except for the tubes and battery, and you get real tube results with a few dollars invested.

I do not recommend the single tube ultra-audion for two reasons. (1) Because the phone impedance forms part of the inductive balance in the circuit which is upset when two or more pair of phones are inserted into the detector circuit, and (2) because there is a considerable body capacity effect in the phone cords when the headset is connected directly to the detector tube. By using an audio transformer as the inductance for the first tube, we do away with both difficulties and the receiver is therefore much more flexible in regard to the output connections. A single tube ultra will not carry two sets of phones satisfactorily, either in series or in parallel, for this varies the feed-back potential and therefore the degree of regeneration. When working full blast on distance, the phone cord capacity may be so great that the station will be tuned in or out every time that you move your head or touch the headset with your fingers, but the introduction of an audio transformer and second tube will prevent this trouble.

Wide Meter Range

IN Fig. 1 is a picture diagram of the two tube ultra-audion using a spiderweb coil or "pure inductance" for the tuning

(Turn to page 42)

**A COMPLETE BLUEPRINT
 SECTION IN THE
 ANNUAL**

A thirty-two page blueprint section, replete with tried hookups and sixteen pages of blueprints in actual color, is the outstanding feature of the RADIO AGE ANNUAL for 1925, now available at \$1.00 a copy. You can use these blueprints as real working drawings, for they are clear and easy to follow. Sixteen pages of blueprints are worth many times the purchase price of the ANNUAL.

In addition to the blueprint section, there are hundreds of new hookups for beginner and expert in the ANNUAL for 1925. Every class of radio fan will find his wants fulfilled.

The first edition consists of a limited number of copies, which are being exhausted quickly. Send your dollar NOW if you want to be assured of getting your copy of the RADIO AGE ANNUAL.

Blueprints of the Two-Tube Ultra Audion on Two Pages Following

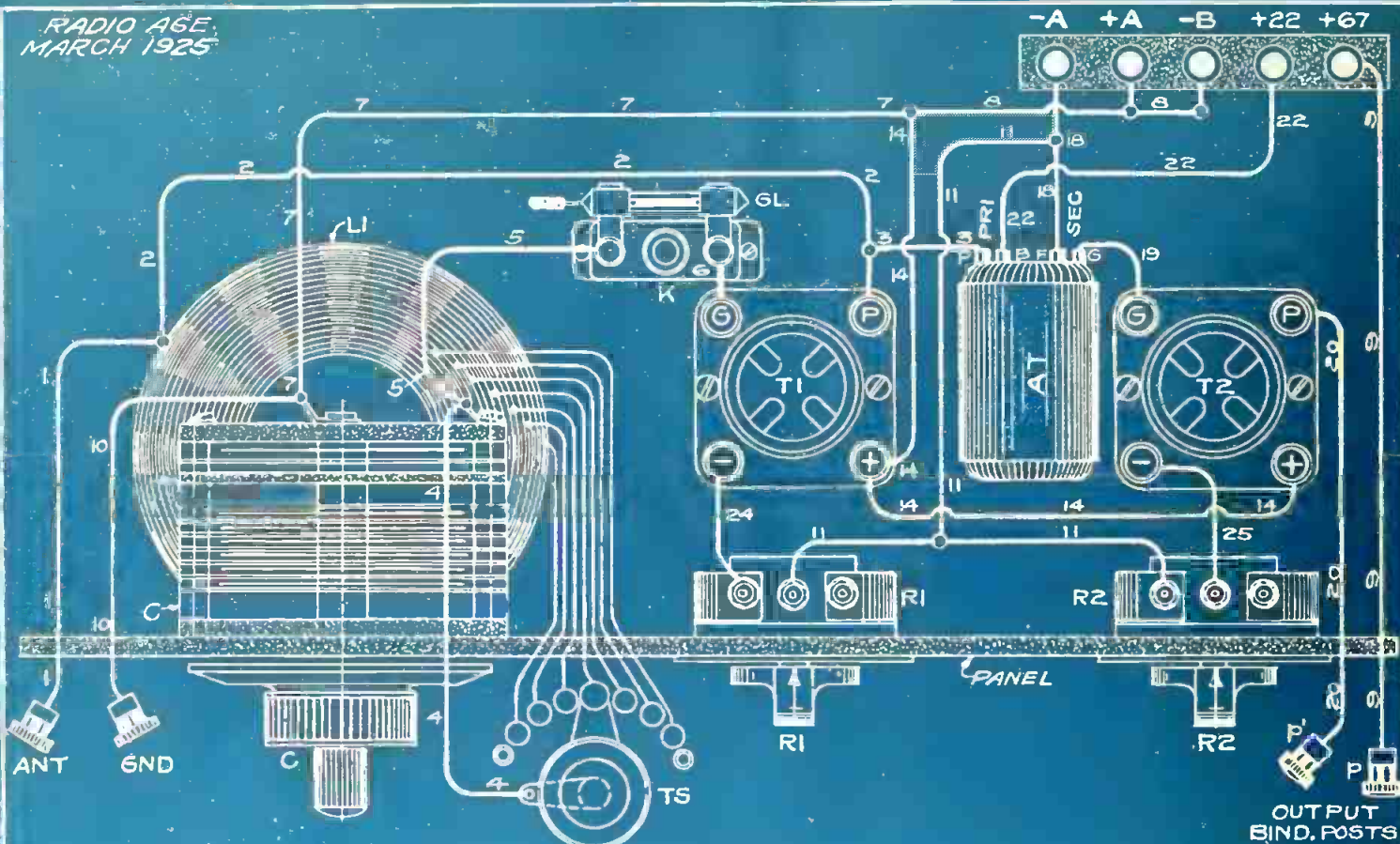


FIG. 1
PLAN VIEW OF ULTRA-AUDION

IN ORDER TO SHOW THE OUTPUT CONNECTIONS FOR EITHER JACKS OR BINDING POSTS AS MAY BE DESIRED, WE SHOW POSTS IN FIG. 1 AND JACK IN FIG. 2.

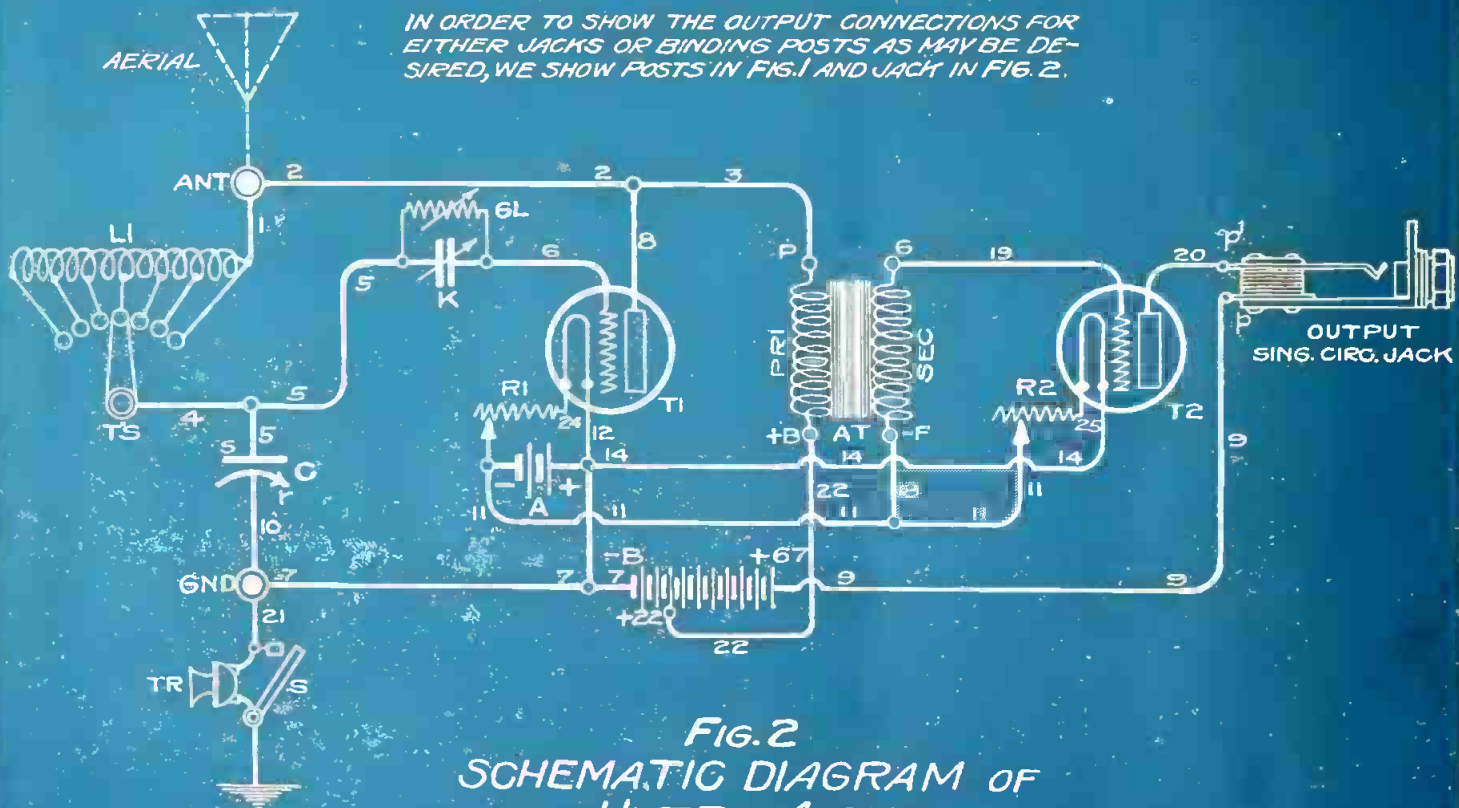
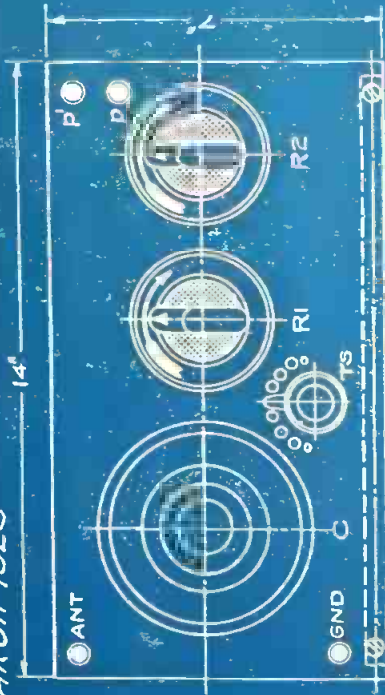


FIG. 2
SCHEMATIC DIAGRAM OF ULTRA-AUDION

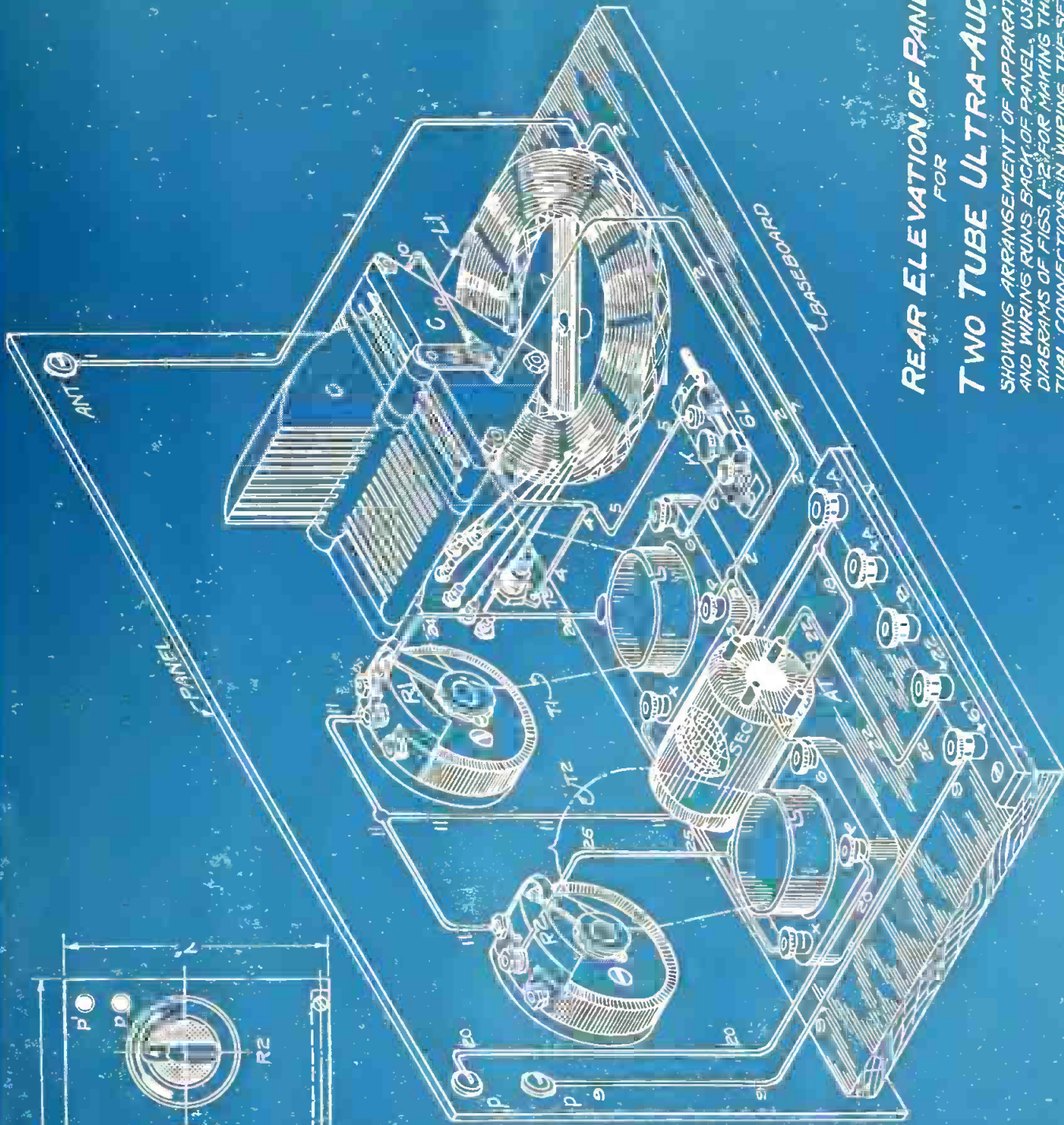
SHOWING RECEIVER WITH ONE STAGE OF AUDIO AND EQUIPPED WITH TRANSMITTER FOR SHORT RANGE RADIOPHONE.



PANEL LAYOUT
(FRONT ELEVATION)

NOTE!
ANY TUBE, SOFT OR HARD, CAN BE USED FOR THE DETECTOR TUBE T1, BUT A HARD AMPLIFIER TUBE T2 MUST BE USED IN THE AUDIO STAGE. TUBES SUCH AS UV-WD-11, WD-12, UV-199, UV-201, UV-201A CAN BE USED IN ALL STAGES.

FOR MAXIMUM AUDIBILITY USE TRANSFORMER RATIO OF 10 TO 1. FOR BEST TONE USE RATIO OF 4 TO 1, OR 5 TO 1. PLATE VOLTAGE 45-90 V.



REAR ELEVATION OF PANEL
FOR
TWO TUBE ULTRA-AUDION

SHOWING ARRANGEMENT OF APPARATUS AND WIRING. RUNS BACK OF PANEL. USE THE DIAGRAMS OF FIGS. 1-2 FOR MAKING THE AC-TUAL CONNECTIONS IN WIRING THE SET.

A New Version of the Ultra Audion

(Continued from page 39)

un.t. This type of coil is far superior to the common homemade coil wound on a tube. With a 23 plate or 0.0005 mf variable condenser (C), the range will be from 200 meters to well over 700 meters with the specified coils. It will be well to use a vernier type of condenser so that the maximum signal strength can be more easily developed by closer tuning.

When a spiderweb coil is used, such as supplied by our advertisers, a total of eighty-five turns should be specified, tapped at such points as will properly cover the range of wavelengths. The tap switch (TS) makes closer tuning possible over a greater wavelength range than an untapped coil, but a plain coil can also be used with a total of 75 to 100 turns. A 75 turn or a 100 turn honeycomb coil will be right, but the 100 turn is probably the better for the broadcast listener with wavelengths averaging about 360 meters. This is one of the advantages of the ultra-audion; it can be used over a very broad band of wavelengths by simply substituting coils of various numbers of turns. Special tapped honeycombs can be used as well as the plain, untapped variety. Tapping is not a necessity but simply a convenience.

When the coil is wound on a cardboard tube, a diameter of from 2.5 inches to 3 inches can be used, and we should have about 120 turns tapped at about ten-turn intervals after the fiftieth turn. Thus, we will tap at 60 turns, 70 turns, 80 turns, 90 turns, 100 turns, 110 turns and at the finish. This will give us seven tapping points, including one end. To conserve space use No. 26 D. S. C. wire, but if desired, No. 24 or No. 22 can also be used. The low loss idea can be introduced by giving the coil a good coating of celluloid varnish (not shellac), and then slipping the coil off of the tube when dried. The varnish can be made by dissolving bits of celluloid in amyl acetate, which produces a fairly good non-capacitative coating. If shellac is used, you will get no results at all. The paper tube can be slit lengthwise before winding, and when the coil is dry, we can easily separate it from the tube by breaking down the latter at the slit.

Now comes an important precaution against body capacity. The stator or stationary plates (s) of the variable condenser (C) should be connected to the grid line (5) while the rotor or moving plates should be connected to ground or to line (23). If this is not done, you will be annoyed with "body capacity" so that when you put your hand anywhere near the dial it will detune or give a shrill "Whee-ee-ee" and break into violent oscillations.

For the best results the grid condenser (K) should be a variable condenser or one of the semi-variable grid condensers now placed on the market for this purpose. When the capacity is once adjusted to the requirements of the particular tube in the socket it does not frequently need

readjustment except on wide variations of wavelengths, and the latter type of condenser is perfectly correct. However, a fixed condenser of 0.00025 mf capacity will do very nicely and is used in most of the ultra-audions. A variable grid leak at (GL) must be used under all conditions as the tube is very critical to the resistance of the leak.

The Plate Voltage

NOW just a word in regard to the voltage of the "B" or plate battery (B). If we are to avoid excessive radiation from our aerial, and reduce interference to a minimum, we must not use over 22.5 volts on the detector tube (T1). This result is attained by taking an intermediate "B" battery tap at the point (+22) at the 22-volt section of the battery, as shown. If maximum amplification is required without regard to

Working Blueprints of this famous ULTRA-AUDION HOOKUP

Are to be found on
pages 40 and 41.

Another set of
BLUEPRINT SURPRISES
in April RADIO AGE

radiation, then we can put the full "B" voltage on both tubes by connecting (+B) of the transformer with the (+67) of the battery by means of the wire (22). If you love your neighbors, don't do this anywhere except in the country where you are at least five miles from the nearest receiving set. At least 45 volts should be used on tube (T2) and preferably from 67.5 to 90 volts so that we gain the maximum audio amplification. The high voltage on (T2) has no radiating effect.

Owing to the fact that full control of the regeneration is had by the adjustment of rheostat (R1) it is sometimes a good policy to make this a vernier rheostat, but fair results will be obtained from a plain rheostat of the proper resistance. The rheostat (R2) is not critical and any type can be used here. The resistance of the rheostats depends upon the type of tube used. Any tube can be used for the detector (T1) but the amplifier (T2) must be some hard amplifier such as the "11," "12," "199," or "201A" type. For small sets the "11" and the "12" tubes work very well, but of course the 201A is preferable where a storage battery is justified. The soft "200" tube is probably a more sensitive detector at (T1) but it is more critical and difficult to manage and also takes more current than the other tubes.

Any good make of audio transformer can be used at (AT) with a ratio of from 5-1 to 6-1. This single stage of audio amplification is sufficient to get good

volume on distance, and with local stations very good loud speaker volume can be obtained. In fact, I have had fair loud speaker volume on local with the detector tube alone, so intense is the regeneration in the ultra-audion circuit. The output (p-p') is connected to the phones or speaker, as may be desired. No jack has been placed between the detector and audio stage, as this would introduce "unbalance" into the circuit and also give phone cord capacity effect, which is disastrous to proper performance.

Only a very small panel is required, and the set has been assembled satisfactorily on a 6"x10" and 6"x12" size with plenty of room for all of the parts. Its portability is a great feature and the small panel permits of placing batteries and all in a comparatively small cabinet, thus making the set self-contained and handy to move about. When the detector is used alone, without audio amplification, a 6"x7" or a 7"x9" panel will be ample for the accommodation of the parts.

In regard to the tap switch (TS), I wish to say that the number of contact buttons used will depend upon the number of tapping points on the coil and this is likely to vary somewhat among different makes of coils. I have shown seven taps on the drawings, but this must be regulated by the coil used. Some commercial honeycombs use five taps, others use seven taps and there are coils with nine taps. It should be understood that the number of taps connected to the contacts is one less than the total number of wire ends, since one end of the coil is permanently connected to the aerial by wire (1).

In Fig. 1 is the picture diagram by which the most inexperienced should be enabled to hook up the set. Fig. 2 is a conventional drawing using symbols, while Fig. 3 is an isometric view showing the back of the panel and the arrangement of the apparatus as it actually appears, but it should not be used in making the actual connections, as some of the wires and connections are hidden from view. For making connections, use either Fig. 1 or Fig. 2. An isometric is very useful for gaining an idea of the general arrangement of the parts and main runs of wire, but if it is made so that all of the wires are in plain view, then the view is so distorted that its principal value is destroyed. All sense of proportion and scale are lost in this way.

IN GENERAL, it is best to place a spiderweb coil (L1), or "pure inductance" as it is sometimes called, at right angles to the condenser (C), for by this arrangement practically all electrostatic coupling between the parts is eliminated. The audio transformer should be kept away from (L1) to prevent noise. It seems almost unnecessary to state that all connections must be soldered, and soldered without acid, but I will say it anyway for the benefit of the beginners.

Now for the transmitter attachment which will get you into trouble sooner or later if you do not have an experimental or amateur's license. The transmitter

(Turn to page 71)

Conserving Energy with A Regenerative Reflex Circuit

By JOHN B. RATHBUN

REFLEX circuit experimenters are divided into two camps. First, those who are adherents of the crystal detector, commonly known as the "Tube Conservationist Party," and second, those who believe in the use of the standard three-element tube as a detector, and derisively called the "Howl Hounds."

There are arguments in favor of both methods, but when it comes down to the final analysis, it is not so easy to give an opinion as to the merits of either side. In fact, I am very glad I am not in a position to take a stand one way or the other and have declared a condition of neutrality so far as these columns go.

There are those who go so far as to state that a reflex circuit never functions properly until there is at least some regeneration in the radio frequency stage, and if this is the case, why not carry out the regenerative idea throughout and dispense with the crystal? The other party to the argument claims clearer reception, but when you come right down to the bottom of the matter, the principal objective is the elimination of the detector tube and conservation of the battery current. So it goes. As reflex circuits with crystal detectors have been presented time and time again in RADIO AGE, I am going to hand you a circuit this time which employs a three element tube detector and which works this detector to the limit of its capabilities; that is, the detector tube will be made regenerative so as to squeeze out the last drop of blood remaining in it.

Advantages as Detector

ALWAYS remembering that I am neutral (?) I will start the ball rolling by stating the following advantages claimed for the tube as a detector. (1) A standard detector tube is capable of considerable amplification within itself, while a crystal detector cannot amplify. (2) A tube detector can be made regenerative, which adds still further to the range and signal strength. (3) The use of a tube detector eliminates "cat-whisker punching" from the game of radio hide-and-seek, and this is truly an advantage. (4) Properly installed, a tube tends to stabilize oscillations in the radio frequency circuit (Perhaps). (5) That the detector tube is so efficient when regenerative that it gives just as much volume as one reflexed tube with a crystal; therefore there is no real tube or battery economy when a crystal is used. In other words, one two-tube set with a tube detector will give just as good performance as two reflexed stages with a crystal detector, so what is the use of the latter? (6) That a crystal detector is not a perfect rectifier as so often claimed, and that it introduces just as much distortion and noise as an improperly adjusted tube detector if not more. There you are; choose for yourself.

While all of the above statements are academically correct, it is not always so easy to make them work out in practice. I have seen some tube detector reflexes which were wonders, and then there were others which were far from having this distinction. I have seen two-tube reflexes (with a detector tube) which would put a three tube and crystal detector outfit to shame, both as to clarity

Getting the Most From Your Detector

and range, and then I have seen the reverse. It depends a good deal upon who builds the circuit and how it is put up. I have seen both circuits howl with considerable vigor, and the tube detector has nothing on the crystal when the latter is out of adjustment.

It might be well to remark at this point that a soft gas detector tube seems to be more effective in stabilizing the circuit than a hard tube, so a soft tube should be used as the detector when possible. Probably one of the best tubes from this standpoint is the "sodion" tube, which really does cut down the oscillating tendency to a marked degree. Then do you remember the little Welsh (501-D) tubes with the filament wrapped around the outside? These were quite good detectors for this sort of circuit, but they lacked the sensitivity of the sodions and the volume was less. These tubes were not oscillators and could not be made regenerative, but they were far more effective than a crystal and were much quieter.

The Circuit Itself

NOW we come to the actual circuit which is illustrated by the accompanying blueprints, Figs. 1, 2, and 3, which are respectively the picture diagram, the conventional symbolic diagram and the isometric view. These pictures and diagrams are clear enough for the class of amateurs I am appealing to without the use of extensive description, for I believe that this job should be tackled only by those who have had previous experience in building reflex circuits. It is not so difficult, but it does need that experience by which we can make adjustments by the sound of the disturbance. Some of the bypass condensers are likely to be rather critical, and with some makes of transformers, it may be necessary to change the values of the units from those given here.

Tube (T1) is the amplifier tube which amplifies at both radio and audio frequencies, and therefore this must be a hard tube similar to the UV-199 or UV-201A. Tube (T2) is the detector tube and can be anything that we may choose to use in the tube line. Either a hard or soft tube can be used as a detector with the preference in favor of a gas-filled sodion type. The rheostats (R1) and (R2) must be adapted to the tubes used, and if controls are to be at a minimum, an amperite can be used in the filament circuit (R1) of the amplifier (T1), but a rheostat must be always used with (T2) as the filament adjustment for this tube is rather critical. Just as a suggestion as to how an automatic filament control can be used with an amplifier tube, I have indicated an amperite at (R1) in place of the more usual rheostat, but the rheostat can be substituted if desired. An automatic filament control gives us just one less adjustment to bother with, and when once right, it remains right.

At (L1-L2) we have the usual aperiodic coupler consisting of about 15 turns on

the primary coil (L1) and from 55 to 60 turns on the secondary coil (L2). The coils are separated by about 5-8 inch for selectivity and are wound on a three inch diameter tube with No. 26 D. S. C. wire. The secondary is tuned by the 0.0005 mf variable vernier condenser (C1). This concludes the tuning unit.

The output of the amplifier tube (T1) passes through the primary of the radio frequency transformer (RFT), and the secondary of this transformer forms the detector circuit of the detector tube (T2). We can have either an untuned transformer at this point or an air-core transformer of the neutrodyne type with a condenser tuned secondary, but for the sake of simplicity in the controls (RFT) is shown of the untuned type which will give good results on the average broadcasting wavelength range of 200 to 600 meters. A tuned transformer gives us slightly more amplification, but it runs up our controls to a total of three, and this is not always desirable in a set of this kind.

As shown, regeneration in the detector tube circuit is had by the plate variometer (VA) which tunes the plate of the detector into resonance with the grid circuit. This not only increases the range and volume but it also helps in obtaining selectivity. In place of the variometer we can also use a "tuned impedance" in the plate circuit consisting of a 0.0005 mf variable condenser with a 50 turn honeycomb coil. This is for the benefit of those readers who are not provided with a variometer, but the results will be about the same in either case. If it is desired, the tube (T2) can be made non-regenerative with the variometer or tuned impedance omitted altogether, and while the amplification will not be as great this way, yet it will be considerably greater than with a crystal detector.

An audio frequency transformer (AT-1) with a ratio of from 5-1 to 6-1, is used for coupling the detector stage output with the amplifier input. This is of the usual iron core type and needs little further comment. Both the primary and secondaries of the transformers are bypassed by the fixed condensers (K1) and (K2). These will probably work out at 0.002 mf, but in some cases the transformer characteristics are such that they can be eliminated altogether. The usual grid condenser (GC) of 0.00025 mf is used in the grid circuit of the detector tube, and a one megohm grid leak (GL) is connected across the grid condenser. As the detector tube is not in the aerial circuit, a higher grid leak value can be used than when the detector is in the forward position and there will be no trouble with oscillations and radiation.

From 45 to 90 volts of "B" battery can be used on the amplifier tube (T1), but the plate voltage of the detector tube depends upon the type of tube employed at (T2). If a soft detector tube of the UV-200 type is used for (T2) we cannot have more than 22.5 volts at this point, and as a rule it is not advisable to have more than 45 volts with any detector (T2) as higher voltages give greater tendency toward squealing and oscillations. To provide for the use of two plate voltages for the detector and amplifier, a detector tap is shown at (DB).

Blueprints for the Regenerative Reflex on Two Pages Following

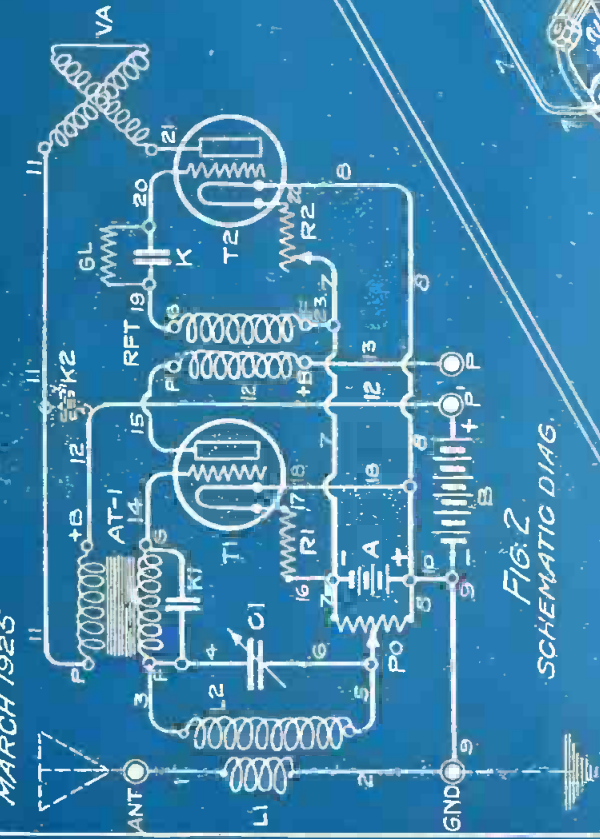


FIG. 2
SCHEMATIC DIAG.

NOTE!
THE POTENTIOMETER P0 USED FOR
THE CONTROL OF THE FREE OSCILL-
ATIONS MAY BE EITHER OF THE 200
OR 400 OHM TYPE, PREFERABLY THE
LATTER. ANY MAKE MAY BE USED

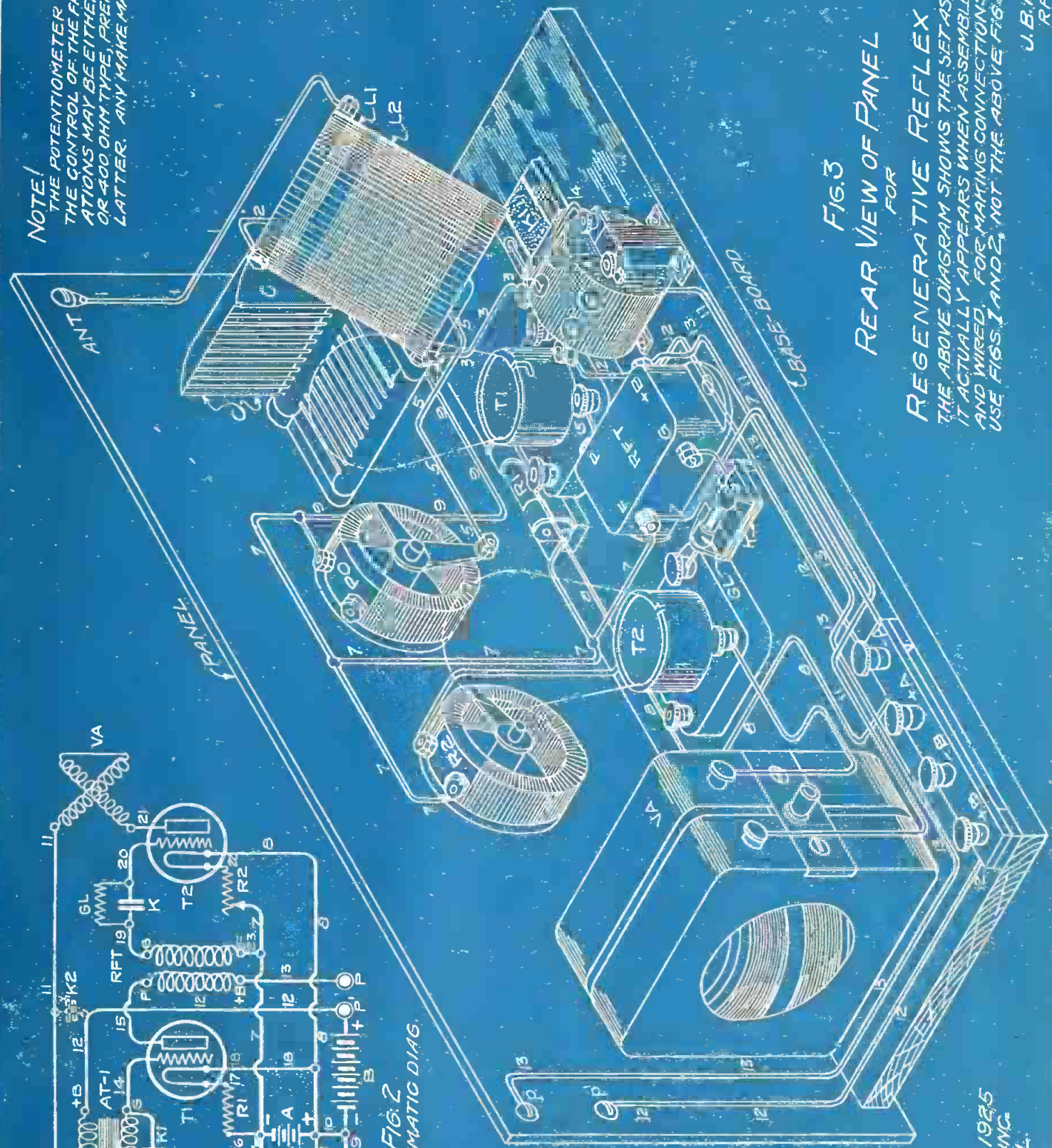


FIG. 3
REAR VIEW OF PANEL
FOR

REGENERATIVE REFLEX
THE ABOVE DIAGRAM SHOWS THE SET AS
IT ACTUALLY APPEARS WHEN ASSEMBLED
AND WIRED. FOR MAKING CONNECTIONS
USE FIGS. 1 AND 2, NOT THE ABOVE FIG.

"Mrs. Schlagenhauer" Steps Up

Art Linick, Comedian of KYW, Proves a Real Dark Horse

By Harry Aldyne

Leads In Popularity Contest for the Month

ONCE more a comedian has come to the front to prove that the radio audience has a highly developed funny-bone. None other than Art Linick, Mrs. Schlagenhauer "himself," jumped a series of hurdles from December 16 to January 15 to finish in first place for the month.

A Few Minutes with "Mrs. Schlagenhauer"

By E. E. Mattson, KYW

Radio has known "Mrs. Schlagenhauer" for a long time, and fans have listened while the radio "aired" her domestic griefs and family quarrels, but probably there are not so many who know the originator of "Mrs. Schlagenhauer." He is probably the best recognized as a "Jack-of-all-trades." His earlier vocations embrace anything from giving voice to the German dialect to the peddling of real estate, and that's a "lot." Someone once said that selling "lots" is the best way of doing someone "dirt." Therefore, Art admits that if you can't find his picture in the Rogues' Gallery of the Police Department, or in the Hall of Fame, you ought to be able to find it somewhere in the public press.

On the Battle Front

RECENTLY, when making an unannounced call on our hero, he was found all dolled up in war paint. He had a regular army coat on, and even a flashy regulation hat, and his salutation was—(with a proper salute)—"Mrs. Schlagenhauer at the Battle of Bolsheviki." Mrs. Schlagenhauer must have thought she was in her own kitchen at home.

Without going back into the annals of history too far and nosing too deeply into his private life, we will start with his advent into the radio world. It's more than a year now that Art came to Westinghouse station KYW. Since then his activities as the radio comedian of KYW have made him a well-known ether entertainer.

Radio is different; a comedian in vaudeville enjoys the privilege of facial expression and pantomime to assist in making his sketch a success, but on the radio this is a lost art. One must voice



Here's a recent picture of Art, himself, without the "Mrs. Schlagenhauer" raiment. If radio fans could only see him perform, they'd appreciate his talent all the more—and that's saying a lot!

his expressions and convey the interpretation of his comedy act to the listener-in. In this, Art surely has succeeded. The Dutch vernacular, of which he is a master, has made "Mrs. Schlagenhauer" a real radio comedy. There are others, too, which Art Linick has introduced. "I Belong to a Lodge" and "Laugh It Off" have come into prominence. You have heard "No Foolin'," "The Wedding Anniversary," "How I Love That Girl," and many others that have been made famous by Art, in a way that only he can do it.

There are times, however, that the radio entertainer does hear applause. On October 11, 1924, when the first "Radio Picnic" was held at the Grant Park Stadium of Chicago, Art Linick was given the microphone, and stayed there two hours and forty-five minutes. Loud speakers had been installed around the field so that the forty or fifty thousand people attending could distinctly hear the speaker, although the talk was given in natural voice. This picnic was

a novel affair; all the local radio stations were represented and an interested audience was there. There were prominent members of society and the business world, as well as the lesser known. During the time Art was at the microphone, he kept his audience at the point of ecstasy. His was the pleasure of possibly being the first radio entertainer to actually broadcast to an audience which he could see as well as hear, for the cheers were lusty and the applause boisterous. It is a treat to entertain a visible audience now and then; it is wonderful to be able to feel and hear their appreciation.

Mr. Linick finds other occupation besides appearing on RADIO AGE's monthly programs and other KYW entertainments. To be sure that time does not hang too heavily on his hands, he makes phonograph records for five companies; he appears personally in the leading motion picture houses of the middle West, characterizing "Mrs. Schlagenhauer" and his other song and monologue hits.

For six years he wrote material for vaudeville. His were comedy skits and sketches. His name is also associated with those of other show producers. Mr. Linick produced two musical shows which played in America as well as England.

(Turn to page 72)



THE WINNER FOR JANUARY

Art Linick..... Entertainer.....KYW, Chicago

WINNERS OF PRECEDING MONTHS

July.....Duncan Sisters, KYW
 August.....Bill Hay, KFKY
 September.....Karl Bonawitz, WIP
 October.....H. W. Arlin, KDKA
 November.....Bert Davis, WQJ
 December.....Jack Nelson, WJJD

STANDING TO JANUARY 15

Name and Classification	Where Heard
Karl Bonawitz, Organist.....	WIP, Philadelphia
H. W. Arlin, Announcer.....	KDKA, Pittsburgh
Bill Hay, Announcer.....	KFKX, Hastings
Bert Davis, Entertainer.....	WQJ, Chicago
Art Linick, Entertainer.....	KYW, Chicago
Harry M. Snodgrass, Entertainer.....	WQJ, Chicago
Duncan Sisters, Entertainers.....	KYW, Chicago
Jack Nelson, Announcer.....	WJJD, Mooseheart
Lambdin Kay, Announcer.....	WSB, Atlanta
John S. Dagget, Announcer.....	KHJ, Los Angeles
Ford and Glenn, Entertainers.....	WLS, Chicago
J. Remington Welsh, Organist.....	KYW, Chicago
E. L. Tyson, Announcer.....	WWJ, Detroit
Hired Hand, Announcer.....	WBAP, Fort Worth
Fred Smith, Announcer.....	WLW, Cincinnati
Jerry Sullivan, Announcer-Entertainer.....	WQJ, Chicago
Nick B. Harris, Entertainer.....	KFI, Los Angeles
Edward H. Smith, Director-Player.....	WGY, Schenectady
Wendell Hall, Entertainer.....	WDAF, Kansas City
Howard Milholland, Announcer.....	KGO, Oakland
"Sen" Kacey, Announcer.....	KYW, Chicago
Scottish Rite Orchestra, Orchestra.....	KGO, Oakland

POPULARITY CONTEST COUPON

Harry Aldyne, Contest Editor
 RADIO AGE, 500 N. Dearborn St., Chicago.

I wish to cast my vote for:

Name of favorite.....

Classification.....

Station..... Date Heard.....

Name [optional].....

Address [optional].....

The Original Czar of Jazz



A Sketch of "The Man Who
Can Make the Piano Talk"

By RUSSELL H. HOPKINS



If you know anything about jazz, you've heard of Axel Christensen. Here's an amiable pose of him.

ANYONE who knows anything at all about jazz has heard of Axel Christensen. His name is almost synonymous with jazz. He was brought up on jazz. And today he is an acknowledged national authority on the syncopation of the piano.

Axel has been playing the piano for so long that the beginning of his activities cannot be recorded with any degree of accuracy. And he was among the first to widen his acquaintance among lovers of the popular brand of music by utilizing radio broadcasting.

He owns a string of music schools in Chicago known as the Christensen Schools of Popular Music, and between personally instructing hundreds of pupils every day, he manages to tour such broadcasting stations as WQJ, KYW and WTAY with surprising regularity.

A Versatile Artist

CHRIStENSEN'S unique trait is that he is not an expert pianist alone. Even if he were, he would still be an interesting radio personality, for the way he makes the piano keys "jump" into the microphone is little short of astonishing. He has been described as one of the very few jazz pianists who can really make a piano talk; and making a piano talk means playing it in all kinds of moods—soft dreamy melodies; lively, syncopated dance affairs; and easy, nerve-soothing selections.

Christensen can do all that, and as a result a piano in his hands is like a sculptor's clay—a thing to be handled at will to express any human emotion that he desires to transfer into the language of the ivory keys.

In addition to his rapid-fire playing of piano selections, Christensen is a keen student of monologues. None of

his programs is complete without one of his original pianologues, which he tells in his own way—sometimes in Swedish dialect, sometimes in German—and others in straightforward "Eddie Guest" style.

Of course, Christensen's most famous radio characterizations are his Swedish monologues. Although his amiable countenance cannot be viewed by his radio audience, his voice alone is enough to cause spasms of laughter at the receiving end. And all of his vocal success would not be possible if it were not for the fact that he has a perfect radio voice—a rich baritone.

A National Figure

AXEL has toured every city of importance in the country during his musical career, so he is well known wherever jazz is popular. His first accomplishment was the conversion of Mendelssohn's Wedding March into a jumpy, rag-time refrain that would make a splendid entrance cue for a couple of end men in an old-time minstrel show.

In fact, Axel possesses a peculiar touch that enables him to "jazz up" any creation regardless of its time or character. This ability is known as the "Christensen System" of piano playing.

He has always had a fondness for the songs popularized by Bert Williams, the late Negro character singer, and on several occasions Axel favors his radio audiences with some old Williams songs, such as "Somebody," "Samuel," and "The Lee Family."

Although Axel was among the first to adopt jazz when it swept the country during the world war, he is really a proponent of the old "rag-time," the predecessor of jazz. Rag-time possesses many of the lively qualities of jazz, so

Axel had no trouble in switching from one form of playing to the other.

After about ten years of obscurity, he suddenly rose to fame (and that was about twenty years ago), and gained the monicker of "Czar of Ragtime."

Now, when you hear him announced from a radio station, you hear Axel introduced as "The Czar of Jazz." And that title should be his to have and to hold; for if anyone has a priority claim on the world of jazz, Axel Christensen is that person.

AXEL CHRISTENSEN is one of the greatest proponents of radio broadcasting as the perfect means of advertising one's livelihood. Although Axel is not so mercenary as to broadcast for the sake of advertising his school alone, he admits the publicity gained from radio performances greatly helps to keep the customers trickling into his offices every day.

Maybe it is because Axel uses radio as an advertisement in a "subtle" way that he reaps such profitable returns. You see, he doesn't need to have it announced that he teaches piano, and where, and for how much. That is unnecessary. If his playing makes a "hit," he avers, the prospective customers will find out all about him on their own initiative.

So Axel merely plays his best and varies his program wherever he appears before the critical microphone. As a result his reputation has spread far and wide, and if he was well known before the coming of radio, he is positively famous today. His long list of students and his endless list of radio listeners and admirers are the best proof of his popularity.

He may next be heard on a special RADIO AGE program from KYW, Chicago, beginning at midnight, Saturday, March 7.



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gives real
and speaker
modulator"
quality.*

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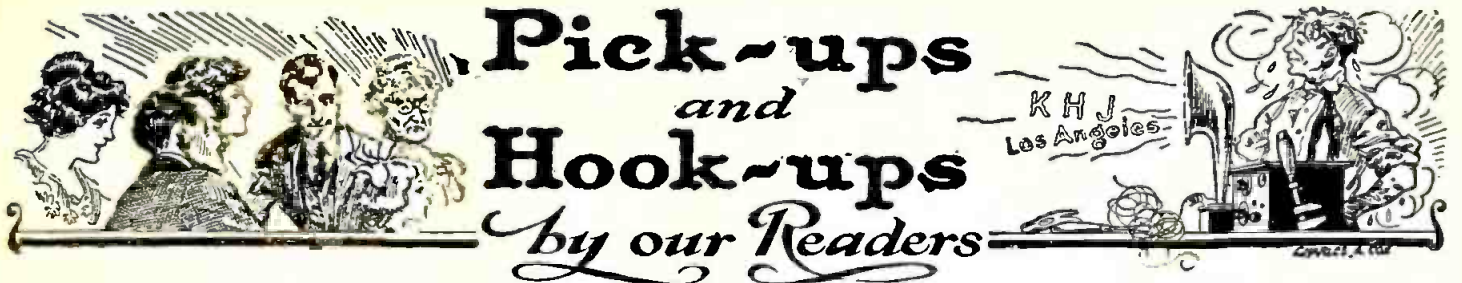


114 SO. WELLS ST., CHICAGO

NEW YORK

ST. LOUIS

SAN FRANCISCO



THE material appearing under the title "Pickups and Hookups by Our Readers" in RADIO AGE, is contributed by our readers. It is a department wherein our readers exchange views on various circuits and the construction and operation thereof. Many times our readers disagree on technical points, and it should be understood that RADIO AGE is not responsible for the views presented herein by contributors, but publishes the letters and drawings merely as a means of permitting the fans to know what the other fellow is doing and thinking.

WELL, fellows, here we are again, with some new records for us to shoot at. Some of the finest DX lists were submitted this month that the Editor has ever had the privilege of reading. It was a real task, deciding who the lucky few would be to get their Dial Twister buttons.

After numerous plans had been devised and countless schemes given trial, we finally found a method by which the lucky people whose name you will see to the right were awarded their Dial Twister "degree."

From the way letters pour into this department, the brotherhood certainly gets a lot of fun breaking records. From all indications it seems that the Canadian lads have a slight edge on all others when it comes to "dragging in" the real long distance stations, and their records have provided a real incentive for many of the other readers of these columns.

We want to thank the fans who so kindly submitted the fine contributions to this department, and to those of you whose letters are not published we want to say that we wish this department were only large enough to publish every letter we received during the month just passed. It is our intention to keep them on file and to find room for them from time to time.

Mr. F. Day furnished us with good technical information regarding a new type super-heterodyne. The circuit, which you will find described in another part of this department, is the last word in selectivity and volume. We know because we have listened to it.

We also have a very interesting account of a really good reflex circuit from Mr. Dolan. This set has proven to be a good one and I am sure that the reflex fans will become very much attached to it. Mr. DePew gives us a nice crisp article on a radio frequency receiver that he is using, and from which he is getting mighty fine results. These three circuits should give you plenty to think of during the coming month.

Before we go to press "super-power" will have become a reality and we anxiously await letters from our readers, telling us just how these stations are coming in. No doubt some of the fans are going to have considerable trouble separating the various stations. Not that it will be the fault of the transmitters, but rather the fault of the receiving set itself, particularly the single circuit type of set, as a circuit of this type will always to a certain extent tune rather broad. Any of you who experience any trouble are invited to avail yourselves of the services of our technical staff, who will advise you so as to tighten up the old set and get through.

CONTRIBUTORS

HARRY DOLAN
Aurora, Ill.

CHAUNCEY DePEW
Alpena, Mich.

F. DAY
Chicago, Ill.

DIAL TWISTERS

Name	Address	City
Mrs. W. H. Fisher	614 Allison Ave.	Pittsburgh, Pa.
Stanley H. Cox	Box No. 7	Fulton, Kas.
H. W. Webb	51 Second Ave.	Little Falls, N. J.
J. N. Bacon		Oshkosh, Wis.
L. Sherk		Peoria, Ill.
Chas. W. Lawson	9812 90th Ave.	Edmonton, Alta., Can.
Turner H. McBaine	11 Glenwood Ave.	Columbia, Mo.
Clifton M. Beaty		Chino, Calif.
J. Clayton	118 Morrison Ave.	Toronto, Ont., Can.
Elmer J. Kenealy	505 E. 68th St.	Los Angeles, Calif.
Alfred La Cascio, Jr.	187 Strathmore Rd.	Brighton, Mass.
F. Timoney	428 Arctic St.	Bridgeport, Conn.
Hugh W. Patterson	516 So. 2nd St.	McAlester, Okla.
J. B. Thompson	1741 New England Ave.	Los Angeles, Calif.
James Smith	587 Sibley St.	Hammond, Ind.
John R. Dell	Box 54	Selkirk, Ont., Can.
Harry Dean		Auburn, Ind.
Willie R. Jones	1233 Reynold St.	Shreveport, La.
Richard Skidmore	Drawer "D"	Upland, Calif.
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J. C. Dunn	2518 Greenmount Ave.	Baltimore, Md.
D. O. Easton	214 Dalzell St.	Shreveport, La.
Robert Zurlinden	1507 Ferndale Rd., N. W.	Canton, Ohio
Wilbur Reinhard	30 W. Fulton St.	Columbus, Ohio
Tom Winn	4219 Marcy St.	Omaha, Neb.
A. Lalonde	183 Garry St.	Winnipeg, Man., Can.
J. Homer McNeely	5036 Manzall Ave.	Kansas City, Mo.
Jerome Davis	9 Hill St.	Binghamton, N. Y.
Henry F. Brunken	9663 Burnette Ave.	Detroit, Mich.
Paul Di Marzo	316 15th St., N. E.	Washington, D. C.
Willard Zahalka	509 Hubbard St.	Racine, Wis.
Karl A. Hutch	Atlanta University	Atlanta, Ga.
P. N. Lyons	Box No. 477	Washington, Ill.
Joseph Brady	3806 Union Ave.	Chicago, Ill.
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Raymond D. Brown	5953 Augusta St.	Chicago, Ill.
A. Deo Rosiero	256 Bridge Ave.	Windsor, Ont., Can.
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Arthur Juola	302 Melbourne St.	Astoria, Ore.
Merville, Chamberlin		Gibbons, Alta., Can.
Robert R. Schuster	531 Rice St.	Springfield, Ohio
C. J. Ahern, Jr.		Dwight, Ill.
R. P. Erlick	2120 Monroe Ave.	Norwood, Ohio
C. Dawson		Ardenode, Alta., Can.

This high power transmission is going to prove a new source of delight to the fan who is looking for DX reception. Judging by the manner in which some of the stations that have already increased theirs are coming in. I'll bet that their will be plenty long distance crystal work in the future.

From one of our contributors, Mr. F. Day, comes a circuit for a new type super-heterodyne. We have seen the set in operation and can vouch for its performance. Those of you fans who are interested in super-heterodynes will find this circuit worthy of consideration.

The outstanding features of the set are:



The above photograph shows the super-het., constructed by Mr. Day. Note the compactness of the set. Study the method used of laying out the sockets. The audio frequency transformers are on the under side of the sub-panel.

first five tubes are connected in series instead of in parallel, as is usual. The set operates on a six volt battery and draws a little over three quarters of an ampere filament current. This is because the first five tubes are WD11's or WD12's, the last two tubes are either 201A's or other six volt tubes, operated in parallel across the battery.

The circuit is balanced by means of a split stator balancing condenser. A pair of headphones is connected in series with the 45 volt positive "B" battery lead that runs to the first tube, and then with the oscillator dial set at about 40 degrees, vary the balancing condenser and the tuning condenser until no click (or a minimum click) is heard when the tuning condenser is in tune with the oscillator circuit. This setting of the balancing condenser will be found to be very near its maximum capacity. When the proper position of the plates has been determined the condenser can be locked in position by means of a small set screw, provided for that purpose.

The operation of the set is very simple. Simply set the condenser (2) to the proper setting for the correct wavelength, and then set the condenser (3) to the corresponding oscillator frequency, adjust the loop to the point at which the signals come in loudest, and regulate the volume by means of the rheostat controlling the audio amplifiers.

F. Day of 4456 No. Racine Ave., Chicago, Ill., was kind enough to furnish us with the above data on this circuit. Mr. Day is a radio experimenter of note, and we are sure that any circuit that he approves of must have given exceptionally fine results.

Harry Dolan of Aurora, Ill., one of our contributors, tells us of the wonderful results he is having with a reflex set of his own construction. It must be a "whiz bang," so we are going to pass it along to the fans.

RADIO AGE:

As I am a continual reader of the "Pick-ups and Hook-ups" section of RADIO AGE, and a confirmed believer in the reflex type of set, I have noticed with particular interest the hookups published in these columns, for reflex circuits. (Turn to page 52)

1. DX reception;
2. Ease of operation,
3. Selectivity;
4. Large amount of volume on a loop antenna;
5. Exceptionally fine tone qualities.
6. Ease of construction;
7. It is portable;
8. Small in size;
9. It is non-radiating;
10. Low battery consumption.

The circuit was designed by the Chief Engineer of the U. S. Signal Corps, Jackson H. Pressley. The design is such that there is no possibility of radiation even over slight distances of a few yards. This is made possible by the simple method employed to connect the detector-oscillator tube to the loop antenna.

The circuit is designed to cover the broadcasting wavelength band. A small switch is used to change from the higher to the lower wavelengths.

The entire set can be mounted on a panel seven by eighteen inches. The cabinet can be made large enough to completely house the "B" batteries.

The wiring diagram is published on this page and by comparing it with the back panel view, the experimenter can get an idea as to how the apparatus should be placed.

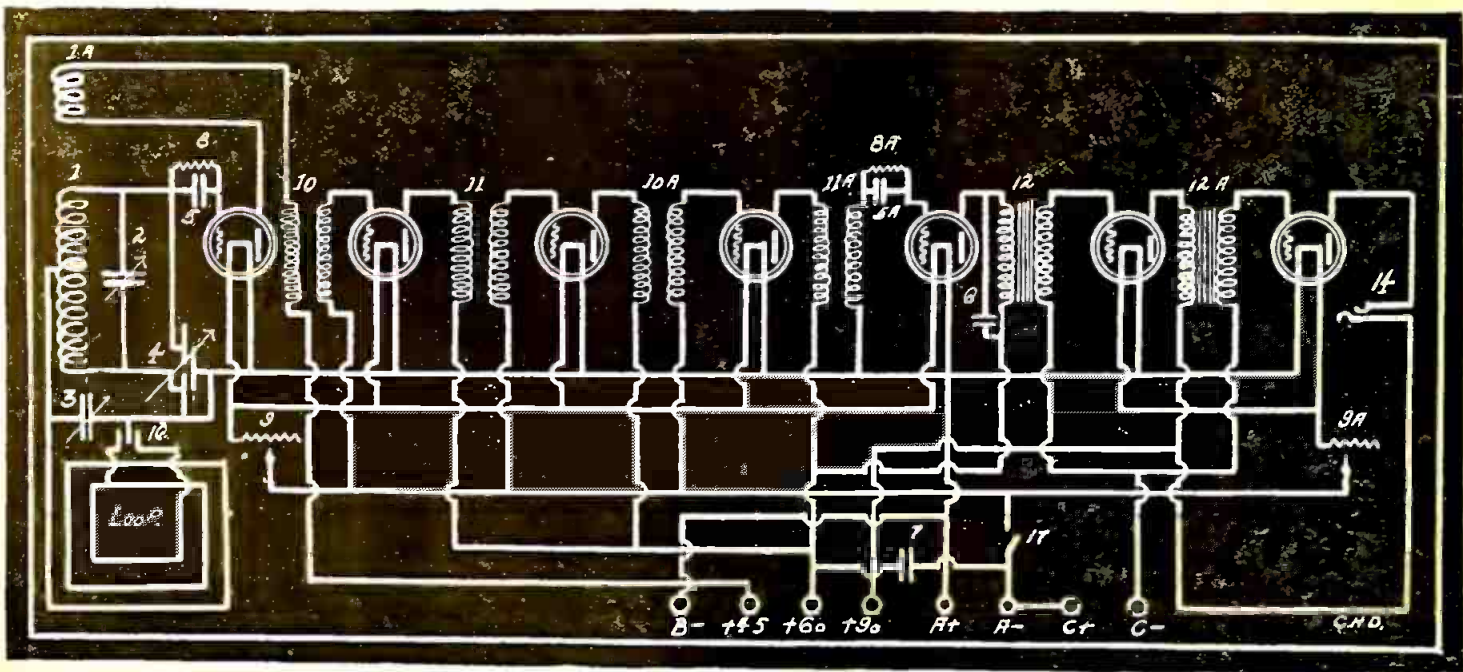
The following key, when used in connection with the wiring diagram will

enable the builder to determine the location of the various items used.

- 1 and 1A. Oscillator coil Unit.
2. Vernier condenser .0005 Mfd.
3. Vernier condenser .0005 Mfd.
4. Split stator balancing condenser.
- 5 and 5A. Mica fixed condensers .00015 Mfd., and grid leak mounting.
6. Fixed mica condenser .005 Mfd.
7. By-pass condenser .5 Mfd.
- 8 and 8A. 1-2 and 2 meg. grid leaks 9 and 9A. 30 ohm rheostat.
- 10 and 10A. Intermediate frequency transformers.
- 11 and 11A. Intermediate frequency transformers.
- 12 and 12A. Audio frequency transformers.
14. Single circuit jack.
15. Double circuit jack.
16. Switch (for long or short waves).
17. Battery switch.

Square or round wire can be used to connect the various instruments together. As round wire is the easiest to handle it is the best to use. The job will look just as neat as if the square wire were used. Before wiring, study the back panel photograph carefully, and note how the wires are bent, so as to avoid one another.

One of the peculiar things about this circuit is the manner in which the tubes are connected. The filaments of the



Wiring diagram of the super-heterodyne perfected by the Army engineers, for the reception of signals transmitted to airplanes. Note the radical departure from the usual form of an oscillator coil. The intermediate transformers should be tuned to 4500 cycles.



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THIS 5-TUBE SET \$39.50

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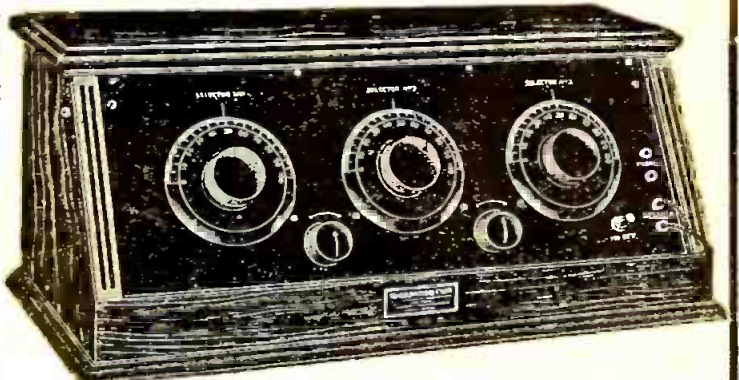
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which will bring in all distant stations on the loud speaker in clear loud tones. A value of three times the price. Shipped on a guarantee of satisfaction or money back. A wonder set constructed on the new principle that requires no neutralizers and is self-balanced. Special features are low-loss coils, engraved bakelite panel, distortionless transformers and pure bakelite sockets. Wiring of the latest loose safety type. Perfect logging of stations. The set alone, shipped prepaid, is.....

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This Set with All Accessories, Including American Bell Loud Speaker, with adjustable unit, 5 R.C.A. UV201-A Tubes, 2 45-volt "B" batteries, 1 6-volt 90 amp. hour storage battery, complete antenna equipment, including approved lightning arrester, shipped prepaid, east of the Rocky Mountains.....

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COMPLETE PARTS FOR

ACME 1-Tube REFLEX..... **\$15.85**

ACME 4-Tube REFLEX..... **\$39.85**

with Genuine Acme parts as specified, drilled bakelite panel and full wiring diagram.



COMPLETE PARTS FOR 5-TUBE NEUTRODYNE RECEIVING SET

Genuine Hazeltine Licensed Fada, or other Genuine Licensed Parts

- | | |
|---|--|
| 1 7x24x1/4 Drilled Panel | 1 .001 Condenser |
| 2 Thordarson or Columbia Audio Transformers | 1 .006 Mica Condenser |
| 3 4-in. Bakelite Dials | 35 feet Hook-up Wire |
| 2 Precision Jacks | 1 Kit consisting of 3 Hazeltine Licensed Neutrodyne Transformers and 2 Neutrodyne Bezels |
| 1 Bakelite Rheostat, 30-ohm | 1 Baseboard |
| 1 Bakelite Rheostat, 6-ohm | 3 Bezels |
| 1 Bakelite Binding Post Strip | Complete blue-prints and working diagrams. |
| 7 Marked Binding Posts | |
| 1 Grid Leak and Condenser | |
| 5 Bakelite Sockets | |

COMPLETE PARTS FOR 8-TUBE SUPER-HETERODYNE

- | | |
|--|--|
| 2 23-Plate Duplex or Laboratory Type Low Loss Condensers | 1 .006 Mica Condenser |
| 3 Remier or Columbia Intermediate Frequency Transformers | 1 .0005 Mica Condenser and 2 megohm Grid Leak |
| 1 Remier or Columbia Tuned Circuit Transformer | 3 .0025 Mica Condensers |
| 1 Special Oscillator Coupler | 10 Binding Posts |
| 1 Midret Condenser | 1 .0025 Mica Condenser |
| 8 Bakelite Sockets | 1 Bakelite Terminal Strip for Binding Posts |
| 2 Thordarson or Columbia A. F. Transformers | 1 Multicord Cable for connecting batteries |
| 1 Connecticut Filament Switch | 1 7x30x1/4 Drilled Bakelite Panel |
| 2 Bakelite 6-ohm Rheostats | 1 Baseboard |
| 2 Bakelite 30-ohm Rheostats | 35 ft. Hook-up Wire |
| 1 Bakelite Potentiometer, 400 ohms | 2 4-in. Bakelite Dials |
| 1 Carter Double Circuit Jack | 2 4 1/2-volt C Batteries |
| 1 Dubilier 1 mfd. Condenser | Complete wiring diagrams, base board layout, blue-prints and instructions. |

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As designed by L. M. Cockaday. Including drilled panel and wiring diagram, complete, ready to wire.

\$39.65



COMPLETE PARTS FOR 3-TUBE COCKADAY RECEIVING SET

- | | |
|---|---|
| 1 Cockaday Coil | 7 Switch Points, 2 Stops. |
| 2 23-Plate HV-Grade Cond. | 1 Bakelite Binding Post Strip |
| 1 Bakelite Rheostat, 6-ohm | 7 Binding Posts |
| 2 Bakelite Rheostat, 30-ohm | 1 7x21x1/4 in. Drilled Bakelite Panel |
| 3 Bakelite Sockets | 3 Bezels |
| 1 high ratio Columbia or Thordarson Transformer | 1 Baseboard |
| 1 Single Circuit Jack | 1 Switch Lever |
| 1 low ratio Columbia or Thordarson Transformer | 24-ft. Hoop-up Wire |
| 2 Double Circuit Jacks | Complete blue-prints and wiring diagrams. |
| 2 3-in. Bakelite Dials | 1-Tube Set |
| 1 Grid Leak and Mica Cond. | \$18.55 |

\$10.10

- | | |
|---|---------|
| Genuine Radio Corporation Tubes UV201-A, UV199, WD12 or WD11..... | \$ 3.55 |
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| Soldering Iron..... | .95 |
| Solderal Tube..... | .15 |
| Approved Lightning Arrester..... | .35 |
| Cockaday Coils..... | 1.59 |
| Balancing Condensers, per pr..... | .59 |
| Harkness Coils, per set..... | 1.95 |
| Hydrometer, Best Quality..... | .44 |
| Battery Meters, 0 to 50 volts..... | .89 |
| Magnavox, M4, Loud Speaker..... | 20.95 |
| Baldwin Loud Speaker..... | 19.95 |
| Brandes Table Talker..... | 8.45 |
| Atlas Loud Speaker..... | 21.95 |
| Multiple Four Phone Plug..... | .89 |
| Two Phone Plug..... | .24 |
| Complete Antenna Outfit, including Lightning Arrester..... | 2.59 |
| Bakelite Moulded Variometer..... | 3.25 |
| Low Loss Condensers: | |
| 11-plate..... | \$1.85 |
| 23-plate..... | 2.05 |
| 43-plate..... | 2.85 |
| Bakelite Rheostats: | |
| 6-ohm..... | \$0.35 |
| 30-ohm..... | .38 |
| Amperites: | |
| For all tubes..... | \$0.94 |
| Bakelite Dials: | |
| 2-inch..... | \$0.26 |
| 3-inch..... | .35 |
| 4-inch..... | .48 |
| Composition Dials: | |
| 2-inch..... | \$0.13 |
| 3-inch..... | .17 |
| 4-inch..... | .29 |
| Accuratone Dials..... | \$3.14 |
| Audio Transformers: | |
| Thordarson: | |
| 3 1/2 to 1..... | \$3.25 |
| 6 to 1..... | 3.65 |
| Acme..... | 3.95 |
| Columbia: | |
| 3 1/2 to 1..... | \$3.79 |
| 6 to 1..... | 3.89 |
| American Bell: | |
| 3 1/2 to 1..... | \$2.45 |
| 6 to 1..... | 2.79 |
| Randolph Special: | |
| 3 1/2 to 1..... | \$1.89 |
| 6 to 1..... | 2.16 |
| Randolph Special Headphones..... | \$2.24 |

Easy to Build Your Own Radio Set
All complete parts for sets on this page consist of standard advertised guaranteed parts and include drilled bakelite panels and wiring diagrams for easy set construction. Everything guaranteed on money-back basis. All transportation charges paid. Don't forget! Only genuine guaranteed parts used. Lack of space does not permit us to itemize individual parts, but you are fully protected by our money-back guarantee. Our Service Division is behind you.

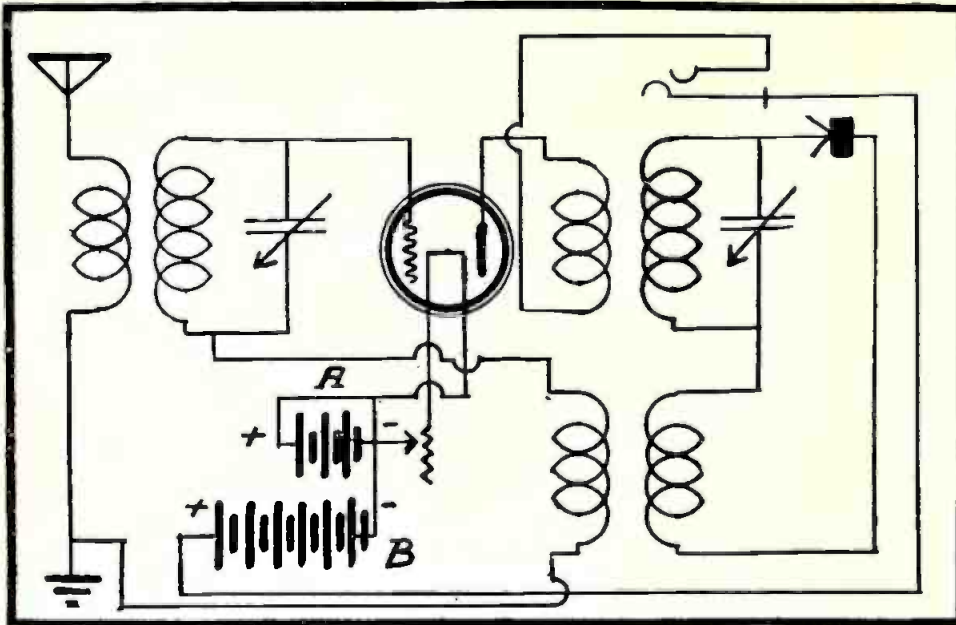
FREE BIG MONEY SAVING RADIO CATALOG

contains a thousand bargains of everything on radio—parts, supplies, complete parts for sets, complete sets, etc. also a mine of very latest information on all different circuits, complete list of broadcasting stations, and other valuable, up-to-the-minute radio data. Send your name and address on a card or letter. Also the names of a few friends. We will send catalog free.

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RANDOLPH RADIO CORPORATION
159 North Union Ave. Dept. 422 Chicago, Illinois



Circuit contributed by Harry Dolan. A reflex circuit that has given exceptionally good results. The transformer at lower right hand side of drawing is an iron core A. F. transformer.

I believe I can safely say that I have tried practically all the different methods of making tubes do double duty. And the only one that has proven to be a real success is the one that I am going to describe.

Using only one tube, I am able to receive all the Chicago stations, (a distance of about thirty-five miles) with sufficient volume, on a loud speaker, to be heard all over the lower floor of my house. The set is remarkably free from distortion, and its tone qualities cannot be surpassed. But enough for praise; let the skeptical ones build it and see for themselves.

By looking at the wiring diagram, you will notice that the radio frequency transformers are of the tuned type. As these can be purchased from any radio store for a reasonable sum, I would suggest that the experimenter do so. Both the condensers have a

capacity of .0005, and are preferably of the straight line type. It is advisable to have a vernier attachment on them.

The audio transformer should have a ratio of about four to one. Increasing the ratio of this transformer will increase the signal strength, but then the set has a tendency to distort.

The crystal detector should be of the fixed type, and be sure that it is a good one, as many times the bad results obtained with a reflex set can be attributed to a poor crystal.

The set can conveniently be mounted behind a panel eight by eight inches, and the whole (including "A" and "B" batteries) put in a cabinet sixteen by eight by eight inches. As can be seen by the above dimensions, the complete receiver makes an ideal portable.

It is very selective. Thus the tuning will be extremely sharp, one or two

degrees on the dial separating stations. Tube control is not critical, however, and a fixed resistance can be substituted for the filament control, if the builder so desires.

I used this receiver entirely last Summer, and the East Coast was heard regularly.

Amongst the stations that I heard during the last week, while the powerful Chicago stations were in operation, are KDKA, WGY, WOAW, KTTHS, WBAP, WSB, KFKX and during the silent period (Monday night) KFI, KGO, KDYQ, and KFOA. With one stage of straight audio, almost all of the above stations were heard on the loud speaker.

Trusting that you will have enough space, this month, to publish the above letter, I remain

Yours very truly,
HARRY DOLAN, Aurora, Ill.

Well, reflex fans, we thought that on the strength of Mr. Dolan's letter, the circuit described certainly was worthy of consideration. We know that the set works very well because we have listened in quite a few times on receivers that employ the same design.

The tuned, air core radio frequency transformers can be wound by the experimenter if he so desires. The secondary is wound on a tube three inches in diameter, and consists of 66 turns of No. 26 D. S. C. wire. The Primary is wound on top of the 66 turns and consists of 11 turns of the same size wire. Separate the secondary from the primary with either empire cloth or waxed paper.

We want to call the attention of our readers to the fact that numerous letters are received by the Technical Department of RADIO AGE that we cannot answer, because a stamped, self-addressed envelope does not accompany the request. As we make no charge for this service, we wish the fans would co-operate with us in this regard.

End your Radio Troubles for 30c in Stamps

We have laid aside a limited number of back issues of RADIO AGE for your use. Below are listed hookups to be found in these issues. Select the ones you want and enclose 30c in stamps for each desired. The supply is getting low, so enrich your store of radio knowledge by laying in an ample stock of copies NOW!

May, 1922

—How to make a simple Crystal Set for \$6.

September, 1922

—How to make a Regenerative Set at a low cost.

October, 1922

—How to make a Tube Unit for \$23 to \$37.

—How to make an Audio Frequency Amplifying Transformer.

November, 1922

—Design of a portable short-wave radio wavemeter.

May, 1923

—How to make a portable Reinarts set for summer use.

June, 1923

—How to build the new Kaufman receiver.

—What about your antenna?

December, 1923

—Building the Haynes Receiver.

—Combined Amplifier and Loud Speaker.

—A selective Crystal Receiver.

January, 1924

—Tuning Out Interference—Wave Trade—Eliminators

—Filters.

—A Junior Super-Heterodyne.

—Push-Pull Amplifier.

—Rosenbloom Circuit.

March, 1924

—An Eight-Tube Super-Heterodyne.

—A simple, low loss tuner.

—A Tuned Radio Frequency Amplifier.

—Simple Reflex Set.

April, 1924

—An Efficient Super-Heterodyne (fully illustrated).

—A Ten-Dollar Receiver.

—Anti-Body Capacity Hookups.

—Reflexing the Three-Circuit Tuner.

—Index and first two installments of Radio Age Data Sheets.

May, 1924

—Construction of a Simple Portable Set.

—Radio Panels.

—Third Installment of Radio Age Data Sheets.

June, 1924

—Important Factors in Constructing a Super-Heterodyne.

—A Universal Amplifier.

—A Sure Fire Reflex Set.

—Adding Radio and Audio to Baby Heterodyne.

—Radio Age Data Sheets.

July, 1924

—A Portable Tuned Impedance Reflex.

—Operating Detector Tube by Grid Bias.

—A Three-Tube Wizard Circuit.

—Data Sheets.

August, 1924

—Breaking Into Radio Without a Diagram.

—The English 4-Element Tube.

—Filtered Heterodyne Audio Stages.

—An Audio Amplifier Without an "A" Battery.

—Data Sheets.

September, 1924

—How Careful Mounting Will Improve Reception.

—One Tuning Control for Hair's Breadth Selectivity.

—Four Pages of Real Blueprints of a New Baby Heterodyne and an Aperiodic Variometer Set.

—Data Sheets.

October, 1924

—An Easily Made Super-Het.

—Two Radio and Two Audio for Clear Tone.

—A Simple Regenerative Set.

—The Ultradyne for Real DX.

—Real Blueprints of a 3-Tube Neutrodyne and a Mid-range Reflex Set.

November, 1924

—Blueprints of a Single Tube Loop Set and a capacity

Feedback Receiver.

—A 3-Tube Low Loss Regenerator.

—Mastering the 3-Circuit Tuner.

December, 1924

—Blueprints of a New 8-Tube Super-Heterodyne.

—How to Make a Receiver that Minimizes Static.

—A Trans-Atlantic DX Receiver.

—How to Make a Home Made Battery Charger and a Loud Speaker at a Small Cost.

January, 1925

—A Reflexed Neutrodyne

—A Six Tube Super-Het

—An Efficient Portable Set

—A Tuned Plate Regenerator

—Making a Station-Finder

February, 1925

—A Sure Shot Super-Het

—A Three Circuit Regenerator

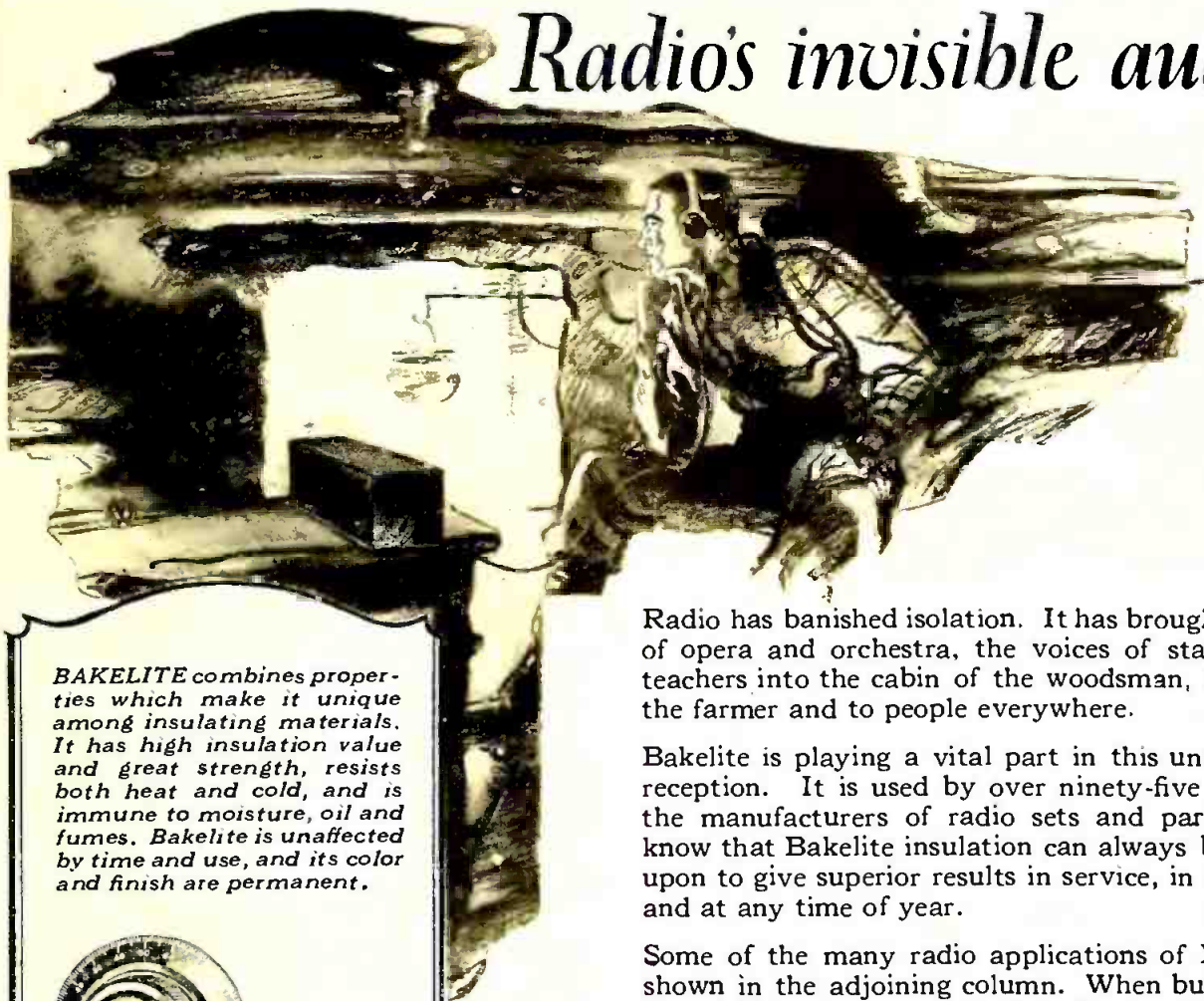
—A Real, Low Loss Set.

—Blueprints of a 3-tube Reflex

RADIO AGE, Inc.

500 N. Dearborn St., Chicago

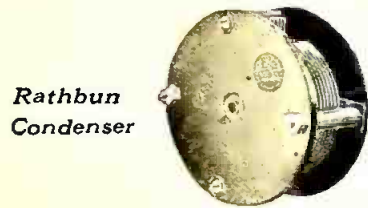
Bakelite — Faultless servant of Radio's invisible audience



BAKELITE combines properties which make it unique among insulating materials. It has high insulation value and great strength, resists both heat and cold, and is immune to moisture, oil and fumes. Bakelite is unaffected by time and use, and its color and finish are permanent.



Na-ald Dial



Rathbun Condenser



Na-ald Tube Socket



R. C. A. Tube Base

Radio has banished isolation. It has brought the music of opera and orchestra, the voices of statesmen and teachers into the cabin of the woodsman, the home of the farmer and to people everywhere.

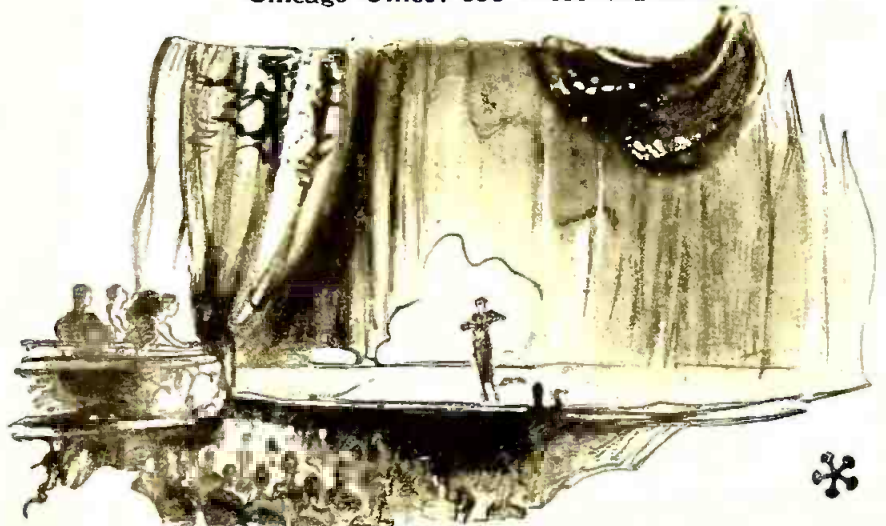
Bakelite is playing a vital part in this universal radio reception. It is used by over ninety-five per cent of the manufacturers of radio sets and parts, for they know that Bakelite insulation can always be depended upon to give superior results in service, in any climate and at any time of year.

Some of the many radio applications of Bakelite are shown in the adjoining column. When buying a radio set or part make sure it is Bakelite insulated, for this is a definite indication of quality.

Write for Booklet H

BAKELITE CORPORATION

247 Park Avenue, New York, N. Y.
Chicago Office: 636 West 22d Street



Bakelite is an exclusive trade mark and can be used only on products made from materials manufactured by the Bakelite Corporation. It is the only material which may bear this famous mark of excellence.

BAKELITE

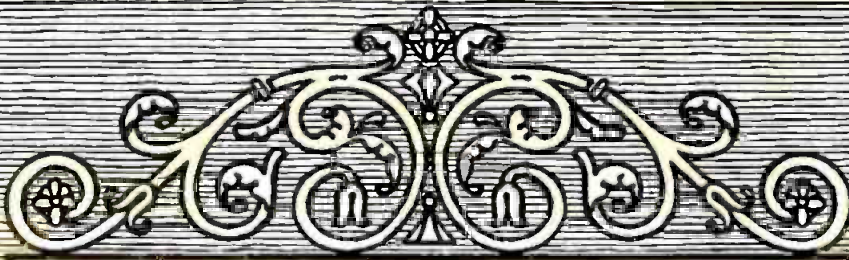
THE MATERIAL OF A THOUSAND USES



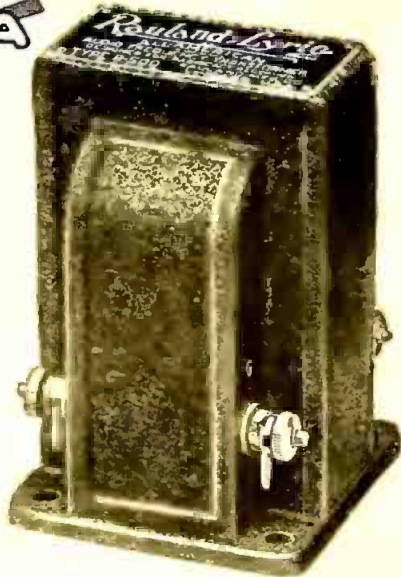
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3527-B

* Tested and Approved by RADIO AGE *



MEMBER
RMA



Radio Music for the Critical

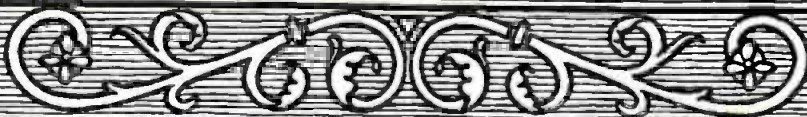
Music lovers find an especial delight in Rauland-Lyric. Used in all audio stages of a radio receiver, it reproduces with fidelity those elusive refinements of tone quality which, to the trained ear, mean artistic excellence.

Rauland-Lyric is a laboratory-grade audio transformer designed especially for music lovers. The price is nine dollars. Descriptive circular with amplification curve will be mailed on request. All-American Radio Corporation, 280 Coyne Street, Chicago.

Rauland-Lyric
AN

ALL-AMERICAN
TRADE MARK
TRANSFORMER

The Choice of Noted Music Critics



To Each Purchaser of a World Battery

A 24-Volt "B" Storage Battery positively given FREE with each purchase of a WORLD "A" Storage Battery. The WORLD Battery is famous for its guaranteed quality and service. Backed by years of Successful Manufacture and Thousands of Satisfied Users. You save 50%.

Prices That Save and Satisfy

Auto Batteries		Radio Batteries	
6-Volt, 11 Plate	\$12.25	6-Volt, 100 Amps.	12.50
6-Volt, 13 Plate	14.25	6-Volt, 120 Amps.	14.50
12-Volt, 7 Plate	17.00	6-Volt, 140 Amps.	16.00

Shipment Express C. O. D. subject to examination. 6 per cent discount for cash in full with order.

2-Yr. Guarantee Bond in Writing With Each World Storage Battery

proves satisfactory World performance. Mail this ad with your name and address - we will ship battery day order is received; and give you your choice of "B" Storage Battery or a handsome nickel finish Auto Spillover, FREE. Write TODAY.

WORLD BATTERY COMPANY
1219 So. Wabash Ave. Dept. 38, CHICAGO, ILL.

This FREE "B" Storage Battery takes the place of dry cell "B" batteries. Can be recharged and will last indefinitely. To be sold retail for \$6.00. It is the only battery of its kind equipped with solid rubber case - and insulation against acid and leakage. Take advantage of this remarkable introductory offer NOW. (To those who prefer it, we will send FREE a handsome nickel finish Auto Spillover, instead of the "B" Battery. Be sure to specify which is wanted.)

GIVEN FREE
To introduce this new and superior World "B" Storage Battery to the Public.



BUILD-UP MICA CONDENSER

Patent Pending

insure high efficiency and the Build-Up feature enables the operator to obtain any definite capacity from .0005 to .006 by simply adding extra plates of copper and mica to the Build-Up base.

Each alternate copper and mica plate has a capacity of approximately .0002 Mfd.

Build-Up Mica Condensers of the following capacities, each assembled complete in carton, at the following prices:

.00025 Mfd.	.....	List price	50c
.0005	.....	"	50c
.001	.....	"	55c
.002	.....	"	60c
.0025	.....	"	65c
.005	.....	"	70c
.006	.....	"	75c

Extra envelope containing 20 copper and mica plates, or sufficient to build up a condenser from .00025 to .006, list price 25c.

Table showing required number of plates needed for any capacity is furnished with each condenser.

Ask your dealer—or order direct

CHAS. SCHINDLER

1404 W. Delaware Ave., Toledo, Ohio

CRESCENT LAVITE RESISTANCES

Absolutely non-inductive

12,000		LIST		
48,000			\$1.50	
50,000				EACH
100,000				
100,000				
Ohms				

Special resistances to order, \$2.50. When better resistances are made they bear the Crescent label
CRESCENT RADIO SUPPLY CO.
9 Liberty Street Jamaica, N. Y.

A Day Out-of-Doors with KYW

A DAY or two out of the studio might reveal some of the activities of a radio man that otherwise are not credited to him. Wilson J. Wetherbee, director of Westinghouse station KYW has had much outside work to do.



Wilson J. Wetherbee

Recently Mr. Wetherbee, with Chief of Police Morgan Collins, Alderman J. M. Arvey and members of the mayor's radio commission made tests of the use of radio in police cars. Detective Chief William Schoemaker, Capt. John Stege, Deputy Superintendent Matthew Zimmer and Mr. Wetherbee conducted this test, which was declared to be successful.

The plan is to install radio sets in each police car for the purpose of picking up radio orders over KYW, the sets to be locked on the KYW meter wavelength



Claiborne Foster

to insure the reception of all calls. These special bulletins will be sent out direct from police headquarters and KYW will stand by at all times to broadcast these emergency calls. "Stand by for police bulletin" will be the opening announcement and the signal for the occupants of the car to be ready for orders.

BUT all outside moments are not always work. A week end visit to Grasmere Farm, the Eugene V. Byfield country home, provides a lot of fun, especially when a pleasant crew gets together.



Mrs. Wetherbee

There were Mr. Byfield, Miss Claiborne Foster and Allen Dinehart of the Applesauce Company, and Mr. and Mrs. Wetherbee, making up a recent party.

It was on this occasion that a real radio feature was arranged. Miss Foster and Mr. Dinehart were invited to visit the KYW studio each Friday evening to put on a sketch written by some radio fan. The scheme was inaugurated and comedy skits were received in great numbers, the best being picked for broadcasting. The idea has met with unforeseen popularity, and will be carried out all of this season.



Allan Dinehart

NOW YOU CAN HAVE THE NEW

ULTRADYNE

MODEL L-2



Built to Your Order

This is a genuine ULTRADYNE built of parts endorsed by R. E. Laeault, A. M. I. R. E., Inventor, and constructed according to his specifications. We guarantee this set to arrive in your home in absolutely perfect condition.

\$150

Ultradyne Kit

Carrying the last improvements of R. E. Laeault, whose personal monogram seal is on each Ultraformer. Kit contains 1 Low Loss Tuning Coil, 1 Low Loss Oscillator Coil, 1 Type A Ultraformer, 3 Type B Ultraformers, 4 Matched Fixed Condensers, 1 Low Loss 180 degree Coupler.

\$30

Special Kit, \$29.50

For those desirous of transforming their old Ultradyne to the improved model L-2, we have arranged a special list containing everything needed.

One complete diagram - - - - -	\$0.50	One Hammarlund Condenser (0005) -	\$5.00
Bakelite Panel (Drilled-Engraved) -	7.50	One Low Loss Oscillator Coil - - - -	} 9.00
Eight Amperite Automatic filament controls - - - - -	8.80	One Low Loss Tuning Coil - - - - -	
Two 2 in. Accuratune Dials - - - - -	1.50	One Low Loss 180 degree Coupler - -	
		Two Stripped Binding Posts - - - -	.45

These parts will be sent you separately at the prices listed or we will send you the kit complete for \$29.50.

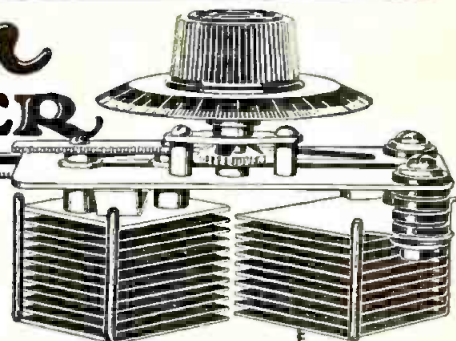
The famous ULTRA-VERNIER Tuning Control.....\$2.50

MANNING-HALL RADIO SERVICE, INC.

1819 Broadway

New York, N. Y.

THE Ensign CONDENSER



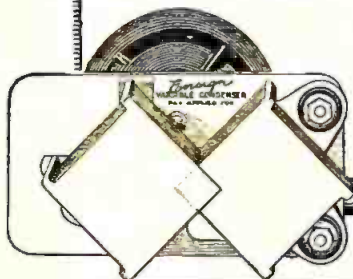
AT LAST!
The Ideal Instrument!

1. Sturdy Construction.
2. One hole mounting.
3. Use of entire dial.
4. No warping or shorting of plates.
5. Straight line wavelength.
6. Lowest minimum capacity.
7. Lowest Loss.
8. Sharper tuning.
9. Low wavelengths not crowded.
10. No body capacity.

Size 2 1/2 x 4 3/4 in.

PRICE
Including Dial
.0025 \$4.50
.0035 \$4.75
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Order by Mail
Send No Money
Pay the Postman
We Guarantee Our Product



Manufactured by
CARLTON SANDERS
MISHAWAKA INDIANA

RADIO SETS
AND COMPLETE LINE OF PARTS
OF THE BETTER KIND
SEE US BEFORE YOU BUY
C. ENIEHOFF & CO.
S.W. COR. LA SALLE ET OHIO STS. - PHONE DEARBORN 7427

HUDSON-ROSS
Largest exclusive Radio
Jobbers in middle West.
Write for discounts.
123 W. Madison St. Chicago



Velvet Action

P-302

Three Circuit Tuner \$5.00

1. Low Loss.
2. Stagger Wound.
3. Sealed against Moisture.
4. Extremely Smooth Tickler Action.
5. Single Panel Mounting.

The simplest, most rugged unit yet designed. Improve your set and your results with it.



Radio Frequency Coils



Set of Three

\$6.00

Users report them superior to any coils they have ever used in a tuned radio frequency circuit for—

Selectivity
Distance
Tone Quality

✱ The PFANSTIEHL RADIO CO.

Highland Park - Illinois
Chicago Office
1001 W. Washington Boulevard
Tel. Monroe 2703



95% Air Dielectric Dopeless, self-supporting, air spaced windings give full inductive power. This is the real, complete low-loss inductance system.

GET MORE VOLUME—GREATER DISTANCE
KNIFE-LIFE SELECTIVITY

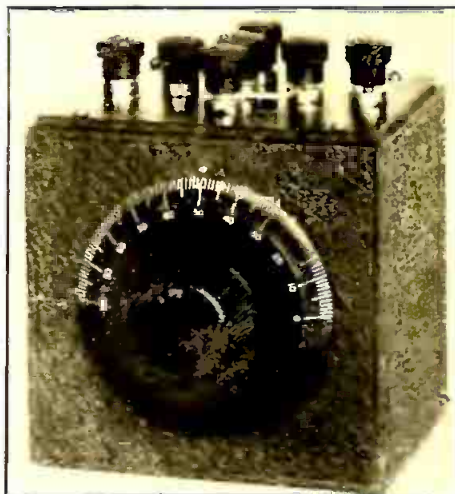
The Henninger Aero Coil is the only tuning inductance and is the only air core R.F. transformer which eliminates all resistances and consequent losses which broaden tuning, decrease volume and limit distance range. These coils will give you a great deal more volume, greater increase your distance range and give you such knife-like selectivity that

you can tune through the most difficult interference. There is nothing else like the Henninger Aero Coil. No inductance system is so efficient. Build a tuned R.F. receiver using this wonder inductance system—or use a single Aero-Coil in place of the tuning inductance in your present set. \$3.50 each or \$10.50 the set of three with all fittings.

Write for free illustrated circular—"The Prevention of Radio-Frequency Losses." Show how to build Henninger Aero-Dyne and how to improve any kind of set by using a single aero coil.

HENNINGER RADIO MFG. CO., 1772 Wilson Ave., Dept. 28, Chicago

MAKE YOUR RECEIVING SET SELECTIVE



The Benson Wave Filter eliminates annoying interferences. It is of the inductive coupled type. Mounted in a beautiful leather covered cabinet with an engraved bakelite panel.

PRICE \$8.75



1225 No. Halstead St. CHICAGO, ILL.

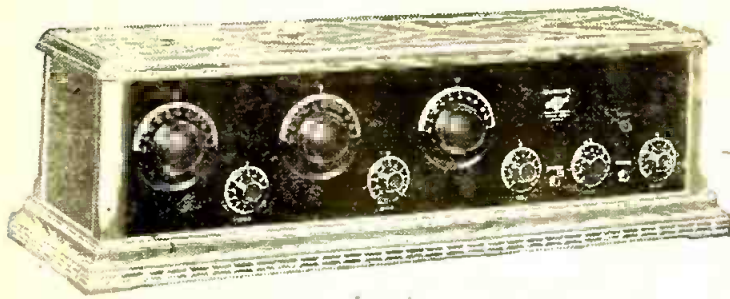


A Speaker of Distinction
VOLUME, CLARITY, BEAUTY
14 inch Pyralin Bell. Aluminum Sound Column
No. 205B-Black Pyralin Bell \$22.50
No. 205D-Shell Pyralin Bell \$25.00

Designed and built by experts, for 30 years makers of telephones.

American Electric
COMPANY
State & 64th Sts., Chicago, U. S. A.

5000 RADIO DEALERS buy from HUDSON-ROSS 123 W. Madison St. Chicago Send for dealers discount.



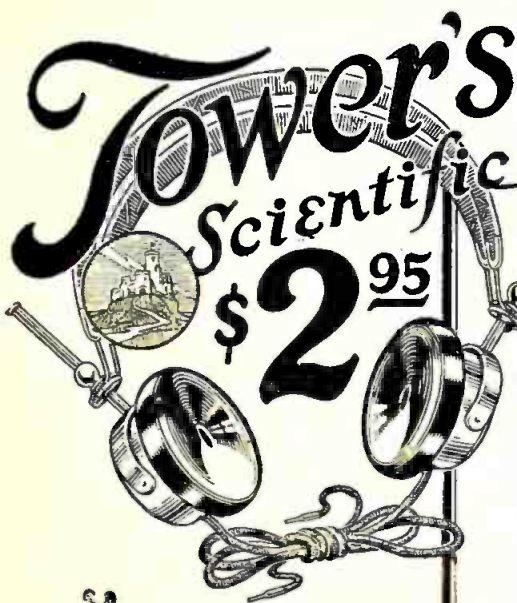
The Howard Five Tube Neutrodyne

The most unusual set on the market. Beautifully finished walnut case. Coast to coast range. Perfect selectivity. Also made in Console type. Designed and perfected according to the Howard standard—and that says more than any superlatives.

Convince yourself by seeing and hearing the Howard demonstrated. Any Howard dealer will be pleased to give you a demonstration.



Howard Manufacturing Company
451-469 East Ohio St. Chicago



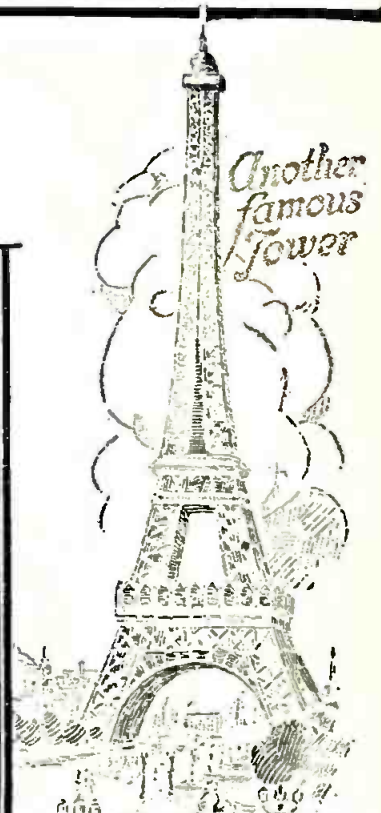
Two Towers

As the Eiffel Tower stands as a monument to skilled engineering construction so TOWER'S Scientific phones stand as a monument to supreme radio achievement. ¶ Each phone is carefully tested and approved before it leaves the factory by a Government Licensed Radio Operator thus guaranteeing perfection in tone quality with a positive uniformity of volume. ¶ Lightest of all in weight (only 8½ oz.) they do not catch in the hair and are unusually easy to adjust conforming gracefully to the head.

If your dealer cannot supply you, order direct, we will ship immediately Parcel Post C.O.D.

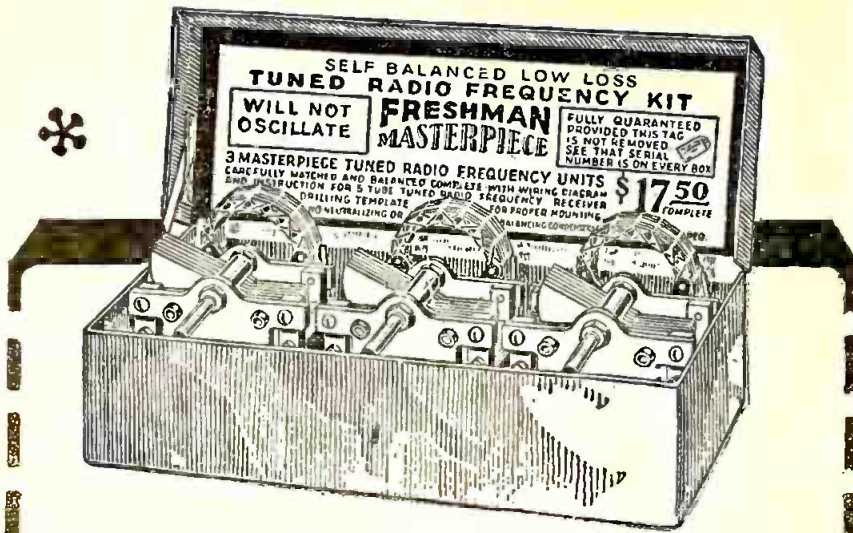
THE TOWER MFG. CORPORATION
98 BROOKLINE AVE. Dept. T. BOSTON, MASS.

MILLIONS are enjoying music and entertainment reproduced in clear, mellow tones, characteristic of TOWER'S Scientifics.



One of the seven wonders of the world.—The Eiffel Tower built in 1887-89 on the Champ-de-Mars contains 3 stories. Reached by a series of elevators, the platform at the top being 985 feet above the ground. In the top story is located the powerful Broadcasting Station F.L.

The World's Greatest Headset Value



It's Easy to Build

THE FRESHMAN MASTERPIECE

or any other 5 tube tuned radio frequency receiver when you use the Freshman Masterpiece Kit.

NO NEUTRALIZING or BALANCING CONDENSERS REQUIRED

when you build with this kit, to construct a set that will be the equal, if not the superior, of any 5 tube receiver on the market, regardless of price. Even those stations farthest away can be brought in night after night at the same points on the dials with precision-like dependability.

Kit consists of 3 Masterpiece Tuned Radio Frequency Units carefully matched and balanced. Complete with wiring diagram and instructions for building any 5 tube tuned radio frequency receiver and also drilling template for proper mountings.

\$17.50

Each and every Freshman Masterpiece Coil bears a serial number and Trademark—our guarantee of electrical and mechanical perfection. For your protection demand only the genuine.

At your dealers, otherwise send purchase price and you will be supplied without further charge.

Chas. Freshman Co. Inc.
Radio Receivers and Parts
FRESHMAN BUILDING
240-248 WEST 40TH ST.-NEW YORK, N.Y.

A Permanent Seven-Tube Super-Heterodyne

(Continued from page 15)

terminals 7 and 8 would be the fixed condenser supplied with the charged filter transformer.

After the set has been completed, the batteries may be connected to it, 90 volts being used for the B-battery and three dry cells for the A-Battery if 199 tubes are used. A storage battery will be required if 201-A tubes are used. A 4½ volt C-Battery will be required on the audio amplifier and a 1½ to 4½ battery on the radio frequency amplifier.

Getting Started

THE right hand tube should be inserted in its socket and the phone plug inserted in the jack. If the grid terminal of this tube is touched, a click should be heard. The next two tubes should now be inserted in their sockets with a 5. megohm grid leak in the first detector condenser clips, and a one megohm grid leak in the second detector clip. If the grid terminal of the second detector is touched, a squeal or click should be heard, which indicates that these three tubes are functioning properly. The two intermediate amplifier tubes should be inserted and the set should squeal as their grid leads are touched, or it may squeal continuously, which is correct. The first detector and oscillator tube should be inserted and the balancing condenser turned to zero.

If the oscillator condenser is rotated with the loop connected to the set, a click will be heard at some point on its scale. This point will vary for different settings of the loop condenser. A signal may now be tuned in by setting the loop condenser at, say, 20 degrees, and rotating the oscillator condenser through a range of ten degrees below the setting of the loop condenser to ten degrees above its setting.

This process may be carried out throughout the entire wavelength range by resetting the loop condenser each time at a five degree higher value and then rotating the oscillator condenser. The set is extremely selective and it is very easy to pass over stations unless it is operated very carefully. Two points will be noticed at which a station can be heard on the oscillator dial; one on either side of the click setting. One point will be noticed on the loop dial. The proper setting of the oscillator coupler rotor is as far out as possible. It should be adjusted on a very weak signal, and when set, it need never be changed.

The Balancing Condenser

THE balancing condenser should be used at as low a value as possible and will make very little difference in the reception of local stations. After a weak signal has been tuned in, increasing value of balancing condenser will increase the strength of the signal up to a point where the first detector tube goes into oscillation.

(Turn to page 60)

RADIO AGE ANNUAL FOR 1924—AT SPECIAL PRICE!

Clip the coupon and send it with 50 cents, and the RADIO AGE ANNUAL FOR 1924 will be sent you by return mail.

RADIO AGE,
500 N. Dearborn St., Chicago.

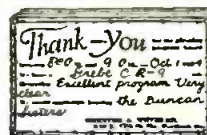
Enclosed is 50 cents, for which send me the RADIO AGE ANNUAL for 1924.

Name.....

Address.....

City.....

SEND NO MONEY!



Your OWN Name and Address Printed Free on Thank You Cards. Hear what YOU like. Stations gladly put on numbers at your request. Thank your favorite stations. Special cards that get ATTENTION. All the RADIO AGE, 100—\$1.00; 200—\$1.60; 300—\$2.00; 600—\$3.00; 1000—\$5.00. Postpaid if pay with order. MONEY REFUNDED if Not Delighted. Quality cards. High grade printing.

FREE LOG RECORD for YOUR set. With first order. Shows call, city, wave length, dial settings, remarks. Other valuable information. Beautiful rippled cover. Send no money—pay postman when you get cards. Order NOW!

RADIO PRINTERS 2023 Main St., Mendota, Ill.

SUPER-HETERODYNE

Ultradyn—Haynes Griffin—Remler
Dealers! Send for Discounts

HUDSON-ROSS
123 W. Madison St. Chicago

* Tested and Approved by RADIO AGE *

\$25.00 Prize to Radio Fans

Who can find the 3rd Circuit in the 3-circuit tuners being placed on the market as "Low Loss."

The "gyp" dealers, mud radio manufacturers and radio morgues surely got a new lease on life when they picked that slogan from Mr. Kruse's article in QST. Most of the manufacturers were handing the public mud sockets, water-soaked, wooden vario-couplers and variometers, and the variable condensers would make a good sieve for any kitchen mechanic.

Any tuner on the market today that advertises Low Loss and states there is no dope and Lorenz type of winding is sure the bunk.

Only one dial to get stations and the other to increase or decrease volume. Kennedy Tuner is used in place of vario-coupler, variometer and honey-comb coils, saving the cost of over \$9.00 worth of unnecessary parts that are in most receiving sets, and no dead end losses.

KENNEDY TUNER

is a Two-Circuit Tuner that gets results and was manufactured when the "gyp" artists were still playing with taps and wood.

RESULTS OF EUROPEAN TESTS 1923 and 1924 :

- 1923—2 LO, London, Eng.
5 WA, Cardiff, Wales.
- 1924—5 NO, Newcastle, PTT,
Lyons, France.

As per certification from Radio Broadcast.



Most Receiving Sets with 5, 6, 7 and 8 tubes call it a "Radio Triumph" when they hear KGO about 3 o'clock in the morning, and then only two numbers. If they think that is a Radio Triumph, let them read this photographic confirmation and weep.

1360 University Ave
New York, N.Y.
Oct. 27th, 1924

Pacific Coast Station,
R.O.O. General Electric Co.
6660 East 14th, St.
Oakland, California

Gentlemen: I had the pleasure of playing up your WONDERFUL STATION Saturday evening at 11:45 P.M. P.S.T. I listened to the following numbers on the LOUD SPEAKER:

11:47 P.M.	Plane Solo by John Warner
11:57	Trombone Solo
11:59	Novelton Music
12:05 A.M.	Speaker in regard to Presidency
12:12	Accordion Solo
12:18	Trombone Solo
12:32	"Quartetto" "Sleep Kentucky Sleep"
12:36	"G" "Kansas River"
12:57	Novelton Music with singing
1:10	Orchestra "Where's My Beauty Hiding"
1:23	Trombone & Trombone Duet "Daddy Come Home"
2:43	Orchestra "In a Rhapsody"
2:53	Jimmy McIntosh singing "Because They A.I. Love You"
2:57	"Where's My Beauty Hiding"
3:00	"Tell me where's My Little Blue Eyed Beauty"
3:03	"When I Love You"
3:07	"I got alone before I met You and I will get along after I leave You"

Your signals came thru fine, I sure did enjoy the WONDERFUL PROGRAM and MUST say your station has only one competitor and that one is a "WIMP" STATION in U.S. I class accent my sincere appreciation. I remain yours for continued SUCCESS.

T. J. Kennedy

P.S. If above check with your station log will you please confirm on carbon copy I am enclosing with stamped envelope addressed.

*above reception correct in every respect
Thank you for your report
yours very truly
K.G.O & JP*

November 24, 1924 November 30, 1924

INTERNATIONAL RADIO BROADCAST TEST

Under the Auspices of RADIO BROADCAST Magazine

This Certifies That

Mr. T. J. Kennedy

Located at *1360 University Ave. New York City*

Has assisted and participated in the International Radio Test and that information received and checked at Radio Broadcast Laboratory (Headquarters of the Test) indicates successful reception of test programs from cooperating European Stations.

Arthur H. Lynch
Director International Tests
Editor Radio Broadcast

Garden City, New York
December, 1924

Radio Fans:—If you are interested in the best radio parts on the market, send your orders to me.

"We do not handle junk." The word "cheap" means the kind of reception you are going to get on that cheap receiver because a radio receiver is as good as its *cheapest* part.

KENNEDY \$5.00 TUNER

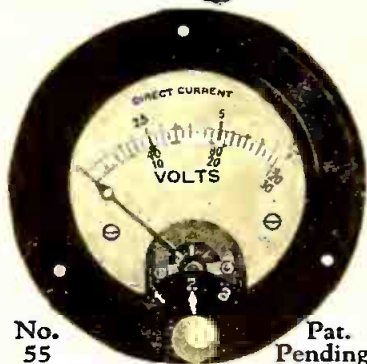
Including Globe Trotter
Diagram

KENNEDY TUNER users must be satisfied. Use tuner for 30 days at my expense and if you are dissatisfied I will refund your money with a smile.

Send for Free Diagram

T. J. KENNEDY

Radio Globe Trotter
1360 University Avenue New York, N. Y.



No. 55 Pat. Pending

Multiple reading instrument with self contained switch

WATCH— Your BATTERIES and TUBES

Mount a Jewell No. 55 on your set and check your Batteries of your filament voltages from the panel of your set.

Every radio fan should have a copy of our 15-A Radio Catalog.

Order from Dealer



Jewell Electrical Instrument Co.

1650 Walnut St. - Chicago
"25 Years Making Good Instruments"

An Unusual Seven Tube Super-Het

(Continued from page 58.)

The balancing condenser should always be kept just below this point. More balancing condenser capacity may be used on the high wavelengths than on the lower waves.

If the oscillator dial appears broad in tuning, the .0075 condenser connected across transformer terminals 7 and 8 should be adjusted in steps of .0005 by adding fixed condensers in parallel to it until the oscillator coupler sharpens up. This will probably be unnecessary under average conditions.

Some Final Hints

A few final words of caution will not be amiss. It is absolutely important that all by-pass condensers shown be used, and they should be of approximately the values specified, although the 1/2 MFD condensers may range as high as one MFD and the .002 condensers may range as high as .005.

If any hand capacity effect is noticed, it indicates that too high a value of balancing condenser or potentiometer is being used or that by-pass condensers have been omitted, or are defective. In some cases, due to the difference in potential between the set and the operator's body, it is necessary to ground the center tap of the loop which is connected to the minus side of the filament line.

If an antenna is to be used with the receiver, an extra oscillator coupler will work very nicely in place of the loop. It should not be necessary except under very poor conditions, as the set will go below the noise level under practically all conditions when a loop is used.

If care has been used in the assembly of the set and if the parts used have been carefully checked and are of first class manufacture, the builder will possess a set of which he will have every reason to be proud—both in appearance and operation.

Experiments with the Double Grid Tube

(Continued from page 58)

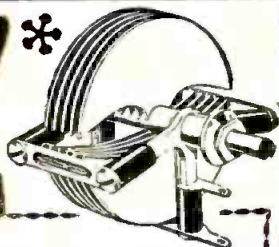
rent characteristic just before the saturation point. In this case, a proper grid voltage must be had and a potentiometer is used as in Fig. 2.

It has been shown that ordinary hook-ups may readily be equipped with double grid tubes, enabling you to save money in the buying of "B" batteries. It is even possible not to use any "B" batteries at all, the return leads of the plate and the inner grid going directly to the positive post of the "A" battery. A sufficient positive potential as regards the negative end of the filament is thus obtained on grid and plate to insure good reception.

In the above hook-up, use is only made of the inner grid to cut down the internal resistance of the tube. Special hook-ups which will be taken up in another article will make use of a grid-plate circuit, where a great amplification is obtained.

The tube gives also very good results in reflex circuits, of which we shall say more in the second part of this article.

FREE
Bulletin



"Good Condenser Design"

What makes a good condenser? Send for this free folder and post yourself on today's requirements. This article is full of meat. It makes plain all the electrical as well as the mechanical qualities of a good condenser.

If you are planning to build a receiving set or to bring your present one up to date, go to your dealer and ask to see the new

Premier "CROFOOT" Variable Condenser

"CROFOOT" has all the necessary electrical and mechanical features. It is a real low loss instrument. It has the lowest minimum capacity yet attained—.000005 M. F. and the greatest tuning ratio—1 to 73. Made entirely of brass and hard rubber giving remarkably low skin resistance and low insulation leakage. Semi-straight line plate construction. All plates soldered; a feature identified by the "red stripe." A sturdy, smooth acting, compact and graceful instrument. Mounts with one hole. Ratios 1 to 19, 1 to 42, 1 to 53 and 1 to 74. Price from \$2.75 to \$3.75. Vernier attachment with dial 75 cents additional.

FREE Hook-Up Diagrams

Ask your dealer for a complete set of Premier diagrams covering all types of hook ups. If he cannot supply them send his name and receive a set with bulletin.

Premier Electric Co.
3803 Ravenswood Ave., Chicago

PREMIER
Quality Radio Parts

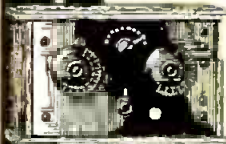
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Want to make big, easy money? Learn how to install, operate, repair, construct and sell Radios. Write now for facts about the amazing opportunities for Radio experts, and our special offer of a FREE 1000-mile receiving set, and how you can quickly train at home by mail.

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No previous experience necessary. Anyone with ordinary education can now learn Radio quickly under our simplified home-study plan. We need men right now to represent our Association. Be the Radio expert in your neighborhood. Get your share of the big profits. Hundreds about you want Radios and advice how to operate. You can earn enough money right from the start to pay for course. Nothing difficult about it. Low cost and easy terms.



FREE 1,000-MILE Receiving Set

Don't miss this big special offer to supply FREE all parts necessary to construct a high-grade 1000-mile receiving set. You can sell this set alone for practically the entire cost of the course. Send for the facts now. Find out all about this big-pay field. Address

Radio Association of America
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One of the first and still in the lead.
Write for discounts.

123 W. Madison St. Chicago

RADIO AGE ON THE AIR

RADIO AGE Programs are noted for their excellence. Hear one from WEBH, 9 to 10 p. m., Feb. 24th; WLS, 7 to 8 p. m., March 6; and KYW at midnight, March 7. Each a Real Show!

A Real Coast-to-Coast R. F. Receiver

(Continued from page 18)

low loss coil is desired, one frame with the spokes made removable will do for the three coils. These frames may be purchased from any reliable dealer in radio supplies for about 25 cents each.

The spokes on these frames should be about one and one-half inches long, and the disc should measure about two or two and one-half inches in diameter. If a frame of these dimensions should prove hard to locate, it can be made with little effort, as follows:—

One disc, two and one-half inches in diameter, will be turned from a piece of close grained wood one-half of an inch in thickness; and seventeen three-sixteenth inch holes will then be drilled around the circumference of the disc to a depth of a little over one-quarter of an inch. These holes will be on centers of slightly less than one-half of an inch or about twenty-one degrees apart.

Seventeen dowell pins will then be cut from three-sixteenth inch stock and the ends rounded and finished off so as not to injure the insulation of the wire while winding. They should measure one and three-quarter inches long. These pins will then be placed into the seventeen holes in the disk and the frame is completed. If a form is being made, the spokes should be fitted into the holes so that they may be removed easily; otherwise they should fit tight.

Winding the Coils

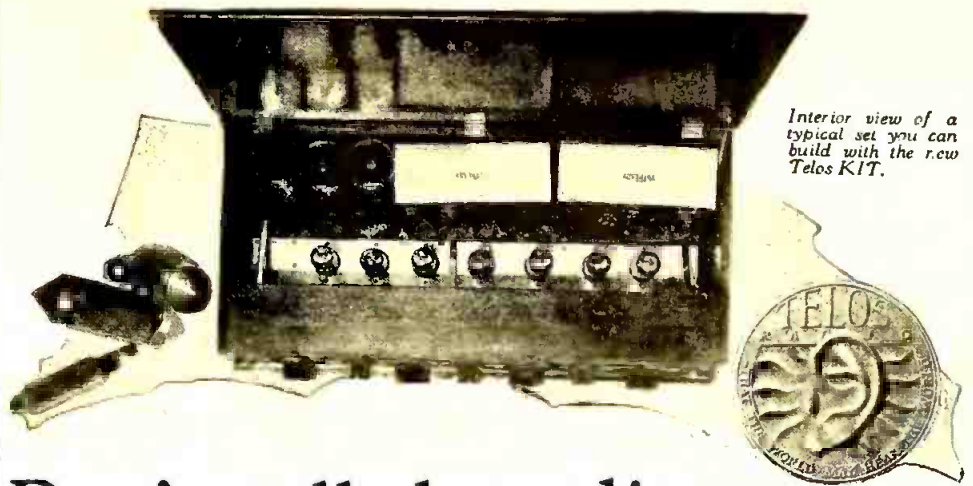
WHEN the form or frames have been completed, the coils will be wound upon them as follows, using number twenty-four, twenty-six or twenty-eight double silk covered copper magnet wire:

The primary coil will have six complete turns of wire wound upon the frame and the ends (P-1, P-2) left about six inches long. The lead (P-1) will be the inside lead of the coil and will be made fast to one of the spokes by looping it around that spoke. Now bring the wire over two spokes on the far side of the coil, crossing over to the near side of the coil between the second and third spokes. Pass the wire over the third and fourth spokes and back to the far side of the coil between the fourth and fifth spokes; repeat this operation of over two and under two until six turns have been made and the lead (P-2) fastened to the same spoke as lead (P-1), finishing the primary coil.

The secondary coil will be wound directly on top of the primary coil in the same manner and in the same direction as the primary coil, starting with lead (S-1), making fifty-five complete turns and finishing with lead (S-2), leaving these leads about six inches long.

It would be well to wind the primary coils of these transformers with a white colored wire and the secondary coils with a green or dark colored wire so as to more easily distinguish each coil and the different leads.

If the form is to be removed, the coil



Interior view of a typical set you can build with the new Telos KIT.

Don't call them liars write for the book yourself!

WHEN you run across a couple of Telos set owners—as everybody does nowadays—stop before you doubt the results they talk about. For you can easily find out whether such power, selectivity, at so little cost, is possible, by using the coupon below. When you do find out how the Telos principle of tuned R.F. has been developed — how it makes three R.F. stages entirely practical—how the A. F. is superimposed (reflexed) on the R.F. tubes—how “Uni-control works”—how 5, 6, and 7 dry cell

tubes are made to operate with half the usual plate current — then you will no longer doubt —but you will want a Telos set yourself.

And you will also find that you can easily build any one of the many interesting Telos sets in a single afternoon — the essential Telos instruments to build scores of circuits, based on the Telos principle, are *all* in the Telos Kit.

So fill out the coupon now! Don't doubt — know for yourself what Telos really does!

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Telos Radio

Danziger-Jones, Inc.,
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New York, N. Y.
Send me at once your booklet “The
KIT of a Thousand Possibilities.”

Name.....

Address.....

This Tag

Insures Success *
of Your Super

It remained for Silver-Marshall to produce long-wave transformers so uniform that *individual amplification curves* could be supplied with each instrument. The idea is revolutionary. It establishes a standard of excellence every progressive manufacturer will be forced to adopt. It demonstrates again the fact that S-M engineering methods are always a year ahead of the industry. Now, you can build your super as an engineer builds a bridge—after a *definite plan*—with assurance of success.



The "Why of Silver Supers"

Send for the "Why of Silver Supers." It tells you all about the seven-tube dry-cell set that gives consistent coast to coast reception with speaker volume on an eighteen-inch loop. It's Free.
McMurdo Silver's book on the "Super" is the most complete and light-shedding book of its kind in print.
Price..... 50c

THE FOUR-TUBE KNOCKOUT

This is the set described in the March issue of *Radio Broadcast*—the set on which a "green" operator in Chicago brought in twenty-seven stations from coast to coast on the loud-speaker, in *daylight*.

Send for Mr. Silver's book on the *Four-tube Knockout*.
Price..... 25c

Silver-Marshall, Inc.
RADIO EQUIPMENT
110 So. Wabash Ave. CHICAGO

Its Curve Is on the Tag

UPPER CURVE
LOWER CURVE
WAVE LENGTH IN METERS

TWO-TEN OR TWO-ELEVEN LONG WAVE TRANSFORMER
Manufactured under the supervision of
McMurdo Silver, Assoc. L.R.E. by
SILVER-MARSHALL, Inc.
105 S. Wabash Ave. Chicago

Story of the Curve

The curve of each TWO-TEN (iron-core inter-stage) and TWO-ELEVEN (filter) transformer is plotted in our laboratory—recorded on a tag, and tied to the instrument. It shows the peak-side bands passed—amplification factor. Both peak at 5000 meters and pass an 11 Kilocycle side-band, without distortion. Supplied in sets of two, or three TWO-TENS, and one TWO-ELEVEN, with identical peaks and separate curves. Price, either type (each).....\$8.00

LOW-LOSS COILS

The R.F. Coupler and Antenna coil designed by Mr. Silver for use in the KNOCKOUT are responsible for the remarkable records already established by this set. They show the lowest losses of any coils obtainable. Send for circulars.

should be painted with a good solution of collodium and allowed to harden before the spokes are removed. This will take about fifteen minutes. After the form has been removed, the inside and outside edges of the coil should be treated with this solution to prevent the wires from coming loose. Three such coils are required.

Collodium is a solution of gun cotton in ether, and may be purchased at almost any drug store. Two ounces will be sufficient and should cost about ten cents.

When the three coils have been formed and the frame removed, insert one of the dowell pins in each coil at the point where the leads or ends of the coil terminate and make fast with cotton or silk thread, as shown in Figure 2, and the coils are ready to be mounted.

The transformers used for radio frequency amplification should be as near alike electrically as possible. Therefore, it would be well to use care in the winding of the above coils to keep the tension of the wire the same on all three of the coils, in order not to have the winding more dense on one than on another, or it would be well to match these coils by use of the slide wire bridge described in the February issue of RADIO AGE.

Assembly of the Parts

THE first step in the assembly of the set will be to mount the five tube sockets (M-1 to M-5) on the shelf and the three condensers (C-1, C-2, C-3), the filament control rheostat (R) and the two jacks (P) and (S) to the panel; then drill the holes in the shelf for passing the wiring to the different pieces and for mounting the three radio frequency transformers (R-1, R-2, R-3).

Five binding posts will then be mounted on the right end of the shelf and designated (G) (-) (A+) (BD) and (B+). One binding post will then be mounted on the left end of the shelf and designated (A). The audio frequency transformer (T-1) will be mounted on the extreme right end on the under side of the shelf, as far back as possible. This transformer should be placed so that the ends of the winding are opposite to the panel or so that the core of the transformer is at right angles to the panel.

The audio transformer (T-2) will then be mounted between the jacks (P) and (S) on the top side of the shelf and as close to the panel as possible. This transformer should be placed so that the ends of the winding are in line with the panel, or so that the core of the transformer is parallel to the panel. This will place this unit so that it will be at or close to an angle of sixty degrees with the third radio frequency transformer (R-3).

Our radio frequency transformers will not be mounted until the wiring has been completed for the parts already assembled, as they are rather delicate and would be easily damaged even with careful handling.

Wiring the Set

As will be noted in the pictures of the

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Radio Age, Inc.,
500 North Dearborn Street,
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\$2.50 A YEAR

Gentlemen: Please enter my subscription for RADIO AGE, the Magazine of the Hour, for one year, beginning with your next issue, for which I enclose \$2.50.

Name.....

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Send cash, money order or check.

receiver, the customary bus-work has been omitted and very little wiring is exposed on the top of the shelf. Little need be said about how to run the leads, except that they should be as short as possible and no two leads run parallel for any distance. This is easily done when the wiring is concealed as the tendency to beautify instead of simplify prevails when wiring is exposed to view.

Number eighteen double cotton covered bell wire, treated with paraffin, was used in this set, it being plenty large enough to carry any currents passing through the receiver, and is sufficiently flexible to permit handling. All leads should be soldered to terminals or to other leads where they are joined. Too much stress cannot be put to this point, as poor contact to the terminals or junctions is the direct cause of over half of the failures among amateur set builders. It is also one of the most difficult causes of trouble to locate, the fault often being laid to a piece of equipment, which is discarded and a new piece put in its place with the terminals all soldered tight and cleaned, whereas resoldering the leads to the original piece of apparatus would have made it function as well as the new piece.

A well known radio engineer recently made the remark that when he soldered a terminal or junction, he tried his level best to pull it apart. If it stays put, he knows he has a good contact; if it comes off, he is one jump ahead of trouble, and I think his policy is a good one to follow, as soldering is not merely to have a hot iron and a piece of solder, but one of the most important operations of assembling a receiving set.

When the leads have all been soldered to their respective terminals on the mounted apparatus, we will return to the radio frequency transformers (R-1, R-2, R-3) which will be mounted to the shelf as shown in Figure 2, using glue or some such method to make the dowel pins rigid in their mounting holes and to prevent them from turning out of their required angles.

Placing the Coils

THESE coils should be placed on an angle of about sixty degrees with respect to the panel and on four-inch centers as previously covered.

They will be wired to the set as follows:

Coil R-1 The inside lead (P-1) of this coil will be connected to the binding post A. Lead (P-2) will be connected to the filament post of the tube socket (M-1) marked (-). Lead (S-1) will be connected to the stator plates of the condenser (C-1) and to the filament post of the tube socket (M-1) marked (-) and lead (S-2) will be connected to the rotor plates of the condenser (C-1) and to the grid terminal of the tube socket (M-1) marked (G).

Coil R-2 The inside lead of this coil, (P-1), will be connected to the plate terminal of the tube socket (M-1) marked (P). Lead (P-2) will be connected to the binding post B+. Lead (S-1) will be connected to the stator plates of the condenser (C-2) and to



The Heart of the Radio

FAINT, trembling impulses are caught from the air and amplified thousands upon thousands of times. Finally transformed into audible sounds by your loud speaker, they are either painfully distorted or lifelike in purity of tone. Which it will be, depends largely upon your transformer.

For the transformer is of the utmost importance in your radio set. Each minute sound vibration coming from the detector is magnified and reissued with a stronger pulse—lending volume and clarity to your radio reception.

Jefferson Super Sensitive Transformers are designed to receive over the entire musical range without howling or distortion. Radio authorities the world over recognize the excellent performance of these wonderful transformers and specify their use in new circuits.

Handled by the better dealers and jobbers.

A superior transformer at a price attractively low.



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507 So. Green St.

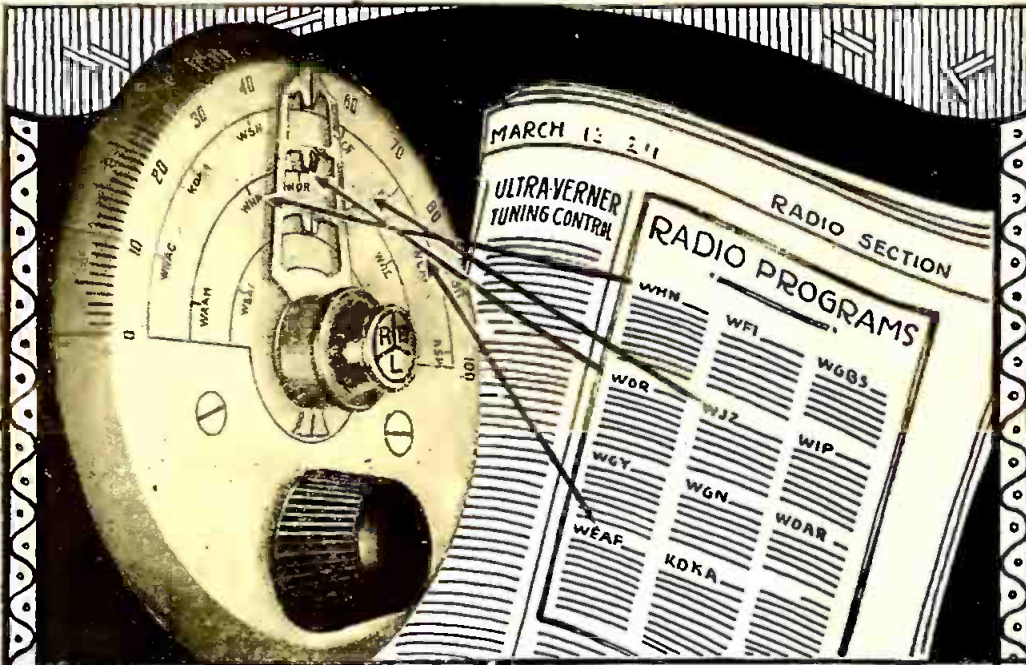
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| <i>Automobile Ignition Coils</i> | <i>Furnace and Oil Burner Transformers</i> |
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Jefferson Transformers



Tune by Sight

Tune your favorite stations once, mark them on the Ultra-Vernier, then forget wave lengths. Tedious tuning, blind fumbling and guessing are over for all time. Now it's possible to pick your entertainment from the radio program and turn the dial instantly, accurately, to your station and know your receiver is tuned with infinite precision.

\$2.50



Designed by R. E. Lacault, E. E., A. M. I. R. E., inventor of the famous Ultradyne circuit. This monogram seal (R. E. L.) is your assurance of Lacault design.

The silvered Ultra-Vernier dial mounts fast to panel. Single control 20-1 ratio, operates vernier for hair-splitting adjustment and governs station indicator. Replace your old dials with Ultra-Verniers. You've never known such tuning ease.

Made by the Hammarlund Mfg. Co., your assurance of quality and dependability — produced solely for the Phoenix Radio Corporation. At your dealer's, otherwise send purchase price and you will be supplied postpaid.

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ULTRA-VERNIER TUNING CONTROL

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Fits Grid Leak any mounting

FRESHMAN PLUNGER TIME VARIABLE GRID LEAK

was designed especially for the non-technical set owner who can replace in an instant the fixed grid leak with this new, efficient cartridge type Variable Grid Leak, without requiring the change of a single wire.

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New Long Distance Crystal Gives Remarkable Results

A recent invention in crystals is amazing Reflex and Crystal Set owners everywhere. It is stated that this marvelous Crystal gets distant stations loud and clear, and there is no disagreeable "hunting" for spots because the entire surface is sensitive. Many are finding it far superior for reflex work and claim it the last word in mounted synthetic crystals.

A Trial Costs You Nothing

In order to introduce his invention, the owner, Mr. Hick, offers you two \$1.00 Crystals for the price of one. Sell one, and put the other on your own set without cost to you. Just send name and address to Mr. Hick, Dept. 9, 1018 S. Wabash Ave., Chicago. Pay postman \$1.00 (plus postage). Unless you are absolutely satisfied, write Mr. Hick, and money will be cheerfully refunded.

* Tested and Approved by RADIO AGE *

the filament post of the tube socket (M-2) marked (-) and lead (S-2) will be connected to the rotor plates of the condenser (C-2) and to the grid terminal of the tube socket (M-2) marked (G).

Coil R-3 The inside lead of this coil, (P-1), will be connected to the plate terminal of the tube socket (M-2) marked (P). Lead (P-2) will be connected to the binding post B+. Lead (S-1) will be connected to the stator plates of the condenser (C-3) and to the filament post of the tube socket (M-3) marked (+), and lead (S-2) will be connected to the rotor plates of the condenser (C-3) and to the No. 1 terminal of the grid leak and condenser (GL). The terminal of the grid leak and condenser (No. 2) will then be connected to the grid terminal of the tube socket (M-3) marked (G) and the wiring will be complete.

Testing Out the Wiring

For safety, it would be a good plan to test the wiring of the set to see if the connections are all in their proper place and to make sure that a high voltage (B) battery lead is not crossed with the filament or "A" battery leads. This will often save many dollars' worth of tubes, and while the builder is usually careful in this respect, it is a good plan to make sure and some disappointing moments may be avoided when the set is put into operation. The first step in a simple test of the wiring will be to connect the negative side of the plate or "B" battery to the binding posts (G) and (-) and the positive side of this battery to the binding posts (BD) and (B+), then secure a small voltmeter or buzzer and attach two leads to the terminals and place them across the filament posts of each tube socket. If a flow of current takes place, it will be caused by the "B" battery, and should be eliminated before any tubes are put into the sockets. If no current flows, the filaments of the tubes will be safe.

All of the wiring in the receiver may be tested with the voltmeter or buzzer in connection with the plate battery and will prove time well spent.

After the set has been wired and tested, it should be put into the cabinet and made ready for operation. The first step will be to connect the plate or "B" batteries. The negative side of the first battery will be connected to the binding post (-) and a tap taken off at twenty-two volts, which will be connected to the binding post (BD). The positive post of the battery, which should be ninety volts, will be connected to the binding post (B+). The filament battery will then be connected to the set. This should be a six volt battery. The negative post of this battery will be connected to the binding post (-) and the positive post to the binding post (A+).

The ground lead will be connected to the binding post (G) and the antenna to the binding post (A).

A single wire, flat top antenna about seventy-five feet in length with a lead-in

of not over twenty-five feet is recommended for use with this set, as it will allow for sharp tuning and will be large enough for any purpose. A smaller antenna will serve as well, however, and when close to a broadcasting station, may prove to advantage in that it will make more sharp tuning possible.

Operation of the Set

When the set has been connected to the batteries, the ground and to the antenna, turn the tube control rheostat (R) to the "off" position, and insert the tubes in their respective sockets. Turn the rheostat on gradually until the tube filaments are caused to glow. Set the dials (C-1, C-2, C-3) at about twenty-five. This should tune the set to a wave of about 300 meters. Move the three dials gradually around until a station is heard; then turn the rheostat (R) until a point is reached where the best reception is obtained.

The same procedure will be taken to tune the set to other waves, remembering that the three dials (C-1, C-2, C-3) will always be at or near the same point if the transformer coils (R-1, R-2, R-3) have been matched close to one another. And the set may easily be logged for wavelength or for stations, making it possible to turn to the place desired without the customary fishing.

Penetrating Through the Strong "Locals"

(Continued from page 12)

Cuba, Canada, etc. In such a location, some of the more powerful or better situated DX stations behave much as locals do for city-dwellers. For instance, DX stations coming through in Virginia so well that they would be classed as locals in the city are, KDKA, WBZ, WSB, WEBH, WQJ, WOC, etc., and when reception of other stations very close to these in wavelength is wanted, the penetrator switch is used on the 2-2 combination to remove interference from them.

Such a receiver is of special interest where a good antenna system is available, since the double tickler control maintains the outfit at its most sensitive state on any wavelength. Ordinary tuned R. F. receivers having no regeneration or tickler controls are in reality supreme for only a small band of waves, usually rather short waves. Below this band oscillation is usually present, and above it the sensitivity falls off greatly. Tuned R. F. users who have tried reception on waves higher than 450 will realize the truth of this quite readily.

When tested in about a dozen different and difficult locations in New York city, the penetrator demonstrated its ability to tune through locals and receive out-of-town stations despite interference from stations within a quarter and half mile. For instance, in a situation about twelve blocks from WJZ, WJY and WHN stations KDKA, WBZ, WGY, WTAM could be heard successfully, whereas with the 6-6 combination (representing the average tuned R. F. outfit) even the locals overlapped each other.



MAGNATRONS have reached that degree of excellence where the mere name is synonymous with the very best in vacuum tubes. You have but to use MAGNATRONS to form the same opinion.

MAGNATRONS have received the unqualified approval of radio fans and radio engineers alike. And small wonder—when you realize that the design and manufacture of MAGNATRONS is carried on by an organization of men who have devoted a decade and more to vacuum tube problems.

MAGNATRONS are made in three types: the DC-201A, the DC-199 with large base, and the DC-199 with miniature base. Your dealer will gladly recommend all of them to you.

Magnatrons are manufactured and guaranteed by the Connewey Electric Laboratories New York City.

MAGNATRONS

Apparatus

THE parts employed in the Penetrator are as follows:

- 2 Low loss three circuit couplers
- 2 Low loss variable condensers to match
- 2 double circuit jacks
- 1 single circuit jack
- 5 tube sockets
- 4 rheostats, 10 ohms each
- 1 filament switch
- 1 double pole double throw jack or anti-capacity switch
- 1 R-4 R. F. transformer
- 1 grid leak, 2 meg., and grid condenser, .00025 mfd.
- 1 fixed condenser .002 mfd.
- 9 binding posts
- 1 binding post panel
- 1 panel, 16 by 24 inches
- 1 baseboard 10 by 22 inches
- 2 3-inch dials for ticklers
- 2 4-inch or vernier dials for condensers

- 4 rheostat dials
- Wire for connections

As mentioned, the coupler tickler coils should be reduced to fifteen turns each. This can either be done by cutting one end and tapping by a soldered joint at the 15th turn, or else by completely removing the tickler and winding another coil of 15 turns to replace it. This extra coil may be wound in a ring or "doughnut" and bound together by a few strips of thread. Low loss form is not of value in the plate circuit, but is of prime importance in the primary and grid circuits of the coupler.

The grid condenser and leak should preferably be a combination instrument. Binding posts are placed at the rear of the baseboard. Six or seven posts will answer, providing some of them are combined, as is quite feasible. Binding post strips may be had either with or

(Turn to page 77)

A New Socket that means Better Reception!



After exhaustive research, our engineers have developed VIRALON, a special glass, processed for 100% efficiency. Sturdy and rugged, absolutely heat and moisture proof, and unaffected by those influences that commonly make rubber, rubber derivatives, porcelain or vitreous products so inefficient.

Other exclusive features are Ezyklean Contacts (proof against corrosion)—One-Piece Contact Springs—Handy Soldering Terminals, etc. Price \$1.25, standard size.

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If your dealer cannot supply you, send us \$1.25 and parcel post to cover each socket.

DURAY RADIO CORPORATION

Dept. 15, 263 Washington Ave., Newark, N. J.

DURAY

ALL-GLASS
VIRALON
SOCKET

RECO RADIO RECEIVER

4-TUBE RADIO FREQUENCY

Equal to any 5 or 6 tube set on the market.

Beautiful Tone Quality. Long Distance Stations brought in easily with volume and clarity.

Enclosed in a beautiful solid walnut cabinet with Duco Two-Tone Finish.

Price \$85⁰⁰ Chicago

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RECO STORAGE BATTERIES
CABINETS — CONSOLES
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ARMSTRONG CABINET SPEAKERS

DAVENPORT - HICKORY
CORPORATION
329 So. LA SALLE ST.
CHICAGO ILLINOIS

Perfecting the "Baby Grand Super"

(Continued from page 24)

conveyed back through the audio and amplified, distorting the reception.

Oscillator Tube Rheostat in Previous Circuits

ONE control has been used for the entire six tubes. It has been found desirable to control the operation of the oscillator tube independently of the other tubes. This is for the reason that the incoming impulse should be nicely balanced with the local oscillations. As tube characteristics change, one tube may give the proper degree of local oscillation when working in common with the other tubes, whereas a different tube used in the oscillator would require separate control. By providing separate control, this variation in tubes is taken care of.

While a great deal has been said about this operation of the super-heterodyne circuit, yet it will by all means bear repeating. It is one place where success or failure may be encountered without warning. Unless you have had a lot of experience in the use of regeneration, you will not recognize the symptoms which will tell you whether you have too much or too little regeneration. Too little regeneration, of course, will prevent the securing of the full quota of distant stations. Too much regeneration will blur, if not altogether obliterate, the reception. If the small condenser does not respond readily when being turned, it is an indication that the capacity is either too high or too low.

If the condenser has the right number of plates, regeneration can be identified by the peculiar rushing noise known to all regenerative circuits. As there are no condensers on the market, so far as the writer knows, that will give exactly the right capacity, it will be necessary to use the same condenser as used in this layout and then remove plates from the rotor one at a time until with the rotor half turned in, you have a good amount of regeneration and plenty of margin for filament control.

As it is contrary to the policy of RADIO AGE, in common with most other radio publications, to give a list of the necessary parts, the writer wishes to say that he will be glad to furnish a complete list of parts and dimensional layout to all those who are interested and upon receipt of 5c in stamps to cover postage.

It is important that specifications both as to layout and parts be followed closely, inasmuch as each super-heterodyne circuit is a law unto itself. Operating as it does at a predetermined frequency, there is no possibility of substituting one make of apparatus for another and of securing even the semblance of efficiency. This has no reference to the comparative merits of apparatus, but rather the operating frequency. The diagrams will show the correct position for each wire and piece of apparatus, and the list of parts will indicate how and where to secure them.

Specifications will be given for the construction of a loop such as used on

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Those who build their own can easily achieve perfect reproduction. There's nothing to equal Resistance Coupling. The

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The Famous Truly Portable TELMACO P-1 Receiver

Four Tubes Do the Work of 7

Coast-to-coast reception. Aerial, loud speaker, and batteries self-contained. Carry from room to room—take it anywhere. Size 8"x10"x18". Total weight only 26 lbs. Complete with tubes and batteries. \$125.00 \$147.50. Receiver only.

P-1 Kit Saves You Money!

In response to a popular demand we now offer the Telmaco P-1 Receiver in kit form. This contains all parts, as built by us, including case, drilled and engraved panel, and illustrated instructions. \$80.00 Complete kit

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HONEYCOMB COILS

The Universal all-wave inductance. Back and front panel mounting. Send 25c for Super Het., R. F. and Honeycomb Coil Circuits and Complete Catalog.

Chas. A. Branson, Inc.
Dept. 13
815 Main St., Buffalo, N. Y.

this set, as well as the cabinet in which the set is placed. Those who wish to use the set as a portable one can follow instructions just as given. Those who wish to use the set indoors entirely may omit the bottom portion of the cabinet, and run the binding posts out of the back so that stationary "A" and "B" batteries may be attached.

As there are six tubes in this set, the total current consumption with the tubes in normal operation will be about 1-2 ampere. The six dry cells hooked up in parallel will serve to furnish current for the filaments over a considerable period of time. The small "B" batteries will last about an equal length of time, depending, of course, upon how frequently and how long the set is used. When the set is used considerably as a postable set, it probably would be well to carry a pair of 45 Volt "B" batteries of large size and use them instead of the small size.

OPERATING on a loop, shown in illustration, this little set during the last two or three months has constantly brought in stations all over the United States, including the west coast, and all of them on the loud speaker. It has been operated within twenty-two miles of Chicago during the large part of this time and cuts through the Chicago stations without any difficulty, even though the eastern stations are in direct line with all large Chicago stations. On account of the fact that this set uses a loop, it is usually easily possible to separate stations of only a few meters apart, providing they are located at slightly different points of the compass. Quite frequently it has been found that a powerful station remotely situated can be tuned in past a local station about the same power, if a distant station is favored, by adjusting the loop.

Do not write in asking if this set will operate on an aerial. The loop has been deliberately used so as to make the set just that much more selective, and to work it successfully, we have provided it with plenty of radio frequency amplification.

If you operate it on an aerial you will bring in more volume, to be sure, but you will also bring in a lot of noise which will be amplified by the radio frequency stages, and you will lose much of the selectivity which is one of the great features of a successful super-heterodyne.

MORE VOLUME—NO DISTORTION

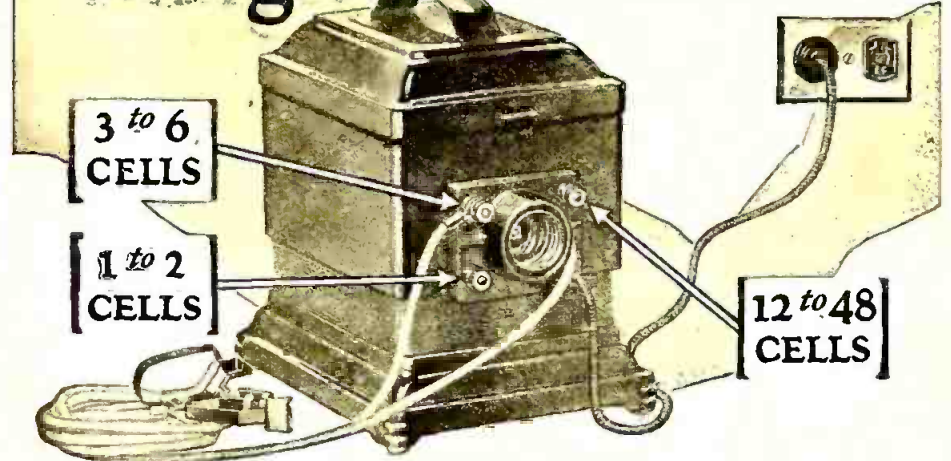
Correct spacing of first grade silicon steel leaves in core carries away high flux densities which cause other transformers to distort reception. Ratio 4.25 to 1. Equally efficient in all stages. Windings absolutely accurate.

The FLINT A. F. T. Better looking than any A. F. T. made and the finest built A. F. T. in the world. Only \$3.00 each. If your dealer can't supply you, order direct. Money back guarantee. Dealers, write for particulars. FLINT RADIO CO. 1644 Wilson Av., Chicago, Ill.



REFLEX
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New Model Tungar charges all batteries



The Tungar is a G-E product, developed in the great Research Laboratories of General Electric.

The New Model Tungar charges radio A and B storage batteries, and auto batteries. Two ampere size (East of the Rockies) . . . \$18.00

The Tungar is also available in five ampere size (East of the Rockies) . . . \$28.00

60 cycles—110 volts

On the back of the Tungar, there are three terminals. Slip the wire into one and charge your radio "A" battery, 2 or 4 volt size. Use the second to charge your radio "B" battery, 24 to 96 volt size. Or the third will charge a 6 volt "A" battery or 6 to 12 volt auto battery.

Just clip on the Tungar, and plug it into any electric outlet in the house or garage. Then leave it overnight to charge while you sleep. Very simple.

Tungar

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BATTERY CHARGER

Tungar—a registered trademark—is found only on the genuine. Look for it on the name plate.

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Low Loss Condenser

High grade, standard radio products that will increase the efficiency of any set and add to the satisfaction of the user. Ambassador Low Loss Products have long been the choice of particular fans. See them—compare them, and you will choose them too. At All Good Dealers.

FREE! Send us four cents in stamps for diagrams of circuits in which Ambassador products can be used. Ask your dealer or

AMBASSADOR SALES COMPANY
108 Greenwich St., New York
326 W. Madison St., Chicago

Have you bought your
1925 ANNUAL?

Don't Always Blame the Hookup

(Continued from page 16)

way that the condensers are overheated. Fixed condensers are insulated with paraffin, and when they are heated above the melting point of paraffin the "gravy" will run out and it is likely that the condenser will be ruined. Attach solder lugs to the condensers by screws and then connect the wires to the solder lugs by a quick deft touch of a very hot iron that will cause as little heating as possible. Don't lay your iron on the condenser for half an hour while the paraffin bubbles and oozes out of the insulation.

Last week I took out six fixed condensers from a set that were shorted by soldering, and as usual the trouble was charged up to the hookup.

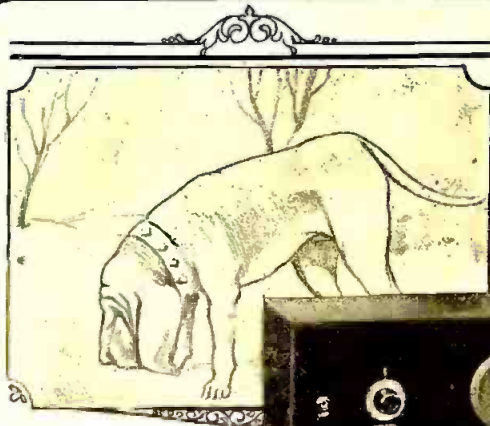
Even the best of manufacturers are not infallible in spite of the precautions taken in inspecting their product. Every once in a while a part will slip through the shop that is defective. Just because a part bears the insignia of a high grade product it does not mean that all of the "bugs" are out of it. The only insurance is to test it out before it is installed in the set, and for this reason it is always best to rig up the circuit experimentally before dolling it all up and putting it into a fancy cabinet. If anything proves wrong when the parts are laid out on the table it can be discovered and remedied before we have put in a lot of work on the final assembly. Just as an example of how faults may develop in apparatus I recently took an \$8.00 transformer apart only to find that the trouble was caused by a cockroach which had crawled under the terminal board and then had calmly laid down in its long last sleep. This was a "bug" in every sense of the word.

Thin Wire is Delicate

H EADSETS and audio frequency transformers are wound with very fine wire—finer than a hair in most transformers. Very frequently a jar in shipping or roughly handling in the store may cause the wire to break near the terminals thus opening the circuit. Transformers and headsets should always be tested for open circuits, and many variometers are not above suspicion in this respect. Inspect all sliding rotor contacts on condenser shafts, coupler rotors, etc.

Next to soldering troubles I have experienced more grief with shellaced coils than any other part of the circuit. The average amateur who has had a smattering of electrical work winds his coils according to specifications and then completes the job by giving the coil a good heavy coat of shellac varnish. Nothing could possibly be worse. The shellac has an exceedingly high electrostatic coefficient and increases the distributed capacity of the coil by at least one hundred times. After painting with shellac we have a condenser rather than an inductance. Paraffin is nearly as bad and should be avoided except with spiderweb or honeycomb coils

Sensitivity



The bloodhound, remarkable for the acuteness of its smell, can pick up a scent and follow a trail when all else fails.



-never before thought possible!



With the extreme acuteness of the bloodhound's scent, the Model L-2 Ultradyne detects the faintest broadcast signals—signals that are "dead" to other receivers—regenerates and makes them audible on the loud speaker.



The Ultradyne Kit Consists of 1 Low Loss Tuning Coil, 1 Special Low Loss Coupler, 1 Type "A" Ultraformer, 3 Type "B" Ultraformers, 4 Matched Fixed Condensers. To protect the public, Mr. Lacault's personal monogram seal (R. E. L.) is placed on all genuine Ultraformers. All Ultraformers are guaranteed so long as this seal remains unbroken.....\$30

It's here, where the development of other super-radio receivers has halted; the Ultradyne forges ahead. The unusual sensitivity of the Model L-2 Ultradyne is due to the successful application of regeneration, to the famous Modulation System of radio reception, recently perfected by R. E. Lacault, E.E., A.M.I.R.E., Chief Engineer of this Company and formerly Radio Research Engineer with the French Signal Corps Research Laboratories.

It's this development, an exclusive feature of the Model L-2 Ultradyne, that makes it possible to receive greater distance on the loud speaker.

In addition the Ultradyne is the most selective receiver known. Regardless of close similarity in wavelength, it selects any station within range—brings in broadcasting clearly, distinctly, faithfully.

Everything that the Model L-2 Ultradyne means in actual results and genuine satisfaction, you will appreciate the first evening you operate it.

Write for free descriptive folder.

ULTRADYNE

MODEL L-2

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32 page illustrated book giving the latest authentic information on drilling, wiring, assembling and tuning the Model L-2 Ultradyne Receiver..... 50c

The HIGH QUALITY — LOW PRICE CLARITRON \$2.30 TUBE BY MAIL



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Detector and Amplifier

Not Cheap Tubes, But Good Tubes, Which We Sell Cheaply. You cannot get a better tube at any price—and why pay more? Our price is low because we sell direct and are content with a fair profit.

We guarantee that CLARITRON TUBES measure up to the highest standards. The well known New York Testing Laboratories declared CLARITRON to be better than standard tubes selling for \$4.00. They will give complete satisfaction or we will.

We make all kinds of tubes including:
Our No. 501A—for same use as 201A
Our No. 112—for same use as WD12
We ship all orders as soon as received. Shipments made by Parcel Post, C. O. D., or Prepaid on Receipt of Express or Postal Money Order.

SUPERIOR RADIO COMPANY, Dept. 203
176 Shephard Ave. Newark, N. J.



OUR TYPE 501A
Tipless
Detector and Amplifier

where insulation capacity has little effect. If the winding must be doped, use some well known brand of anti-capacity varnish or else a stiff solution of celluloid dissolved in banana oil.

Now we come to the cheap "molded mud" tube sockets, the primal curse of radio. One of these 11c sockets will waste more energy than can be supplied by ten aeriols. There are only three materials suitable for tube sockets—bakelite, porcelain and hard rubber. With the exception of the porcelain, all of the materials are rather expensive and therefore all sockets except the porcelain types are certain to be rather high priced. A few makers produce cheap bakelite sockets by making the walls about one sixteenth inch thick and by hollowing out all around the base to save material. Such tube sockets have the proper insulation value all right but are so weak mechanically that they are likely to crack out of the notch and allow your tube to shoot up to the ceiling. I broke two \$5.00 tubes in this way before I decided to economize in other directions than on the sockets.

And Now the Batteries

REVERSED battery polarities are another cause of premature gray hair. Please remember that the positive "B" battery connection (+B) should always go toward the plate (P) of the tube in any circuit. The (+B) may reach the plate (P) directly or else indirectly through other parts of the circuit, but the negative "B" (-B) should never be connected in this way. Follow your circuit diagram to the bitter end in regard to polarities. As a general rule, the filament rheostat should be placed in the negative "A" battery line (-A or -F). The positive "A" (+A) should go straight to the (+) or (+F) post of the tube socket, and this applies both to detector and to amplifier circuits. In making such connections remember that the sign (+) means "positive" and that (-) means "negative." Again, it is sometimes customary to indicate polarities by colors and in this case RED indicates the positive pole while BLUE or black, the negative.



*Read
the evidence*

LITERALLY thousands of people have come to know the joys of perfect radio reception through the Ferbend Wave Trap. Testimonials from all parts of the world continue to pour in, unsolicited, from those who have equipped their set with this marvelous instrument.

You, too, will find it the shortest, easiest, and—best of all—the least expensive route to clear, undistorted reception—without interference. Never reduces, but nearly always increases volume. You can make your set selective to the point of perfection by simply adding a Ferbend Wave Trap. It will absolutely cut out any interfering station, no matter how loud, how close by or how troublesome. So why pay \$50.00 to \$200.00 extra for increased selectivity when you can buy it for \$8.50?

Guaranteed to tune out any interfering station. The Ferbend Wave Trap is designed and manufactured complete by us after years of careful experimenting. It is not to be confused with imitations, hastily assembled from ordinary parts. The price is \$8.50. Shipment is made Parcel Post C. O. D., plus a few cents postage. If you prefer, you can send cash in full with order, and we will ship postage prepaid. Clip and mail the COUPON today!

FERBEND ELECTRIC CO.
16 E. South Water Street CHICAGO, ILL.



FERBEND
Wave Trap
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Always look for this Trade Mark. It is your protection against misleading imitations and those who infringe on the registered name "Wave Trap" and its reputation. "If it isn't a FERBEND, it isn't a WAVE TRAP."

Dunbar, West Va.
Ferbend Electric Co.
Gentlemen: I bought your Wave Trap to see if I could not cut out the awful noise of telegraph stations which ruined most of our programs. Since we installed it in our five-tube Fada Neurodyne set we have not heard any more telegraphers—we let 'em in sometimes to show our friends how easy it is to kick 'em out with the Wave Trap. I would not have a set without a Ferbend Wave Trap.
(Signed) H. E. Atherton

Ferazul, Iowa.
Ferbend Electric Co.
Dear Sirs: I set my radio where Havana, Cuba, should come in but received only a jumble of K.F.N.F., W.O.R. and W.L.A.G. I then tuned in with the Trap and had Havana for two hours. I have several times taken a jumble like this and separated five and six stations. I find it a great help in clearing up stations that can not be brought in distinct. I am using a Crosley X.J.
(Signed) W. T. Cox.

Towson, Md.
Ferbend Electric Co.
Gentlemen: Well to say I am pleased with the Trap is putting it mildly. It is simply a wonderful instrument. I have had more or less trouble in getting K.D.K.A., W.B.Z., W.D.R. and W.L.W. with my Freed-Esemann Set as they are only a few degrees apart on my dials. Your Trap lets me through with the clearest possible reception. In my candid opinion there is no Radio Receiving Set complete without the addition of the Ferbend Wave Trap.
(Signed) E. W. Stevenson.

FERBEND ELECTRIC CO.
16 E. South Water St., Chicago, Ill.
Gentlemen: Please send me:
 WAVE TRAP. Send postpaid. I am enclosing (check, M. O., etc.) for \$8.50.
 WAVE TRAP. Send C. O. D. I will pay Postman \$8.50, plus few cents postage, when it arrives.
 FREE BOOKLET on interference.
Name.....
Address.....
City..... State.....

**TRY US!
RADIO DEALERS!**

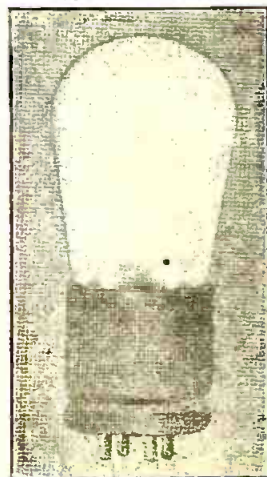
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FEDERAL
Type F 201 A Tube



GUARANTEED PRICE \$4.00

AT LAST!

The Tube Without An Equal
The Federal Type F 201 A Tube

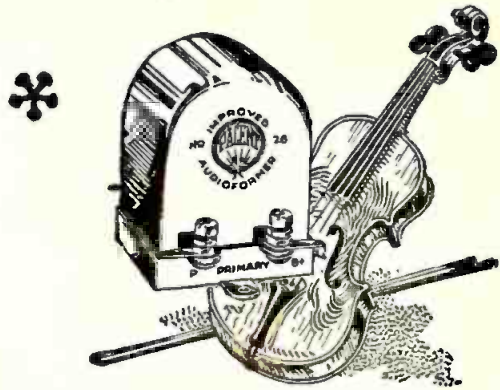
For clearer and better reception. The Federal Tube, through its vastly improved and guaranteed filament, achieves a clarity of tone unequalled in any other tube of similar type. Non-microphonic and of very rigid construction, and also noted for its extremely long life.

You Will Welcome this Wonderful Tube
Take advantage of our special introductory offer. Fill out the coupon and present same to your dealer, who will give you a 50c reduction off the regular price

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This coupon when presented to your dealer, will entitle you to a 50 cent Reduction on every FEDERAL TUBE purchase within the next 30 days.
If your dealer cannot supply FEDERAL TUBES, send your order direct to us. The Service Lamp Co.

THE SERVICE LAMP COMPANY
Manufacturers of Federal Tubes, New York City



Fidelity

Just as the rare old violin expresses the finest instincts of its master, so does the Pacent Improved Audioformer bring out the best in any radio set.

It gives faithful, pure and undistorted reproduction over the entire band of sound frequencies, with an unusually high amplification factor *throughout the entire range* rather than at one high peak.

You will be more enthusiastic than ever about your set when you hear it with Pacent Improved Audioformers. Order a pair today from your dealer.

Write for complete catalog of *Pacent Radio Essentials.*

PACENT ELECTRIC COMPANY, Inc.
91 Seventh Avenue, New York City
Washington Minneapolis Boston San Francisco
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Pacent

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 - Autoplug
 - Coil Plug
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 - Condensers, Low Loss
 - Detector Stand
 - Duojack
 - Duoplug
 - Duo-Lateral Coils
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 - Jack Set
 - Radioloop
 - Loop Plug
 - Loop Jack
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 - Potentiometers
 - Rheostats
 - Resistors, Laboratory
 - Socket
 - Twindapter, etc., etc.

DON'T IMPROVISE - PACENTIZE

"The Sleuths of Honeymoon Camp"

(Continued from page 30)

created by a very small current operating somewhat like a pilot light in a water-tank heater. The killing of this magnet breaks the circuit, and this in turn closes a larger circuit and thereby throws over the receiving switch. With the lapse of the ether wave, the dead magnet becomes alive again, and the action is reversed."

"How does the burglar alarm work?" asked Carl, who had not been taken into confidence regarding the invention.

"No doubt Ray has got his rights safely protected by this time, so I suppose it is all right for me to uncover his secret to his personal friends," Billy replied.

"Several months ago, you know, their place was broken into by burglars, and Ray contrived a burglar alarm in conjunction with his automatic switch operating device. With the opening of any door or window in the house, another current is broken and a magnet killed, thereby serving to throw over the sending switch and broadcast an alarm to the amateur world. But he really did not regard this invention seriously; it was contrived more as a plaything than anything else. I doubt if he made any actual experiment with it among radio amateurs. But it evidently does the work, and no doubt many amateurs right now are wondering what is the meaning of that stuff we just listened to."

"It's simply an automatic broadcaster, isn't it?" Jerry inquired.

"Sure. I bet I can hold a ghostly conversation with those two burglars and maybe scare them nearly to death. Meanwhile the switches there will work back and forth automatically with our voices. I happen to know that Ray keeps his instrument tuned up to 162 meters, so there's no reason why the device shouldn't work to perfection. Now listen, and we may have some fun with them. Maybe we can scare them away without taking anything with them. If I can't scare them away, or afflict them with some sort of radio paralysis, I'll try to get word to the police. Be careful; don't laugh or make any noise. Something funny may happen. Quiet now; here they are again."

The Voices Again

"GEE, THIS is some find," said a heavy voice in the loud speaker. "All this silverware is solid, and this diamond necklace will sure bring several hundred dollars. And here's a pair of silver mounted opera glasses and a solid silver water pitcher. Say, Sam, it was hard work breaking open the safe, but it was worth the trouble, wasn't it?"

"I'll say so," was "Sam's" reply. "But don't talk so much. No use hangin' around here any longer. Let's dump all this stuff in the bags and hustle out. No tellin' when some of these foks'll come in on us."

"Aw, no danger o' that. They're gone for a week or two. We could go to bed here and sleep till 3 o'clock in the morning."

"Yes," returned the other with sarcasm; "you can set the alarm and have

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Twenty-five
Different
Engraved
Tops

They Don't
Lose
Their Heads

At Dealers everywhere
H. H. EBY MFG. CO.
Philadelphia, Pa.

Radio Dealers
HEADQUARTERS

Dealers—if you want the best products, the fastest shipments and the most liberal discounts, write on your letterhead for our catalog L1003.

WAKEM & McLAUGHLIN
225 E. ILLINOIS ST. — CHICAGO

your doze, but I'm for makin' my get-away now."

"Aw, I was only kiddin'," guffawed the sleep suggester. "But there's no great rush. Let's see what else we can find."

"All the valu'bles were in this safe," insisted the alarm-clock arguer. "That's what they keep it for. When we've cleaned that out, we're through."

"Yes, it's father's home," cried Alice, with a picture of two rough characters in her mind. "He put that safe in after the other robbery. It's right near the radio. I recognize all those things they wera talking about. Oh, dear me! Let'e jump right into your machine and rusq back and get the police."

Billy laughed, in spite of the gravity of the situation.

"No, we'd never get back in time, unless they should set the alarm clock and go to bed," he objected. "Besides, I've taken one of the rear wheels off and Jerry's sedan is on the blink. Just be patient, and maybe I can do something with them. I'm going to throw over the transmitting switch. You may spoil the whole thing if you utter a sound."

He threw over the switch and called into the microphone: "Hands up, or I'll shoot!"

[To be concluded in April RADIO AGE]

A Novel Ultra-Audion

(Continued from page 42)

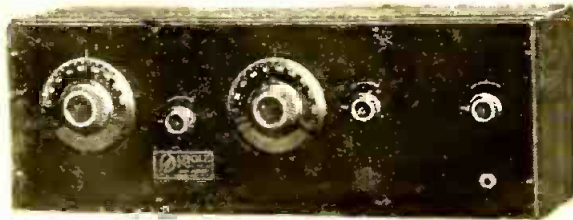
(TR) is shown only in the schematic diagram Fig. 2 and is connected into the ground circuit. It is shunted by the switch (S), so that when we wish to receive instead of send, we can short-circuit the transmitter by means of the switch. This can be built into the set by using a regular microphone, or else one of the Skinderviken microphone buttons which can be procured at about \$1.00. Under proper conditions this outfit can transmit about five miles with 90 to 120 volts on the plate of the first detector tube (T1). This should be a UV-201A or preferably a five watt tube such as the UV-202, but good results will be obtained with the former tube.

The set is tuned to wavelength when transmitting by the condenser (C) just as when receiving. The tube is turned up until oscillation is obtained, the switch (S) is opened, and then we can transmit when speaking into (TR). One night while fussing around with this outfit, it was set up in the kitchen while another receiver was tuned in on it from the front living room about 30 feet away. Never thinking that it would go beyond the walls of the building, I was greatly surprised to discover on the following morning that my confidential conversations had been heard all over town. If you wish to broadcast your domestic affairs, this is one way to do it!

If it were permitted by law, that is without a license, it will seem that a device of this sort would be of great convenience in the farming sections where the houses are a mile or so apart. Low power sets of this sort would not carry far and hence there would not be much danger of interference beyond a short radius.

ORIOLE Radio Receivers

Are Easy to Tune!



Four Tube Tuned Radio Frequency

DEMONSTRATION at your local dealer will convince you that a non-regenerative Oriole is the receiving set that will both fit your pocket-book and most exacting demands for performance. If you are not acquainted with the location of the Oriole representative in your neighborhood, a letter to our factory will bring full particulars about the set.

SELECTIVITY, VOLUME and TONE
were the dominating factors in designing this economically operated receiving set. Unusually clear and natural in tone, Oriole meets every requirement from the standpoint of selectivity. Volume is assured to a point where greater intensity would interfere with pure tone quality.

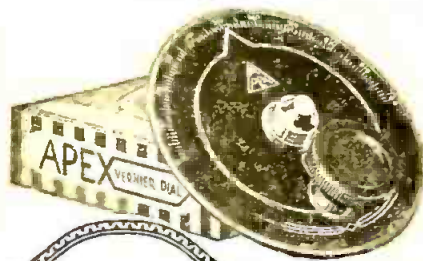
BEAUTY
has been considered to the minutest detail. The solid mahogany cabinet follows lines of delicate simplicity from the base of its dielectric panel to the piano-hinged cover.

DISTRIBUTORS and DEALERS who believe they can properly handle an exclusive contract in their territory are invited to correspond with our factory. Oriole Radio Receivers are not sold through jobbers. Let us hear from you immediately, for while several good territories are still open, they are rapidly being closed.

Manufactured By
W-K ELECTRIC CO.

Kenosha, Wisconsin

Illinois Distributor: Oriole Radio Distributing Co., 3838 North Ave., Chicago.



MORE DISTANT STATIONS

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For sale by all good Radio Dealers.

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\$2.00 for Royal Brass Finish.

\$2.50 for Satin Silver Finish.

\$3.50 for De Luxe Gold Plated Finish.

7 Tube Microdyne Super-Heterodyne for \$97.50

Receive the parts complete to assemble your set. Coast to coast on an 18 in. loop. Assemble this 7-tube Microdyne Super-Heterodyne on a 7 x 18 in. panel in 3 hours. Parts complete. Price of cabinet, to fit, on application. If your radio dealer cannot supply, send check or money order and name of dealer.

The Apex Super Five

is a tuned radio frequency receiver of the highest type. Built into a highly finished walnut cabinet—complete with Jones Multiple Battery Cable—all settings highly gold plated. List price \$95.00 complete.

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Description: 5 tube set. Comes completely assembled in beautiful mahogany cabinet, size 25x7x7 1/2. Has 2 stages Tuned Radio Frequency, Detector and 2 stages Audio Frequency. Equipped with the highest quality, approved standard low-loss parts. Genuine Bakelite Panel. Bakelite dials. Use any standard tubes and batteries.

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Arrow Battery Co.
1215 South Wabash Ave.
Dept. 1 Chicago, Ill.



Competition Narrows in Radio Age Contest

(Continued from page 46)

But the biggest "hit" of them all was the radio. The Art Linick of the radio is the comedian we all know. He and his twenty-eight radio numbers. Did you ever hear him sing "Previous?"

Votes Growing Heavy

BY FAR the heaviest vote cast to date was during the thirty-day period from December 16 to January 15. In referring to the "Standing to January 15" several notable changes will be found, the meteoric rise of Art Linick from sixteenth to fifth place being most spectacular. His name was not even tabulated in the January issue of RADIO AGE. He and Bert Davis are closely crowding the leaders who had apparently held a safe berth for some time past.

While Harry M. Snodgrass and Hired Hand have also strengthened their positions, it will also be noted that three new names appear upon the scene from far down the scale into what we call the first division.

The major contest is almost over. As this issue of RADIO AGE goes to press, there remain but three of the twelve months in which to name your candidate. The contest will absolutely end at midnight, June 5.

We have tried to be fair, as we have no favorites. It is in your hands to see that your candidate carries off the palm, or we should say "shield" of victory. If his name does not appear in first division, there are still three months left to put your choice in the lead.

Possibly some of the broadcasting stations will be kind enough to call the attention of their audiences to this contest. Anyhow, here's hoping, and may the best man win!

"The Mystery Man" of Station WEEI

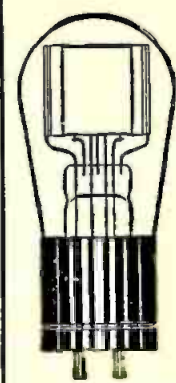
(Continued from page 38)

More than anything else, "Whit" is striving to make WEEI a station of personality. He wants people to feel that it is a homelike, friendly affair, and not something remote. With his genial, drawling voice, it should not be a hard task.

No article about WEEI would be complete without mentioning "Bob" Emery, the lovable, congenial "Big Brother." "Bob" came to WEEI from Amrad, WGI, and is chief announcer. He is bound to win a popularity contest one of these days. He has a perfect radio voice, can sing, play the piano and the ukelele—and a dozen different things. His original "Big Brother" club has an enrollment of 7,500 youngsters and the little tots.

But that's another story!

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VERY SPECIAL PRICE **\$2.29**

These high grade tubes are made in two popular sizes only, and are guaranteed Brand New, quiet in operation and highly sensitive.

No. P. V. 301A Detector and Amplifier Tube with standard base, Only \$2.95

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CHAS. FRESHMAN CO., Inc. 240 - 248 W. 40th St., N. Y.

**The Girl Who Conquered
The Radio Bores!**

(Continued from page 33)

thrilled jazz-loving multitudes by every known means of sound conveyance! Gracing the stage, thousands know her as an unassuming girl who could knock the Van and Schenck out of those eighty-eight keys absolutely unassisted!

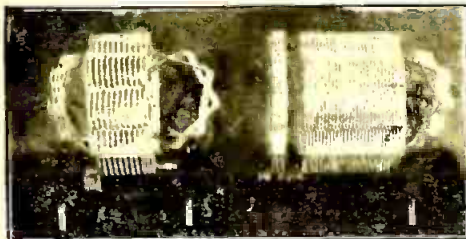
And her pianola rolls? Well, thousands of American homes derive the benefits of her artistry through the application of a little foot power.

BUT the Hudson vapors that enwrap the broadcasting towers of WEAF must await Vee's arrival on the air each Sunday evening with no small degree of joyous expectation. Indeed, happy as they are to hear her, they in no way near the keen enthusiasm of WEAF's six million potential radio fans!

Applause cards are nice little things and all that—very easy to send—and Vee gets loads of them. But when your thankful listeners bespeak their gratitude with dinner invitations, aye, verily, 'tis gratitude indeed! Applesauce on the table is worth two applause cards in the mails, any radio artist will agree.

Vee is known in the inner circles of radio life as the girl with the dinner invitations. Somebody up in Rhode Island started it—you know, friends of the family and that sort of thing—and this feeding-Vee fad has spread to wherever WEAF is heard.

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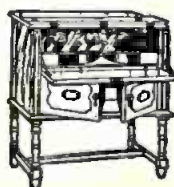
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Kladag Radio Laboratories, Kent, O.

Corrected List of Broadcasting Stations

KDKA	Westinghouse Electric & Mfg. Co.	East Pittsburgh	309	KFQP	G. S. Carson, Jr.	Iowa City, Ia.	224
KDPM	Westinghouse Electric & Mfg. Co.	Cleveland, Ohio	270	KFQR	Walter LaFayette Ellis	Oklahoma City, Okla.	250
KDPT	Southern Electrical Co.	San Diego, Calif.	244	KFOT	Texas National Guard	Denison, Texas	252
KDYL	Newhouse Hotel	Salt Lake City, Utah	250	KFOU	W. Riker	Holy City, Calif.	234
KDYM	Bavoy Theatre	San Diego, Calif.	280	KFOV	Omaha Grain Exchange (Portable)	Omaha, Nebr.	231
KDYO	Oregon Institute of Technology	Portland, Ore.	340	KFOG	C. F. Knerim	North Bend, Wash.	248
KDZB	Frank E. Stiefert	Bakersfield, Calif.	240	KFOH	Alfred M. Hubbard	Seattle, Wash.	233
KDZE	Rhodes Department Store	Seattle, Wash.	270	KFOI	Farmers State Bank	Balden, Neb.	273
KDZI	Electric Supply Co.	Wenatchee, Wash.	360	KFOJ	Taft Radio Co.	Hollywood, Calif.	240
KFAD	McArthur Bros. Mercantile Co.	Phoenix, Ariz.	360	KFRJ	Guy Simmons, Jr.	Conway, Ark.	250
KFAE	State College of Washington	Pullman, Wash.	330	KFRM	James F. Boland	Fort Sill, Okla.	263
KFAF	Western Radio Corporation	Denver, Colo.	278	KFRN	M. Laurence Short	Hanford, Calif.	224
KFAJ	University of Colorado	Boulder, Colo.	360	KFRP	Curtis Printing Co.	Ft. Worth, Tex.	246
KFAR	Studio Lighting Service Co. (O. K. Olsen)	Hollywood, Calif.	280	KFRU	Okmulgee Dist. Oil and Gas Assn.	Bristow, Okla.	381
KFAU	Boise High School	Boise, Idaho	270	KFRW	United Church of Olympia	Olympia, Wash.	220
KFAW	The Radio Den (W. B. Ashford)	Santa Ana, Calif.	280	KFRX	J. Gordon Klemgard	Pullman, Wash.	217
KFBB	F. A. Buttrey & Co.	Hayes, Mont.	360	KFRY	New Mexico College of Agriculture and Mechanic Arts, State College, N. M.	266	
KFBC	W. K. Azbill	San Diego, Calif.	278	KFRZ	The Electric Shop	Hartington, Neb.	222
KFBG	First Presbyterian Church	Tacoma, Wash.	250	KFSG	Angelus Temple	Los Angeles, Calif.	278
KFBK	Kimball-Upson Co.	Sacramento, Calif.	283	KFSY	The Van Buren Co.	Helena, Mont.	341
KFBL	Lees Bros.	Everett, Wash.	224	KFJU	Hopbert Plumbing and Heating Co.	Breckenridge, Minn.	242
KFBU	The Cathedral	Laramie, Wyo.	283	KFUL	Thomas Goggin & Bros. Music Co.	Galveston, Tex.	258
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KFUM	W. D. Corley	Colorado Springs, Colo.	242
KFCB	The First Congregational Church	Helena, Mont.	248	KFUP	Concordia Seminary	St. Louis, Mo.	549
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KFUR	Fitzsimmons General Hospital	Denver, Colo.	234
KFCB	The First Congregational Church	Helena, Mont.	248	KFUS	Julius Brunton and Sons Co.	San Francisco, Cal.	234
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KFUV	H. W. Peery and C. Redfield	Ogden, Utah	224
KFCB	The First Congregational Church	Helena, Mont.	248	KFVU	Louis L. Sherman	Oakland, Calif.	233
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KFWU	University of Utah	Salt Lake City, Utah	234
KFCB	The First Congregational Church	Helena, Mont.	248	KG	Colburn Radio Labs.	San Leandro, Cal.	234
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGB	Tacoma Daily Ledger	Tacoma, Wash.	252
KFCB	The First Congregational Church	Helena, Mont.	248	KGC	General Electric Co.	Oakland, Calif.	312
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGD	Martin A. Mulfony	Honolulu, Hawaii	250
KFCB	The First Congregational Church	Helena, Mont.	248	KGE	Portland Morning Oregonian	Portland, Ore.	485
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	St. Martins College (Rev. Sebastian Ruth)	Lacy, Wash.	258
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Times-Mirror Co.	Los Angeles, Calif.	404
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Louis Wasmer	Seattle, Wash.	360
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	C. O. Gould	Stockton, Calif.	273
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Northwest Radio Service Co.	Seattle, Wash.	405
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Bible Institute of Los Angeles, Inc.	Los Angeles, Calif.	252
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Warner Brothers Radio Supplies Co.	Oakland, Calif.	360
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Tribune Publishing Co.	Oakland, Calif.	509
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Reynolds Radio Co.	Denver, Colo.	283
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	San Joaquin Light & Power Corp.	Fresno, Calif.	248
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Love Electric Co.	Tacoma, Wash.	263
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Walter Heinrich	Kukah Bay, Alaska	250
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Los Angeles Evening Express	Los Angeles, Calif.	337
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	General Electric Co.	Denver, Colo.	323
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	New Mexico College of Agriculture & Mechanic Arts, State College, N. Mex.	348	
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Detroit Police Department	Detroit, Mich.	288
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Hale Bros.	San Francisco, Calif.	423
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Pasadena Presbyterian Church	Pasadena, Cal.	229
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Doubleday-Hill Electric Co.	Pittsburg, Pa.	270
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Charles D. Herrold	San Jose, Calif.	240
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	V. C. Battery & Electric Co.	Berkeley, Calif.	275
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Kansas State Agricultural College	Manhattan, Kans.	341
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Post Dispatch (Publisher Pub. Co.)	St. Louis, Mo.	549
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	New Alington Hotel Co.	Hot Springs, Ark.	375
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	First Presbyterian Church	Seattle, Wash.	360
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Examiner Printing Co.	San Francisco, Calif.	246
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Portable Wireless Telephone Co.	Stockton, Calif.	360
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Los Angeles Examiner	Los Angeles, Calif.	360
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Electric Shop	Honolulu, Hawaii	270
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Westinghouse Electric & Mfg. Co.	Chicago, Ill.	535
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Preston D. Allen	Oakland, Calif.	360
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Valdemar Jensen	New Orleans, La.	278
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Tulane University	New Orleans, La.	265
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Ohio Mechanics Institute	Cincinnati, Ohio	248
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Chicago Daily Drivers Journal	Chicago, Ill.	288
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	I. B. Nelson Co.	Newark, N. J.	263
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	University of Missouri	Columbia, Mo.	254
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Omaha Grain Exchange	Omaha, Nebr.	288
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Lake Forest University	Lake Forest, Ill.	227
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Harrisburg Sporting Goods Co.	Harrisburg, Pa.	266
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Parker High School	Dayton, Ohio	283
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Lake Shore Tire Co.	Souderton, Ohio	240
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Bangor Railway & Electric Co.	Bangor, Me.	240
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Connecticut Agricultural College	Storrs, Conn.	283
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	O. A. Doherty Automotive and Radio Equipment Co.	Saginaw, Mich.	254
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Att Radio, Inc.	LaCrosse, Wis.	244
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Lake Avenue Baptist Church	Rochester, N. Y.	281
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Laverford College, Radio Club	Haverford, Pa.	263
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Scott High School, N. W. B. Foley	Toledo, Ohio	240
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Victor Talking Machine Co.	Camden, N. J.	226
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	College of Wooster	Wooster, Ohio	234
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Henry B. Joy	Mt. Clemens, Mich.	270
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	John Magaldi, Jr.	Philadelphia, Pa.	242
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Coliseum Place Baptist Church	New Orleans, La.	315
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	A. H. Grebe & Co.	Richmond Hill, N. Y.	263
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Purdue University	W. Lafayette, Ind.	283
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Clemson Agric. College	Clemson College, S. C.	331
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	The Dornton Co.	Minneapolis, Minn.	417
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Wireless Phone Co.	Faterson, N. J.	244
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	James M. Hill, University	Decorah, Ill.	261
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Yorham-Carter Publishing Co. (Star Telegram)	Fort Worth, Tex.	472
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Erner & Hopkins Co.	Columbus, Ohio	293
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	John H. Stecker, Jr.	Wilkes-Barre, Pa.	254
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Western Electric Co.	New York, N. Y.	492
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Barbey Battery Service	Reading, Pa.	234
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Irrving Vermilya	Mattapoisett, Mass.	248
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	J. Irving Bell	Port Huron, Mich.	246
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Grace Covenant Presbyterian Church	Richmond, Va.	283
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	E. Leslie Atlas	Chicago, Ill.	226
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Blake, A. B.	Wilmington, N. C.	275
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Petoskey High School	Petoskey, Mich.	246
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	First Baptist Church	Rossville, N. Y.	273
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Jeans Motor Sales Co.	New Orleans, La.	252
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Johnstown Radio Co.	Johnstown, Pa.	245
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Ruffner Junior High School	Norfolk, Va.	222
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Washington Light Infantry Co. "B" 118th Inf.	Charleston, S. C.	268
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Noble B. Watson	Indianapolis, Ind.	227
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Foster & McDonald	Chicago, Ill.	266
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Baxter Laundry Co.	Grand Rapids, Mich.	256
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Jones Elec. & Radio Mfg. Co.	Baltimore, Md.	254
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Pennsylvania State Police	Wilkes-Barre, Pa.	281
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Baltimore Radio Exchange	Butte, Pa.	236
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	D. W. May, Inc.	Newark, N. J.	260
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Southern Radio Corp.	Charlotte, N. C.	275
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Westinghouse E. & M. Co.	Springfield, Mass.	333
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	St. Lawrence University	Canton, N. Y.	240
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Kaufmann & Baer Co.	Pittsburgh, Pa.	461
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Clyde R. Randall	New Orleans, La.	286
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Entrekin Electric Co.	Columbus, Ohio	268
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KFCB	The First Congregational Church	Helena, Mont.	248	KGF	St. Olaf College	Northfield, Minn.	336
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Sanders & Stayman Co.	Baltimore, Md.	275
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Chesapeake & Potomac Telephone Co.	Washington, D. C.	468
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Alamo Radio Electric Co.	San Antonio, Tex.	283
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	W. H. Dunwoody Industrial Institute	Minneapolis, Minn.	260
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	State College of Mines	Rapid City, S. Dak.	240
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Durham & Co.	Philadelphia, Pa.	266
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	J. C. Dice Electric Co.	Little Rock, Ark.	263
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	University of Vermont	Burlington, Vt.	300
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	Carthage College	Carthage, Ill.	246
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Charles W. Heibachm	Allentown, Pa.	280
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KGF	University of Michigan	Ann Arbor, Mich.	280
KFCB	The First Congregational Church	Helena, Mont.	248	KGF	Wilbur G. Voliva	Zion, Ill.	344

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Beg Your Pardon!

Through an error last month, the cuts showing wiring of circuits contributed by Mr. Gerrill and Mr. Hultman, in our Pickups Section, were reversed. We are sorry this happened and trust that the fans have suffered no inconvenience.

EVERYTHING FOR THE RADIO HOOKUP FAN Will be found in the RADIO AGE ANNUAL for 1925. SEE PAGE 80 for complete details. Have you seen the 32-page BLUEPRINT SECTION In the NEW RADIO AGE ANNUAL?

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WCBG Howard S. Williams (Portable). Pascagoula, Miss. 268
WCBH University of Miss. Oxford, Miss. 242
WCBI Nicoll, Duncan & Rush. Bennis, Tennessee 240
WCBJ J. C. Maus. Jennings, Louisiana 244
WCBK E. Richard Hall. St. Petersburg, Fla. 266
WCBL Northern Radio Mfg. Co. Houlton, Me. 280
WCBM Charles Swars. Baltimore, Md. 229
WCBN James P. Boland. Ft. Benj. Harrison, Ind. 266
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WMOU Doolittle Radio Corp. New Haven, Conn. 268
WMOU North Dakota Agricultural College. Agricultural College, N. D. 283
WMOU Superior Radio & Telephone Equipment Co. Columbus, Ohio 286
WMOU Concordia College. Moorhead, Minn. 286
WMOU John R. Koch (Dr.). Charleston, W. Va. 273
WMOU The Municipality of Atlantic City. Atlantic City, N. J. 296
WMOU Horace A. Beale, Jr. Parkersburg, Pa. 270
WMOU E. B. Gish. Amarillo, Texas 234
WMOU Moore Radio News Station (Edmund B. Moore). Springfield, Vt. 275
WMOU Electrical Equipment Co. Miami, Fla. 283
WMOU Scranton Times. Scranton, Pa. 280
WMOU Calvary Baptist Church. New York, N. Y. 360
WMOU Abilene Daily Reporter (West Texas Radio Co.). Abilene, Texas 360
WMOU Prince-Walter Co. Lowell, Mass. 266
WMOU Calumet Rainbo Broadcasting Co. Chicago, Ill. 447
WMOU The Rice Institute. Houston, Tex. 256
WMOU The Radio Club (Inc.). Lupton, Ind. 224
WMOU Lombard College. Galesburg, Ill. 244
WMOU Black Hawk Electrical Co. Waterloo, Iowa 236
WMOU St. Louis Radio Service Co. St. Louis, Mo. 263
WMOU Antioch College. Yellow Springs, Ohio 242
WMOU Avenue Radio Shop (Horace D. Good). Reading, Pa. 238
WMOU Flaxon's Garage. Gloucester City, N. J. 268
WMOU Emanuel Lutheran Church. Valparaiso, Ind. 278
WMOU Radio Corp. of Am. Washington, D. C. 468
WMOU Reo Motor Car Co. Lansing, Mich. 286
WMOU Washington Radio Hospital Fund. Washington, D. C. 256
WMOU Doron Bros. Hamilton, Ohio 360
WMOU Union College. Schenectady, N. Y. 270
WMOU University of Illinois. Urbana, Ill. 273
WMOU Police and Fire Signal Department. Dallas, Tex. 261
WMOU Tarrytown Radio Res. Labs. Tarrytown, N. Y. 273
WMOU Southeast Missouri State Teachers College. Cape Girardeau, Mo. 275
WMOU Clemson Agricultural College. Clemson College, S. C. 326
WMOU J. A. Foster Co. Providence, R. I. 263
WMOU Lorenz Vandenberg Davis. St. Petersburg, Fla. 264
WMOU United States Playing Cards Co. Cincinnati, Ohio 325
WMOU Grove City College. Grove City, Pa. 258
WMOU Allentown Call Publishing Co. Allentown, Pa. 229
WMOU Seventh Day Adventist Church. New York, N. Y. 263
WMOU Doughty & Welch Electrical Co. Fall River, Mass. 254
WMOU Camp Marienfeld. Chesham, N. H. 229
WMOU C. W. Vick Radio Construction Co. Houston, Tex. 360
WMOU Irving Austin (Port Chester Chamber of Commerce). Port Chester, N. Y. 233
WMOU Chas. Electric Shop. Pomeroy, Ohio 258
WMOU Atlanta Journal. Atlanta, Ga. 428
WMOU J. and M. Elbert Co. Utes, N. Y. 243
WMOU School of Engineering. Milwaukee, Wis. 246
WMOU Hardem Sales and Service. Broadlands, Ill. 233
WMOU State University of Iowa. Iowa City, Iowa 498
WMOU Fall River Daily Herald Publishing Co. Fall River, Mass. 248
WMOU Penn Traffic Co. Joplin, Mo. 283
WMOU Louis J. Gallo. New Orleans, La. 242
WMOU Toledo Radio & Electric Co. Toledo, Ohio 252
WMOU Willard Storage Battery Co. Cleveland, Ohio 389
WMOU Cambridge Radio & Electric Co. Cambridge, Ill. 242
WMOU S. H. Van Gordon & Son. Osseo, Wis. 220
WMOU Reliance Electric Co. Norfolk, Va. 280
WMOU Charles E. Erbstein. Detroit, Mich. 303
WMOU Edison Electric Illuminating Co. Boston, Mass. (Portable) 244
WMOU Ruetz Battery & Electric Co. Tecumseh, Neb. 242
WMOU Agricultural & Mechanical College of Texas. College Station, Tex. 280
WMOU Williams Hardware Co. Streator, Ill. 231
WMOU Oak Leaves Broadcasting Station. Oak Park, Ill. 283
WMOU Thomas J. McGuire. Lambertville, N. J. 283
WMOU Kansas State Agricultural College. Manhattan, Kans. 273
WMOU Travelers Insurance Co. Hartford, Conn. 323
WMOU H. G. Saal Co. Chicago, Ill. 268
WMOU Wright & Wright (Inc.). Philadelphia, Pa. 360
WMOU The Alamo Ball Room. Joliet, Ill. 242
WMOU Ford Motor. Detroit, Mich. 273
WMOU Detroit News (Evening News Assn.). Dearborn, Mich. 352
WMOU Loyola University. New Orleans, La. 260
WMOU Michigan College of Mines. Houghton, Mich. 244

Getting Through the "Locals"

(Continued from page 65)

without posts, and if the strip is already labelled, connections may be more easily made. Bus bar is suitable for wiring, although a much easier and just as effective job may be done with "fixture" wire, obtainable at electrical supply houses. This is about No. 16 in size, well covered with rubber and cloth insulation. Leads with this wire may be run direct, without unnecessary length due to right angle bends and the like.

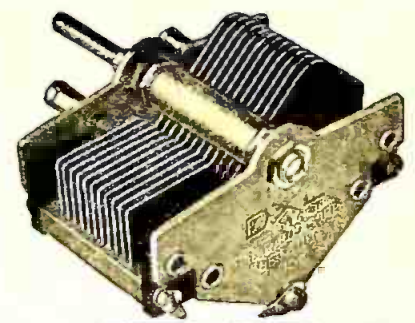
Connections

ALTHOUGH the audio portion of the receiver is wired in the customary manner, the leads to the penetrator switch may be somewhat confusing. The antenna is joined to one of the long springs of the switch and the return from the radio frequency tickler coil connected to the other long spring. There are two shorter springs for each of the two long springs, either of which may be brought into contact with the long spring according to the position of the control knob or handle. In one case, the entire primary coil of six turns is in use, while in the other, only two turns are employed. It is important to get the 2-2 combination and the 6-6 combination working in unison, for it is easy

enough to reverse them and have two turns in one primary when the other is connected for six. It will be noticed that the tickler coil is not in the plate circuit of the first R. F. tube, even though it is the first R. F. tube that is tuned by the R. F. condenser and coupler. The tickler feed-back is made from the plate of the second R. F. tube, whose grid is fed by the iron-core transformer. Thus advantage is taken of the amplifying effect of both tubes upon the regeneration available.

With regard to the R. F. transformer chosen, the type mentioned is used on account of its high natural wavelength "peak." Most R. F. transformers have a lower "peak" wavelength and as such are not as satisfactory because of the greater readiness with which the two R. F. tubes get into oscillation upon each other. However, other R. F. transformers will answer if their secondary windings are shunted by a small variable condenser (inside the set) of about .00025 mfd. and adjustment made for the best fixed point, or if a potentiometer is bridged across the A battery wires and the grid return from the transformer (F—) made to its movable arm.

Have you ever heard of the "Hoot Owls"? They compose one of the most interesting radio clubs in the world. An unusual account of their origin and present activities will be a feature of the all-star April RADIO AGE.



TRADE **DXL** MARK

Straight Line Low Loss Condensers

Increased distance and volume, better still, much greater Selectivity are certain results with DXL Straight Line Low Loss Variable Condensers. No DXL Condenser leaves the factory that doesn't meet the quality tests outlined by DXL engineers. Set builders can use DXL Condensers right out of the carton with the certainty that each one is perfect. Use DXL Condensers and you are sure of the best performance.

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Now ready—the DXL 5 Tube Tuned R. F. Receiver Kit absolutely Straight Line and Low Loss. Will separate two stations only 6 meters apart, broadcasting simultaneously. No squeals, non-oscillating, coast to coast reception on loud speaker. Less static interference. Positive results guaranteed if built in accordance with detailed instructions and blue print, free with every DXL Kit.

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DXL RADIO CORPORATION
5765 Stanton Ave. Detroit, Michigan

Radio Age Institute

Manufacturers' Testing Service

MEMBERS of the staff of RADIO AGE will be pleased to test devices and materials for radio manufacturers with the object of determining their efficiency and worth. All apparatus which meets with the approval of various tests imposed by members of the technical staff of RADIO AGE will be awarded our endorsement, and the seal shown to the left will be furnished free of charge. Materials for testings should be sent to

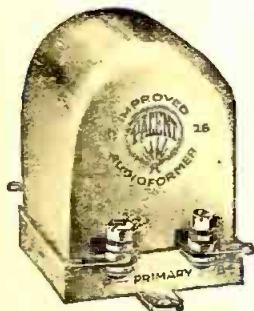
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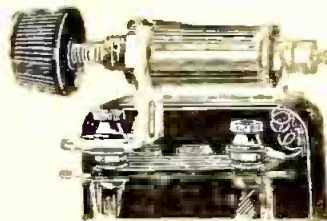
DEVICES

displaying this seal have been tested and approved by the RADIO AGE INSTITUTE.

The apparatus illustrated and described below have successfully passed our tests for March 1925.



Test No. 34. **THE PATENT IMPROVED AUDIOFORMER.** The patent audio frequency transformer, especially designed for broadcasting frequencies. It is exceptionally well designed and has a very good curve which covers the range of audio frequencies commonly in use at broadcasting stations. The transformer is quite large in size and is very efficiently shielded, giving maximum amplification with a minimum of distortion. Manufactured by the Patent Electric Co., 23 Park Place, New York City, N. Y. Tested and approved by RADIO AGE Institute.



Test No. 35. **THE ELECTRAD "AUDIOHM."** A device manufactured by the Electrad Co., 428 Broadway, New York City, N. Y. Controls tone, quality and volume; can also be used for resistance coupled amplifiers. It has a resistance ranging from 10,000 to 120,000 ohms, and works very well when placed across the secondary of the last audio frequency transformer. Distortion was practically eliminated by the use of this instrument. The device is very well made and arrived in excellent condition. Tested and approved by RADIO AGE Institute.



Test No. 36. **"CELERON"** submitted by the Diamond State Fiber Co., Philadelphia, Pa. Several samples of the above material were received last month. Their composition known as "Vulcaewood" was first tested and found to be very satisfactory. "Vulcaewood" is primarily intended to be used as a material for cabinet construction. It is furnished by the above company either in the regular manner (cut to size) or in packages containing complete parts for a standard-size cabinet, metal end plates, etc. It was found to be very satisfactory, has high insulation qualities and is not affected by heat or dampness. The lustre was found to be of a lasting quality and it is practically impossible to warp "Vulcaewood," which passed successfully the tests and requirements of RADIO AGE Institute.



Test No. 37. The A. H. Miller Radio Co., 1259 W. Grand Blvd., Detroit, Michigan, submitted one of their "Battery Crystals." After a very thorough test, we do not hesitate in placing our approval on this crystal detector. It has proven itself to be a very valuable asset in reflex circuits, and worked much better than the ordinary crystal in all circuits in which it was tried. No tests were made to determine its life. But from indications it should last much longer than the ordinary. Tested and approved by RADIO AGE Institute.

Canadian Stations

CFAC	Calgary Herald	Calgary, Alberta	430	CHXC	J. R. Booth	Ottawa, Ont.	435
CFCA	Star Pub. & Prtg. Co.	Toronto, Ontario	400	CHYC	Northern Electric Co.	Montreal, Quebec	410
CFCH	Marconi Wireless Teleg. Co. of Canada	Montreal, Quebec	440	CJCB	Jarvis Baptist Church	Toronto, Ont.	312
CFCH	Abitibi Power & Paper Co.	Iroquois Falls, Ont.	400	CJCC	Edmonton Journal	Edmonton, Alberta	455
CFCL	La Cio de L'Evenement	Quebec, Quebec	410	CJCD	London Free Press Ptg. Co.	London, Ont.	430
CFCK	Radio Supply Co.	Edmonton, Alberta	410	CJCE	T. Eaton Co.	Toronto, Ont.	410
CFCN	W. W. Grant Radio (Ltd.)	Calgary, Alberta	440	CJCF	Sprott-Shaw Radio Co.	Vancouver, B. C.	420
CFCO	Radio Specialties (Ltd.)	Vancouver, B. C.	450	CJCF	The News Record	Kitcbener, Ont.	295
CFCT	Laurentide Air Service	Sudbury, Ont.	410	CJCI	Maritime Radio Corp.	St. John, New Brunswick	400
CFCT	Victoria City Temple	Victoria, British Col.	410	CJCK	Radio Corp. of Calgary	Calgary, Alta.	316
CFCU	The Jack Elliott Radio Limited	Hamilton, Ont.	410	CJCM	J. L. Philippe	Monti Joli, Quebec	430
CFCW	The Radio Shop	London, Ont.	420	CJCN	Simons Agnew & Co.	Toronto, Ont.	410
CFDC	Sparks Co.	Nanaimo, B. C.	430	CJSC	Evening Telegram	Toronto, Ont.	430
CFHC	Henry Birks & Sons	Calgary, Alta.	440	CKAC	La Presse Pub. Co.	Montreal, Quebec	430
CFLC	Cbas. Guy Hunter	551 Adelaide St., London, Ont.	410	CKCD	Vancouver Daily Province	Vancouver, B. C.	410
CFQC	The Electric Shop (Ltd.)	Saskatoon, Saskatchewan	400	CKCE	Canadian Independ. Telephone Co.	Toronto, Ont.	450
CFRC	Queen's University	Kingston, Ontario	450	CKCK	Leader Pub. Co.	Regina, Saskatchewan	420
CFUC	University of Montreal	Montreal, Quebec	400	CKCO	Ottawa Radio Association	Ottawa, Ont.	440
CFXC	Westminster Trust Co.	New Westminster, B. C.	440	CKCX	P. Burns & Co.	Calgary, Alberta	440
CFYC	Victor Wentworth Odium	Vancouver, B. C.	400	CKLC	Wilkinson Electric Company	Calgary, Alberta	400
CHAC	Radio Engineers	Halifax, Nova Scotia	400	CKOC	Wentworth Radio Supply Co.	Hamilton, Ont.	410
CHBC	Albertan Publishing Co.	Calgary, Alberta	410	CKY	Manitoba Telephone System	Winnipeg, Manitoba	450
CHCB	Marconi Company	Toronto, Ont.	410	CNRC	Canadian National Railways	Calgary, Canada	440
CHCD	Canadian Wireless & Elec. Co.	Quebec, Quebec	410	CNRE	Canadian National Railways	Edmonton, Alta.	455
CHCE	Western Canada Radio Sup. (Ltd.)	Victoria, B. C.	400	CNRM	Canadian National Railways	Montreal, P. Q.	340
CHCL	Vancouver Merchants Exchange	Vancouver, B. C.	440	CNRO	Canadian National Railways	Ottawa, Ont.	430
CHCM	Riley & McCormack	Calgary, Alberta	415	CNRR	Canadian National Railways	Regina, Sask.	400
CHCS	The Hamilton Spectator	Hamilton, Ont.	420	CNRS	Canadian National Railways	Saskatoon, Sask.	412
CHNC	Toronto Radio Research	Toronto, Ont.	350	CNRT	Canadian National Railways	Toronto, Ont.	400
				CNRW	Canadian National Railways	Winnipeg, Man.	450

Cuban Stations

PWX	Cuban Telephone Co.	Habana	400	2K	Alvara Daza	Habana	200
2DW	Pedro Zayas	Habana	300	2HS	Julio Power	Habana	180
2AB	Alberto S. de Bustamante	Habana	240	2OL	Oscar Collado	Habana	290
2OK	Mario Garcia Velez	Habana	260	2WW	Amadeo Saenz	Habana	210
2BY	Frederick W. Borton	Habana	260	5EY	Leopoldo V. Figueroa	Colon	360
2CX	Frederick W. Borton	Habana	320	6KW	Frank H. Jones	Tuinucu	340
2EV	Westinghouse Elec. Co.	Habana	220	6KJ	Frank H. Jones	Tuinucu	275
2TW	Roberto E. Ramires	Habana	230	6CX	Antonio T. Figueroa	Cienfuegos	170
2HC	Heraldo de Cuba	Habana	275	6DW	Eduardo Terry	Cienfuegos	225
2LC	Luis Casas	Habana	250	6BY	Jose Ganduxe	Cienfuegos	300
2KD	E. Sanchez de Fuentes	Habana	350	6AZ	Valentin Olivarrri	Cienfuegos	200
2MN	Fausto Simon	Habana	270	8BY	Alberto Ravelo	Stgo. de Cuba	250
2MG	Manuel G. Salas	Habana	280	8FU	Andres Vinnel	Stgo. de Cuba	225
2JD	Raul Perez Falcon	Habana	150	8DW	Pedro C. Anduz	Stgo. de Cuba	275

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2 Aerial protectors	58 Couplers, molded	115 Inductances, C. W.	169 Phone connectors, multi-	222 Solder solution
3 Aerial insulators	59 Couplers, vario	116 Insulation, molded	170 Phonograph adapters	223 Spaghetti tubing
4 Aerials	60 Crystal alloy	117 Insulation material	171 Plates, condenser	224 Spark coils
5 Aerials, loop	61 Crystal holders	118 Insulators, aerial	172 Plugs, coil	225 Spark gaps
6 Amplifier	62 Crystals, rough	119 Insulators, composition	173 Plugs, telephone	226 Stampings
7 Amplifying units	63 Crystals, mineral	120 Insulators, fibre	174 Pointers, dial and knob	227 Stators
8 Ammeters	64 Crystals, synthetic	121 Insulators, high voltage	175 Poles, aerial	228 Stop points
9 "B" batteries	65 Crystals, unmounted	122 Insulators, cloth	176 Potentiometers	229 Switch arms
10 Batteries (state voltage)	66 Crystals, mounted	123 Insulators, glass	177 Punching machines	230 Switch levers
11 Batteries, dry cell	67 Desks, radio	124 Insulators, hard rubber	178 Reinartz set parts	231 Switch points
12 Batteries, storage	68 Detector units	125 Insulators, porcelain	179 Regenerative set parts	232 Switch stops
13 Battery chargers	69 Detectors, crystal	126 Irons, soldering	180 Receiver caps	233 Switches, aerial
14 Battery clips	70 Detectors, fixed crystal	127 Jacks	181 Rectifiers, battery	234 Switches, battery
15 Battery plates	71 Dial, adjusters	128 Filament control	182 Resistance leaks	235 Switches, filament
16 Battery substitutes	72 Dials, composition	129 Jars, battery	183 Resistance units	236 Switches, ground
17 Bezels	73 Dials, hard rubber	130 Keys, transmitting	184 Rheostat bases	237 Switches, inductance
18 Binding posts	74 Dials, rheostat	131 Knobs	185 Rheostat strips	238 Switches, panel
19 Bindings posts, insulated	75 Dials, metal	132 Knock-down panel units	186 Rheostats, automatic	239 Switches, single and double throw
20 Books	76 Dials, vernier	133 Laboratories, testing	187 Rheostats, battery	240 Tone wheels
21 Boxes, battery	77 Dials with knobs	134 Lever, switch	188 Rheostats, dial	241 Towers, aerial
22 Boxes, grounding	78 Dies	135 Lightning arresters	189 Rheostats, filament	242 Transformers, audio frequency
23 Bridges, wheatston-	79 Drills, electric	136 Loosecouplers	190 Rheostats, potentiometer	243 Transformers, filament
24 Broadcasting equipment	80 Dry cells	137 Loud speakers	191 Rheostats, power	244 Transformers, modulation
25 Bushings	81 Earth grounds	138 Loud speaker units	192 Rheostats, vernier	245 Transformers, power
26 Buzzers	82 Electrolyte	139 Lugs, battery	193 Rods, ground	246 Transformers, push-pull
27 Cabinets	83 Enamels, battery	140 Lugs, terminal	194 Rotors	247 Transformers, radio frequency
28 Cabinets, battery	84 Enamels, metal	141 Measuring instruments	195 Scrapers, wire	248 Transformers, variable
29 Cabinets, loud speaker	85 End stops	142 Megohmmeters	196 Screw drivers	249 Transmitters
30 Carbons, battery	86 Eyelets	143 Meters, A. C.	197 Screws	250 Tubes, vacuum—peanut
31 Cat whiskers	87 Experimental work	144 Meters, D. C.	198 Schools, radio	251 Tubes, vacuum—two element
32 Code practisers	88 Fibre sheet, vulcanized	145 Mica	199 Sets, receiving—cabinet	252 Tubes, vacuum—three element
33 Coils	89 Filter reactors	146 Mica sheets	200 Sets, receiving—crystal	253 Tuners
34 Coils, choke	90 Fixtures	147 Milliammeters	201 Sets, receiving—knock-down	254 Variocouplers, hard rubber
35 Coils, coupling	91 Fuse cut outs	148 Minerals	202 Sets, receiving—Neutrodyne	255 Variocouplers, molded
36 Coils, filter	92 Fuses, tube	149 Molded insulation	203 Sets, receiving—portable	256 Variocouplers, wooden
37 Coils, grid	93 Generators, high frequency	150 Molybdenum	204 Sets, receiving—radio frequency	257 Variometers, hard rubber
38 Coils, honeycomb	94 Grid choppers, rotary	151 Mountings, coil	205 Sets, receiving—reflex	258 Variometers, molded
39 Coils, inductance	95 Grid leak holders	152 Mountings, condenser leak	206 Sets, receiving—regenerative	259 Variometers, wooden
40 Coils, Reinartz	96 Grid, transmitting leaks	153 Mountings, end	207 Sets, receiving—Reinartz	260 Varnish, insulating
41 Coils, stabilizer	97 Grid leaks, tube	154 Mountings, grid leak	208 Sets, receiving—sectional	261 Voltmeters
42 Coils, tuning	98 Grid leaks, variable	155 Mountings, honeycomb coil	209 Sets, receiving—super-regenerative	262 Washers
43 Condenser parts	99 Grinders, electric	156 Mountings, inductance switch	210 Sets, receiving—transmitting	263 Wave meters
44 Condenser plates	100 Ground clamps	157 Name plates	211 Sets, transmitting	264 Wax traps
45 Condensers, antenna coupling	101 Ground rods	158 Neutrodyne set parts	212 Slate	265 Wire, aerial
46 Condensers, by-pass	102 Handles, switch	159 Nuts	213 Shellae	266 Wire, braided and stranded
47 Condensers, coupling	103 Head bands	160 Ohmmeters	214 Sliders	267 Wire, copper
48 Condensers, filter	104 Head phones	161 Oscillators	215 Socket adapters	268 Wire, insulated
49 Condensers, fixed (paper, grid, or phone)	105 Head sets	162 Panel cutting and drilling	216 Sockets	269 Wire, Litz
50 Condensers, variable grid	106 Honeycomb coil adapters	163 Panels, drilled and undrilled	217 Solder	270 Wire, magnet
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52 Condensers, vernier	108 Horns, composition	165 Panels, hard rubber	219 Soldering paste	272 Wire, tungsten
53 Contact points	109 Horns, fibre	166 Parts	220 Solder flux	
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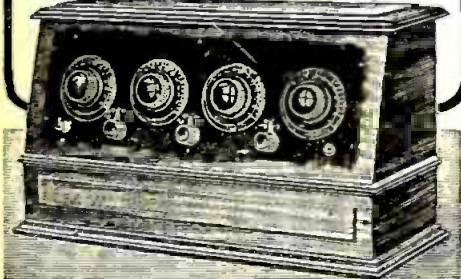
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Ready For The WLS—
RADIO AGE Party?

"ALL-ABOARD—for the WLS airplane ride into Harmony Land—with Ford and Glenn and the RADIO AGE broadcast artists!"

The foregoing is probably what George Hay, announcer of WLS and one of the most popular radio announcers in the country, will say when he opens WLS' RADIO AGE program at 7 o'clock, Friday, March 6.

Ford and Glenn (known in public as Ford Rughand Glenn Rowell), the original "How Do You Do Boys," will start the harmony moving with their inimitable "Lullaby Time" melodies. About 7:15 the RADIO AGE artists will take charge, and, lulled by "The Solemn Old Judge's" crooning voice, a galaxy of popular and old-time favorites will be presented, the program lasting until 8 o'clock on the dot.

Among the stars expected to appear for RADIO AGE will be The Belwyn Four-RADIO AGE Quartet; Grace Wilson, contralto, who is well known to WLS fans; Arthur W. Hickman, exclusive RADIO AGE artist whose rich baritone voice has been declared perfect for radio broadcasting; and the RADIO AGE Music Masters, a group of talented musicians who will acknowledge requests for well-known selections.

This will be the second time RADIO AGE has broadcast from WLS, the Sears-Roebuck Station on the Hotel Sherman, Chicago, and many fans will be pleased to hear that our artists will be heard again from this popular station.

So tune in on 345 meters, folks, on Friday night, March 6, from 7 to 8 o'clock, and let that expert aviator, Ford Rush, guide you into clouds of musical ecstasy!

Pfanstiehl Offices In Chicago

The Pfanstiehl Radio Co. announces the opening of offices at 11 South La-Salle St., Chicago. The office will be in direct charge of Edmund H. Eitel, Vice President, who has been with the Pfanstiehl organization from its beginning.

Mr. Alex Poole, formerly with the Kennedy Co. has been appointed District Sales Manager with an office at this address. Mr. Poole has been in radio from its beginning and has a wide experience in radio merchandising. Mr. Poole will make his headquarters in Chicago, and his organization will keep in contact with Pfanstiehl jobbers and dealers in the five adjacent states.

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The "SELF ADJUSTING" Rheostat

Write for
\$1.10 FREE
EVERYWHERE Hookup

No rheostat knobs on panels to turn—no meters needed—no tube worry. One amperite, used in series with each tube, inside the set, automatically supplies just the right current for each individual tube's greatest efficiency. Works on thermo-electric principle. Simplifies wiring. Reduces set cost. Proved in use. Adopted by more than 50 set manufacturers. No set is up-to-the-minute in design without it.

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Lasts Indefinitely—Pays for Itself

Economy and performance unheard of before. Recharged at a negligible cost. Approved and listed as Standard by leading Radio Authorities, including Pop. Radio Laboratories, Pop. Sci. Inst. Standards, Radio News Lab., Lefax, Inc. and other important institutions. Equipped with Solid Rubber Case, an insurance against acid and leakage. Extra heavy glass jars. Heavy rugged plates. Order yours today!

SEND NO MONEY Just state number of batteries wanted and we will ship day order is received. **Extra Offer:** 4 batteries in series (96 volts), \$15. Pay expressman after examining batteries. 5 per cent discount for cash with order. Mail your order now!

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1219 So. Wabash Ave., Dept. 81, Chicago, Ill.
Makers of the Famous World Radio "A" Storage Battery
Prices: 6-volt, 100 Amp. \$12.50; 120 Amp. \$14.50; 140 Amp. \$16.00.
All equipped with Solid Rubber Base.

World FOR STORAGE BATTERIES RADIO

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I	S	L	E	A	T	A	B	A	N	A		
D	I	A	E	S	A	T	E	V	A	L	E	N
O												
F	O	W	E	E	N	S	T	A	R	A		
I	N	E	M	P	T	T	E	L	E	A	N	
E	A	T	E	S	B	M	E	N	E	S	R	
L	C	G	O	D	S	A	R	D	E	D		
O	P	A	T	C	A	P	A	I	R	E		
B	E	R	S	U	P	E	R	P	A			
A	L	T	M	A	P	R	U	N	D	U	N	
M	O	D	D	G	E	S	C	O	D	E		
P	O	W	E	S	T	U	R	A	D	T	G	
S	P	S	T	B	R	A	S	S	M	O	O	N

Did You Solve the Cross-Word Puzzle?

At the left is the correct solution of the cross-word puzzle published in last month's RADIO AGE for the cross-word fans. Most of the terms concerned radio, and quite a few of the fans sent in the correct solutions, although a few were baffled by the abbreviations.

The names of the first winners will be published in April RADIO AGE, along with another puzzle for the "advanced" radio cross-word students. If you haven't yet tackled these radio brain-ticklers, get your February RADIO AGE and try your luck. Send your completed puzzle to the Puzzle Editor care Radio Age.

The Best Radio Hookups are in RADIO AGE ANNUAL for 1925

*A Thirty-Two Page Blueprint Section
is Only One of its Many Features!*

AMERICA'S radio fans have been quick to respond to the announcement that the RADIO AGE ANNUAL for 1925 is now on sale! Thousands have already been sold, and universal appreciation is being voiced for this biggest and best radio hookup book ever placed on the market! Your radio library is incomplete without this comprehensive RADIO AGE ANNUAL for 1925.

THE ANNUAL for 1925 is the result of three years of constant research work and experiments by the staff members and writers of RADIO AGE. It is the cream of the radio hookups that have made their appearance since the birth of radio and have won lasting favor with America's millions of radio enthusiasts.

One hundred and twenty pages of new hookups, construction articles, and kindred subjects in the radio field compose the unusual contents of the RADIO AGE ANNUAL for 1925. No other book has ever been printed approaching its excellence. No other book can be found that will give you such a variety of hookups and "How to build" articles.

THE predominating feature of the RADIO AGE ANNUAL for 1925 is the big, thirty-two page blueprint section, consisting of sixteen full pages of blueprints of favorite hookups, from single tube outfits to efficient neutrodynes, reflexes and super-heterodynes. The kind of blueprints that made the RADIO AGE monthly section the talk of the radio world. Use them as *actual working drawings*. Every one of the hookups in the blueprint section and in the rest of the *Annual* has been thoroughly tested by experts in our radio laboratory.

Complete instructions for building every kind of hookup—from crystal to super-het, are found in the ANNUAL. The biggest dollar's worth ever offered for home experimenters as well as experts. The blueprint section alone is worth many times the cost of the book.

THOUSANDS of Annuals sold last year on a money-back guarantee. **AND NOT ONE CAME BACK!**

Our first press run is but 25,000 copies. First names on the list will get first delivery. Pin a dollar bill to the coupon below if you want your ANNUAL NOW!

**\$1.00 a
Copy**

**RADIO AGE ANNUAL
FOR 1925**

**\$1.00 a
Copy**

*Some of the Features You'll Find
In This Wonder Hookup Book*

How to read and understand hookups.
How to understand radio phenomena.
Building your first simple set.
How to select the right receiver.
Substituting a tube for a crystal—building the first tube set.
How to amplify any kind of set.
Making a reflex set.
Building your first Reinartz set.
The renowned Baby Heterodyne No. 1.
Adding audio and radio stages to the Baby Het.
How to make a battery charger.
How to make a loud speaker.
RADIO AGE ANNUAL BLUEPRINT SECTION with such popular hookups as the aperiodic variometer, loop sets, feed-

back receivers, neutrodynes, reflex hookups, Baby Het No. 2, a Wonder Super-Het, and others.
How to get rid of interference.
How to make an amplifying unit.
How to recognize and deal with every kind of tube trouble.
Another super-heterodyne for the super experimenters.
Hints on tracing troubles in super-heterodyne circuits.
A three-tube long distance regenerator.
A 3-tube set that easily receives KGO on the loud speaker from Ohio.
Improving the ever popular Reinartz.
AND MANY OTHER UP-TO-THE-MINUTE HOOKUPS AND ARTICLES.

ORDER YOURS NOW!

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RADIO AGE, INC.,
500 North Dearborn St., Chicago, Ill.

Gentlemen: I want to be one of the first to get the RADIO AGE ANNUAL FOR 1925. Enclosed find \$1.00. If I am not satisfied with the ANNUAL I will return it within five days and you will refund my dollar.

Name.....

Address.....

City..... State.....

3-25

Not Merely a Clear Receiver, but a Fine Musical Instrument



*Brings out the
Overtones—
the Rich Timbre
of both Music and
the Human Voice*

Radio is becoming as much of a household convenience as the telephone. It should be just as dependable and true. Quality of tone is the supreme test. Distance can always be obtained by sufficient amplification. The problem is to secure distance without distorting or blurring the tone.

For years radioengineers have realized this. While the public was going wild over reaching out for distance, they were quietly exhausting every resource in experimentation to overcome the internal noises which increased with every new stage of amplification. The same steps which amplified the tone also amplified the stray oscillations within the set itself, as a by-product.

Nobody knew how to prevent them. Various means were employed to choke them or neutralize them. Potentiometers, extra condensers, complicated wiring were employed with only partial success. They work only when perfectly adjusted, and their operation interferes with a perfectly pure, free, flexible tone. By absorbing the true signal as well as the stray energy, they lose or blur those delicate overtones which make real music. They cannot prevent the conflict which occurs in the circuit between the forward stream of radio energy and the feedback of stray energy, blotting out the overtones.

The real trouble was this: No structurally correct long-distance radio system had been designed. All de-

signs up to date generated feedback of stray energy which chattered, howled and squealed unless choked down or neutralized; and radio reception, while accomplishing wonders, was still a makeshift.

A New Capability in Radio: Overtones Perfectly Reproduced

Pfanstiehl's big contribution to radio lies in his discovery of the real causes of oscillations and his complete elimination of them by a circuit system which **KEEPS THEM OUT**. No choking or neutralizing elements are any longer needed. No adjusting is required. The receiver is always at its best. Tuning and operation are absolutely quiet. The tone or voice comes in sweetly, in all of its natural richness. All of the overtones are perfectly reproduced, exactly as transmitted. This is true of long distance. High amplification doesn't distort. His invention has turned radio from a stunt device, for fans to play with, to a dependable, enjoyable and trouble-proof instrument in the home—the thing it should be and was destined to become.

See the new Pfanstiehl at your radio or music dealer's. If he does not have one to show you, we can quickly get it to him.

Dealers: Write for the Pfanstiehl proposition.

PFANSTIEHL RADIO COMPANY

Highland Park

22 Second Street

Illinois

Pfanstiehl

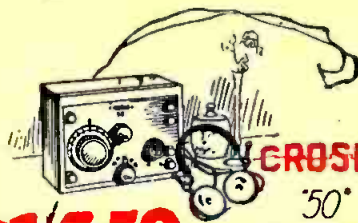
OVERTONE RECEIVER

A 5-tube Receiver using the new system of tuned radio frequency

* Tested and Approved by RADIO AGE *

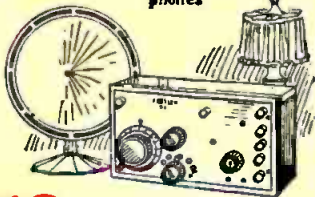
CROSLEY AGAIN LOWERS PRICES

Big Reduction in Famous Trirdyn and other Radios



\$14.50

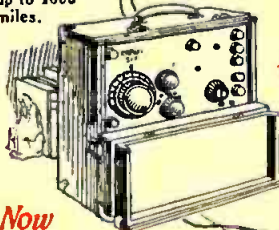
CROSLEY
"50"
A one-tube radio that easily brings in distance with phones



\$18.50

CROSLEY
"51"

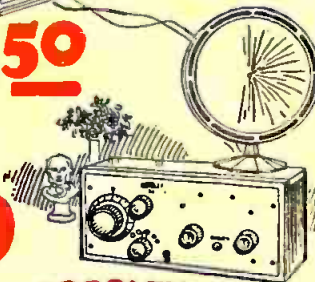
A two-tube set that gives loud speaker reception under fair conditions up to 1000 miles.



CROSLEY
"51" Portable

The two-tube utility radio. Let your dealer hook it up in his store.

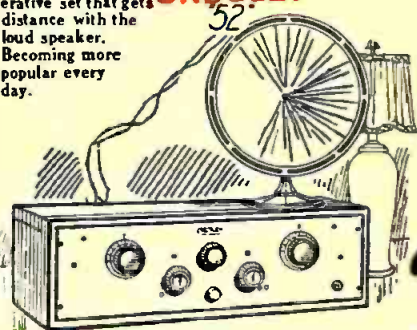
Now **\$23.50**



CROSLEY
"51" Special

A three-tube regenerative set that gets distance with the loud speaker. Becoming more popular every day.

\$30



CROSLEY
"52"

The biggest selling high grade receiver on the market—the Crosley Trirdyn—reduced from \$65 to \$50.

The Trirdyn Special—the beautiful Model with cabinet to house batteries—formerly \$75, now \$60.

The Crosley 51-P, a tremendous seller at \$25, reduced to \$23.50.

We unhesitatingly state that these sets, together with the other Crosley Radios, represent the biggest values ever offered.

CROSLEY RADIOS JUSTLY POPULAR

Only the less expensive Crosley Radios have exceeded the Trirdyn in sales. This deserved popularity of the entire Crosley line is the result of extraordinary performance at a very low price.

Crosley Radios cost less originally, use fewer tubes and consume much less battery current. At the same time they give results not equalled by receivers costing a great deal more and using two or three additional tubes.

The unique Trirdyn circuit—a combination of Armstrong Regeneration, Radio Frequency Amplification and Reflexed Audio Amplification—has proven beyond a doubt that the features of selectivity, volume and ease of operation can be obtained with three tubes better than heretofore has been possible with five or even six.

Hundreds of voluntary letters have come to us, telling of the unparalleled foreign reception during international test week with Trirdyns and all other Crosley Radios; even the little one-tube Crosley 50 at only \$14.50.

It is this continued remarkable performance that has created such a tremendous demand for Crosley Radios. And it is this great popularity that now allows us to decrease our production costs and pass this large saving along to you.

NEW CROSLEY MODELS

In order to allow even a greater selection, three new Crosley Radios have been added to our extensive line. Taking its place with the well known Crosley 50 and Crosley 50-P is the leatherette covered, one-tube 50 Portable, a utility set in which the dealer can quickly make the necessary connections and allow you to carry it home complete.

The New Crosley 51 Special, a two-tube receiver similar to the Model 51, is housed in a cabinet large enough to hold the necessary batteries and has a sloping panel.

Similar to the Crosley 52, but with sloping panel and cabinet to house the batteries is the new Crosley 52 Special.

These additional receivers make the Crosley line absolutely complete—a radio for all tastes and every pocket-book. See illustrations for prices.

No matter what appeals to you most in a radio, you will find that point outstanding in a Crosley.

Most good dealers handle Crosley Radios. You Will Make No Mistake in Buying One.

All Crosley Receivers contain the famous Armstrong Regenerative circuit, and are licensed under the Armstrong U.S. Patent, No. 1,113,149. As is customary, prices shown do not include tubes, phones, loud speakers or batteries.

Prices West of Rockies, add 10%.

From a small beginning three and a half years ago, Crosley Radio has grown until it now produces more sets than any other concern in the world. The present production—nearly 5000 per day—is probably from two to three times as great as that of any other radio manufacturer.

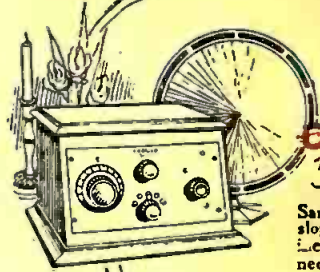
Crosley owns and operates the new super power WLW Broadcasting Station located at Harrison, Ohio, remotely controlled from studios in one of three large Crosley owned manufacturing plants in Cincinnati.



CROSLEY
"50P"

The new leatherette covered one-tube utility set. Will give the same results as the Crosley 50.

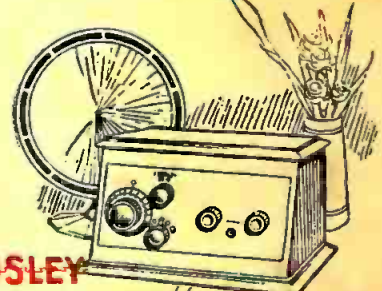
\$16



CROSLEY
"51" Special

Same as 51 in new sloping panelled cabinet which houses all necessary batteries.

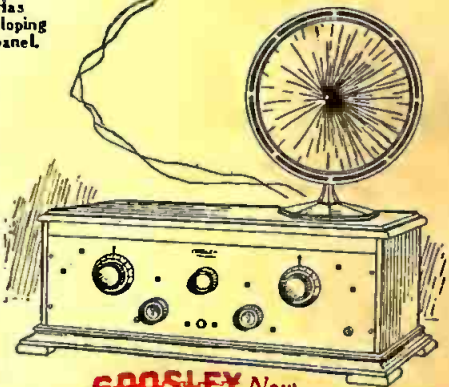
\$23.50



CROSLEY
"52" Special

The Crosley 52 in new cabinet to house batteries. Has sloping panel.

\$35



CROSLEY Now
"TRIRDYN" Special

Same as the Trirdyn in beautifully finished large cabinet to hold the batteries.

\$60

Now **\$50**

CROSLEY
"TRIRDYN"

The biggest selling high-grade radio on the market. Distant loud speaker reception under all conditions.

3 Tubes do the work of 5
In a **CROSLEY Trirdyn**

The loud speaker shown is the wonderful new Crosley loud speaker that is to be announced in the near future

Write for Complete Catalog

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363 Sassafras Street

Powel Crosley, Jr., President

Cincinnati, Ohio

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