

NEW ENGLAND

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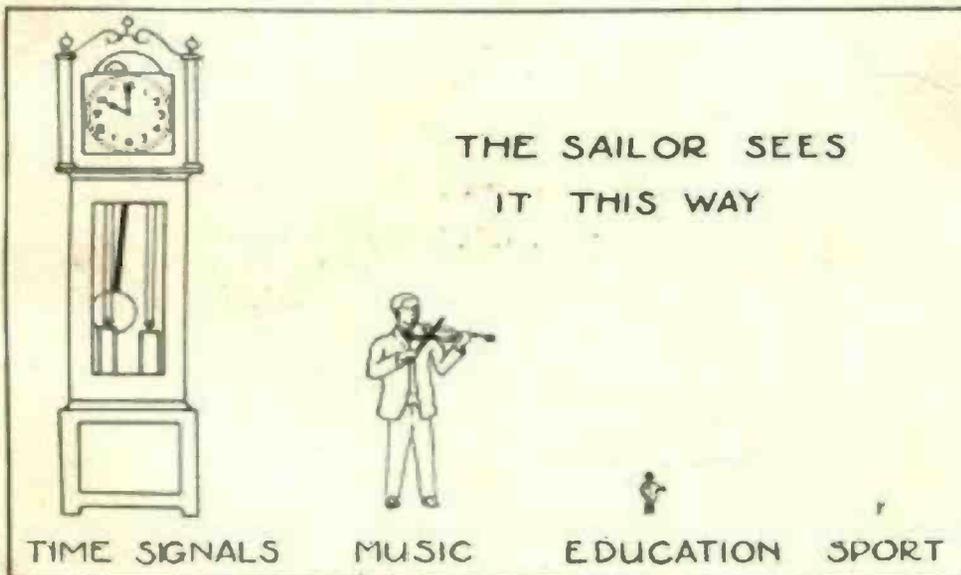
# RADIO PROGRESS

Acknowledged Authority  
and Guide for Radio Fans  
in New England

Established March, 1924

FEBRUARY 15, 1926

Published Twice a Month



HOW PEOPLE THINK ABOUT THE RADIO PROGRAMS

SEE PAGE 6

UNLIKE ANY OTHER RADIO MAGAZINE  
"YOU CAN READILY UNDERSTAND IT"

# NEW ENGLAND RADIO PROGRESS

HORACE V. S. TAYLOR, EDITOR

Volume 2, Number 23

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# New England Radio Progress

"ALWAYS ABREAST OF THE TIMES"

Vol. 2, No. 23

FEBRUARY 15, 1926

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## What's Doing in Congress

### *Here Are Two Bills Which May Become Laws*

By HORACE V. S. TAYLOR

WE ALL like bills if they are of the ten dollar variety. But a bill before Congress is another matter. Some may be much in favor of it, while others are bitterly opposed.

Among others before the present session in Washington are two which stand out particularly—the Dill bill and the one sponsored by White. As both these are much in the public eye at present it will be interesting to give the latest developments in regard to them.

#### Charge What They Can Get

The first of these which was introduced by Senator Dill has to do with the copyrighting of musical pieces in regard to their broadcasting. The National Association of Composers which now controls most of the popular music being sent out by radio has been asking license fees which the broadcasters think are exorbitant. Since the copyrights belong to this association and there is no provision of law regulating the matter, they naturally have the legal right to charge anything they can get for permission to use their music.

A copy of the bill which has been stripped of its legal wording is as follows: The copyright law of March, 1909, is amended to include the broadcasting by radio or other means of electrical transmission for profit of copyrighted musical works. However, this shall include only those compositions which are published and copyrighted after this amendment goes into effect. It shall not include the works of a foreign author or composer unless the foreign state or nation of which such author or composer is a citizen or subject grants, either by treaty, convention, agreement, or law, to citizens of the

United States similar rights.

#### If One, Then All May

The owner of a copyright is not required to grant permission to have his piece put on the air at all. But if he allows *anyone* to broadcast his music by that act he is required to allow every sending station the same privilege upon the payment to the proprietor of a royalty for each broadcasting. The amounts of the royalties are not stated in the bill, but are left blank to be filled in after conference. It is suggested that the figures for different sizes of station may run up so that the 5000-watt transmitters pay substantially more than the little fellow.

If he continues broadcasting of any musical work for a period of more than \_\_\_\_\_ (to be filled in) minutes it shall be considered additional act to be paid for in the same schedule. The number of times any piece has been broadcast must be reported under oath on the 20th day of each month and the royalties are due on the 20th day of the next month.

#### Then He Can't be Sued

If a copyright owner decides that he will not allow anyone to use his music in this way, he must file his determination with the copyright office accompanied by a small recording fee. If he does not give such a notification then a broadcaster who sends out his piece at any time and is willing to pay in accordance with the schedule, cannot be sued for infringement.

However, the broadcaster must keep up his end by sending a registered notice to the copyright holder informing him that he intends to use his music. If he

neglects to do this the court may fine him up to three times the amount due as damages for not performing his part of the contract. Then if the sending station does not pay its bills, 30 days after demand is made, the court may enter judgment for three times the entire amount due and require a bond before the station is allowed to go on the air again.

#### A Commission for Radio

The White bill has to do with the control of radio by the Department of Commerce. It is stated on good authority that the White Radio Bill will be reported out of Committee substantially in its original form. There probably will be a minority report opposing the placing of so much power in the hands of the Secretary of Commerce, or in an Advisory Committee, but the report will strongly advocate the establishing of a Communication Commission which will sit permanently in Washington for the purpose of handling radio and all other forms of communication.

The big question in Radio Legislation seems to be about what authorized person or body shall say who is to broadcast, and upon what wave bands and hours of operation. There are three logical suggestions, namely, 1, A Government official, such as the Secretary of Commerce; 2, A committee of outstanding citizens; 3, A permanently employed commission.

#### Attracting the Smart Men

Let us analyze these. Suggestion No. 1 has the disadvantage of placing unusual power in the hands of one person, but has the advantage of undivided authority, supported by data gathered

by an extensive Government organization. Suggestion No. 2 has the disadvantage of placing great responsibility upon citizens who may not be qualified, or whose interest would not be sufficient. If employed in an advisory capacity to the Secretary of Commerce, it has the advantage of softening any criticism which might arise from decisions by the Secretary of Commerce, or of moderating his decrees. Suggestion No. 3 has the drawback of establishing another Government commission, and would find objection in the minds of those legislators who are opposed to commissions in general. It has the advantage of requiring a number of minds to meet before rendering decisions, and if organized upon a permanent basis, would undoubtedly attract competent men who would give their whole time and attention to the problems which would be submitted to them.

Another point of importance is the attitude towards selling wave frequencies. It has happened several times recently that a big corporation which wanted to broadcast, finding itself without any chance of having a wave assigned to a new station, has found some small broadcaster who is willing to sell, usually at a high figure, the station and the wave which goes with it. Thus it is reported that Liberty Magazine recently bought two small transmitters at a price of a quarter of a million.

**Picking Up Every License**

This would be impossible under the provisions of this Bill. As Congressman White explains it, "The reason for that is perfectly apparent. If the holders of licenses could sell and transfer them without limitation, there would be absolutely nothing to prevent one or two or half a dozen concerns gathering up every outstanding license in the United States, and you would create the very monopoly of which you are afraid."

Some of the testimony given at one of the hearings on the White Bill is rather interesting, as it explains the policies of the Department of Commerce. Here is a conversation by Mr. W. D. Randall of Muscatine, Ia.

*Mr. Randall:* But, why, if we want to go to five thousand watts, can not we do so, with 1,170 kc. (256 meters)? I am just curious to know. Could you answer me?

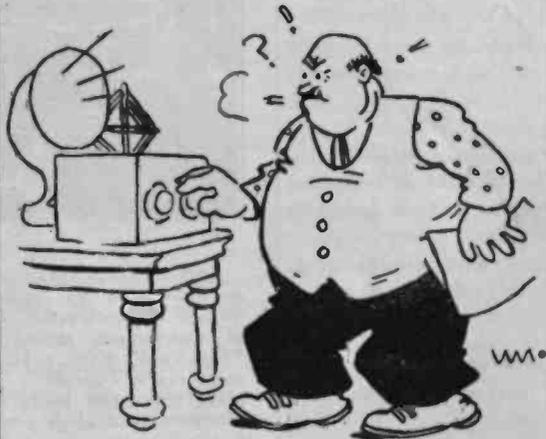
**Interfering With 15 Others**

*Solicitor Stephen B. Davis:* Because, there are probably fifteen or eighteen other stations in the United States on precisely the same wave length, and if you went to five kilowatts, you would interfere with every other one of these

*Solicitor Stephen B. Davis:* That also is easy to answer. We can take small stations with low power and duplicate them very extensively over the United States. We can have a 100 watt station at Norfolk, another one in Pittsburgh, another one in Shenandoah, Iowa,



**JOHN ALEXANDER MCBINES HAS A BIRD OF A ONE TUBE SET HE PUTS ON THE PHONES AND HE FINDS THAT DX IS EASY TO GET**



**WHILE OSCAR AUGUSTUS M'LOONS OWNS A MIGHTY FINE SUPER HET HE TUNES AND HE TUNES AND HE TUNES BUT LOCALS ARE ALL HE CAN GET**

stations. That is the complete answer.

*Mr. Randall:* That is our answer, but I wondered why the small stations were all put on 1,170 kc., our station and the others, when the high powered stations are set off here, all alone.

another one in St. Louis, for the sake of argument, 100 watt stations all on the same wave frequency, and their power will be so small that they will not interfere with each other, because their range is not long enough. It is

like two people standing on opposite sides of the street and throwing rocks at each other. If they throw hard enough each one may get hit, but if each one only throws hard enough to go half way across the street, no one will get hurt. That is it.

#### Keeping Him Always Secretary

*Mr. Randall:* We have no complaint whatever to make of the Department of Commerce. In fact, at our own particular station, I talked an hour there the other day and we decided we should be perfectly happy if things remained as they are; that we would have absolutely no objection at all provided Mr. Hoover should always be the Secretary of Commerce.

*The Chairman:* Many people have expressed the same idea here, but unfortunately, that is an unsafe way to leave legislative matters.

*Mr. Randall:* Unquestionably.

#### Prepared Before it Happens

*The Chairman:* The time to prepare for an emergency is before the emergency actually happens. So that, as I understand you, this legislation puts you in no worse position than you now are?

*Mr. Randall:* Probably not, with your interpretation of the renewal proposition.

*Congressman Briggs:* In fact, it puts you in a better position, does it not, because it gives you a right of review of the Secretary's action and an appeal to the courts?

*Mr. Randall:* I have always questioned whether we did not have that anyway.

#### Can't Go Over His Head

*Congressman Briggs:* But you have not under the existing law. You have no right of review of the discretion of the Secretary, or his actions. They have tried it out in one instance, in the Court of Appeals here, and they were turned down. But this act specifically provides for it.

*Mr. Randall:* We felt that was your intention, undoubtedly, but we do not understand your act.

*Congressman Briggs:* It broadens and widens the law. There are many provisions in this act that do not obtain in the law now, in reference to monopolies

and prohibition against them, and things of that kind.

*Congressman White:* Would you suggest that the Committee undertake to determine what wave length each particular station should be on?

*Mr. Randall:* Not this committee.

*Congressman White:* It must therefore be left to someone?

*Mr. Randall:* Absolutely.

*Congressman White:* And have you anyone to suggest whom you believe better qualified to do it than the Secretary of Commerce?

*Mr. Randall:* No, but have you done

#### RADIO GOING TO DOGS



Another radio broadcasting novelty has made its bow-wow from WLW in Cincinnati. A new pack of entertainers, calling themselves "The Pups" gives a Midnight program every Thursday. Kay Nyne plays the organ while Big Barker announces and plays a violin in the Crosley studio.

so in this bill by the creation of the commission?

#### Who Has the Power?

*Congressman White:* Oh, we have given the power absolutely to the Secretary of Commerce.

*Mr. Randall:* Then why the creation of the commission?

*Congressman White:* So that if any person feels himself aggrieved by the decisions of the Secretary, he would

have an appeal.

*Mr. Randall:* If a little station in Yakima, Wash., feels aggrieved he comes here to the commission, as I understand the operation of the bill.

*Congressman White:* As we want to have it, he could appeal from the decision of the Secretary to the commission. As the bill now is, he would have an appeal from the Secretary to the courts, but it is generally felt around the committee table that we will change it so that he can take his appeal to the commission first, as an intermediary appeal.

In the meantime, until this matter has been passed upon by Congress and the bill either passed or rejected, the Department of Commerce is paving the way for a fair and impartial handling of future broadcasting licenses, through adopting the policy of issuing temporary permits for present broadcasting. Therefore, if a radio law is passed, whatever authority is created for the handling of radio problems will have a free hand in handling the situation.

#### SETS SECURELY SEALED

Maybe you think that the Government in Washington has a lot to say about business throughout the United States. But what would you do if you lived in Japan?

In that country, while the people are enthusiastic about radio, the government looks at it a bit askance. It is feared the air may open a path for the dissemination of Bolshevik doctrines by Russia. Sets, therefore, are sealed, so they may only tune in on certain definite Japanese stations.

In China, the Philippines, South Africa, Turkey, Slam and Asia generally lack of sufficiently powerful broadcasting stations has been the chief obstacle. There is also, in many of these countries, a shortage of local talent to provide programs. Only where their receiving sets are able to tune in on far distant stations can many of the radio owners in these countries enjoy entertainment of any quality, quantity and variety.

# American Radio Relay League

## WILL ENGLAND BEAT U. S.?

Radio amateurs in England are discussing initial arrangements for world tests on schedule, according to W. G. Dixon of New Castle, Eng., secretary of the British Section of the International Amateur Radio Union. Mr. Dixon has suggested to the American Radio Relay League that distances reached by British amateurs in sending would indicate that California, Hawaii, and other Pacific Ocean points might be picked up on a prearranged schedule. The plans are still in a nebulous state, but it is expected that during the course of the winter, arrangements will be made for British amateurs to join the American key pounders in recording radio contact with practically every civilized country of the globe.

## AMERICAN RADIO RELAY LEAGUE CLEAN UP INTERFERENCE

The Vigilance Committee, sponsored by the American Radio Relay League to trace radio interference in Vancouver, B. C., reports that this difficulty has been practically eliminated in-so-far as it falls within the province of the committee. The only interference known to exist now is caused by violet ray machines, X-ray apparatus, power leaks and similar troubles. Information dealing with these have been turned over to the proper governmental authority and it is expected that suitable action will be taken upon the complaints. The record in this city duplicates to a large extent that made by Vigilance Committees in other cities of the Dominion and of the United States. Most of the interference has been definitely located in sources outside the control of the radio using public.

## AMATEURS STEP ON IT

Radio amateurs who are out this winter to better the record made by the fraternity during the polar communication work last summer, are adding to their laurels with distance work, and in many notable instances are showing a burst of speed that might well arouse pride even in a purely commercial company, when speed means profits.

Perhaps the outstanding pair of events were staged with the joint assistance of the Orient and the Occident.

The first relay was started from the station of Lieut. H. P. Roberts at Fort McKinley, Rial, Philippine Islands. This station, Pi-1HR, turned the relay over to station 6BUC, the Radio Club of Hawaii station at Honolulu. The Hawaiians in turn passed the message to Station 5LI, owned and operated by Max Patton, Jr., of Greenville, Texas. The message completed its travels when the Texan established communication with John Mulvihill, owner of amateur station 2BN, New York. The entire transaction was completed in 18 hours and 9 minutes, from Manila to New York.

Another of the successful relays originated in station Pi-8LBT, Saigon, French Indo-China. It was relayed from there to Lieut. Roberts at station Pi-1HR, Rizal, Philippine Islands. The next jump, the longest in the relay, carried the message to station g-2LZ, owned and operated by Mr. Mayer in England. While the message was destined for Brazil, the English station was not in touch with South America. Instead of sending the message directly, Mr. Mayer relayed it to J. S. Streeter, owner and operator of station A4Z of Cape Town, South Africa, who in turn passed the message to the more powerful sending station of R. Oxenham also of Cape Town.

This latter South African was able to give the message to station BZ-1AF, owned and operated by C. Almeida of Rio de Janeiro, Brazil, who acted as the delivering agent.

The message was consigned to station Bz-5AB, a station that had been putting its signals into French-Indo-China with perfect regularity according to the Saigon amateur.

## NOT OLD "CHILLY" JOKE

Earle Chang, owner and operator of amateur radio station c5GO of Vancouver, B. C., has added new laurels to the crown of amateur radio in this part of Canada through confirmation of a recent two-way contact between 5GO

and ch-2LD, the amateur radio station of Luis M. Desmaras of Santiago, Chile. Mr. Chang has also recorded authentic reception of bz-2AB, the station of Justine Justi, Sao Paulo, Brazil.

Another British Columbia amateur, a fellow member of Mr. Chang in the American Radio Relay League, is the first amateur on the Canadian Pacific Coast to record reception of signals by English amateurs.

## BUSINESS BROUGHT BY BROADCASTING

Music hath charms to produce business where there wasn't any. Six weeks of Community Concerts, broadcast on Monday nights from Station WSAI, Cincinnati, in the name of the community—as "Cincinnati's contribution to the happiness of the world"—have demonstrated an unexpected and unsolicited commercial value.

Manufacturers and wholesalers of this city who have been sending out monthly invitations to their respective mailing lists, announcing the community concerts, are reporting a substantial increase in business. The most significant tribute to the value of this radio advertising of the city, however, is in the numerous letters received at the Chamber of Commerce from persons who state they have been listening in to the concerts, and who make inquiries as to where they can place orders for various commodities.

A man in Sal Salvador, Central America, confided that he is organizing a band and asked to be put in touch with a firm dealing in musical instruments. By a coincidence, the same mail brought a letter from a Northwest Royal Mounted Policeman in Saskatchewan, asking that a ukulele be sent him, C. O. D. Inquiries for a variety of commodities, ranging from personal wearing apparel and jewelry to laundry machinery, soaps, adding machines and household furniture, have been received by the Chamber of Commerce from all parts of the United States, Canada and Mexico, and are directly attributable to the community concerts.

# Farm and City Split on Programs

## Sailors Too Are in a Class by Themselves About Radio

By KENYON W. MIX, Sleeper Radio Corp.

DO farmers really go around chewing a straw in their teeth? As a matter of fact, it is hard to pick out a countryman by such ear marks, (or should we say "mouth marks").

But there is one way in which the farmer differs very much from his brothers of the town. It is in radio for in spite of the universal appeal of broadcasting as a medium of entertainment, the radio tastes of Western farmers are widely different from those of city people.

### Forecasts Featured for Farmers

Whereas, the majority of urbanites much prefer music in one form or another to speeches or lectures, most agriculturists are inclined to disregard melody and to tune-in on educational features, weather forecasts, and particularly market quotations.

Music is what the farmer selects only after he has obtained from his set more valuable and important items like the market prices of farm products. He works late and goes to bed early, so when he does listen-in he selects something of material and immediate interest, like the price quotations, weather forecasts, and bits of practical farming

advice; music is entirely incidental to him.

### Picking up a Follies' Girl

If you happen to be a typical "man about town" you probably regard the different divisions of broadcasting programs about as shown in Fig. 1. Music

takes by far the first place. Many a broadcast listener in the big cities has been known to start turning his dials just as soon as any musical program threatens to change into a speech unless it be that of President Coolidge or one of the Follies' Girls.

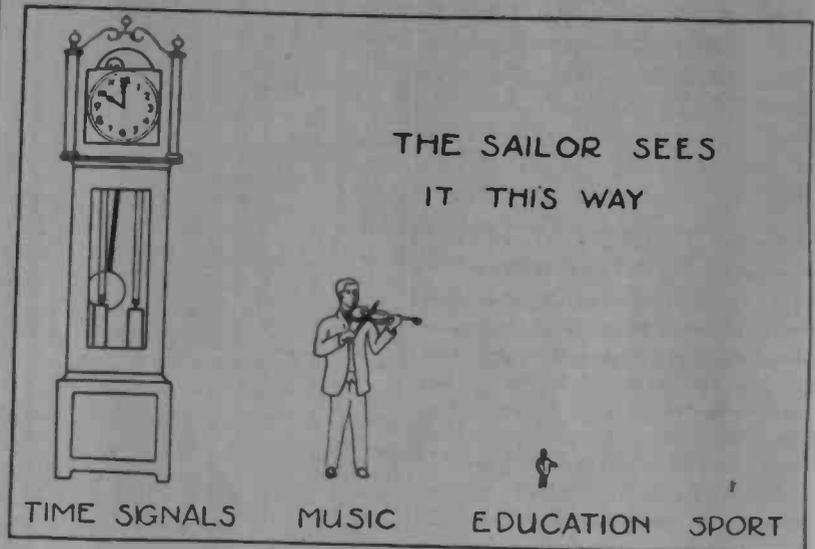


Fig. 2. Safety on the Deep Means Much to the Sailor, and He Votes for the Time Signals



Education may stand next but it is a poor second. This term is meant to include lectures of all kinds whether they are quite technical or are popular presentations of interesting facts. Then follow sports. Most everybody is willing to listen to the scores of the ball games but the time actually spent in hearing them is small. The market reports for the city dweller have shrunk to a size of very low visibility.

### Don't Mean the "Dog Watch"

With the sailor a different situation is seen, Fig. 2. The front page of his radio program is taken up with the time signals. Most sailors are notoriously superstitious. One of their beliefs is that they will live longer if they are able to determine the latitude

Fig. 1. The Large Towns Think Music is About the Best Entertainment

and longitude of their ship when at sea. As the time signals help to correct their observations of position, you will see that they give them first importance. However, the time signals have nothing to do with the "Watches" which you read about in sea stories.

The farmer thinks the other two are all wrong when it comes to rating the different numbers. Market reports as shown in Fig. 3 tower away above the other items. The ticking of the time signals don't mean so much to the farmer as they tell him only when it is noon and evening. What he wants is a system which will inform him when it is time to sow his wheat or to sell his rye, (a kind of grain).

**Said "Cut Out the Music"**

The experience of one of the most popular broadcasting stations in the West shows very clearly this preference of those who till the soil. The management mailed out statements to more than 18,000 farmers saying that the station would find it necessary to subdivide its time, and requesting that listeners voice their preferences in program material. Fully 75 per cent. of the farmers replied, in effect: "Cut out the music and give us the educational features and market quotations. We must educate our children, and we must know what our products are worth."

The city man listens with mild amusement to an announcer's recitation of a long list of prices on hogs, corn, wheat, butter, eggs, cream and potatoes, but the farmer attends with deep concern, for it affects his personal welfare. This was brought home to me when I personally witnessed the following incidents:

A hog buyer from Kansas City visited and offered him a certain price for a quantity of his hogs. The farmer and his wife demurred, complaining that the figure was too low. The buyer excused himself and rode off to another farm.

**Buyer Buncoed by Broadcasting**

Two hours later the farmer tuned his radio set and caught the eleven o'clock market quotations. The broadcast price for hogs was below the one offered by the departed buyer, so the farmer did some quick thinking. He knew the man must be at another house a few miles up the road, so he called up by telephone, got in touch with him, and after

saying that he needed some money and had decided to sell at the quoted terms, he closed a profitable deal. Of course, the buyer did not know of the sudden price change, and so held to his original quotation.

In another case I met a farmer who had for a neighbor a man who was regarded as terribly tight fisted. The first

**Music is Only Music**

I could recount hundreds of instances in which radio has afforded farmers direct benefits, in the form of hard cash. They have learned the value of accurate price and weather information, and they look forward to broadcasts of this nature. Music is just music, and unless it comes from New York or some other big city

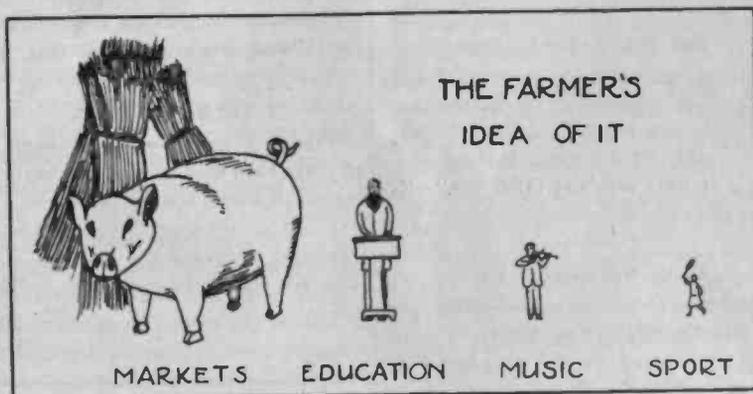


Fig. 3. Making Money Appeals to All of Us, and the Farmer is Helped by the Market Quotations

had a radio set, but the neighbor didn't. One day, while the former was listening in on his receiver, he learned that the price of cabbages had suddenly gone up \$20 a ton. Thereupon he went out, bought from his neighbor all the latter's available cabbage, at the old and lower price, of course, and then resold at a healthy profit. The other man now also has a radio receiver in his living room.

through a network station, they care little for it.

Speaking of the educational feature of radio for the farmer, some of the mid-Western agricultural colleges go so far as to award degrees to radio students who have followed broadcast lessons arranged by them, and who attend the school in person for three days for an examination.

**PLAY NO CORPSES**

Banning all musical selections that have been "played to death" on the radio, the directors of the concert orchestras whose programs are featured by Station WRC at Washington, will for a time include in their programs only those new-old compositions which are seldom, if ever, heard on the concert stage or on the air.

Working in co-operation with Ralph Edmunds, Program Manager of Station WRC, the eight station directors will search their libraries for musical compositions whose melodies lie half forgotten on their shelves, and will eliminate from their programs any numbers that they themselves have played in radio con-

certs in the past year or any which they may have heard played by some other orchestra. This innovation was decided upon following numerous requests from listeners for "new" music, instead of the almost continual repetition of selections which in many cases have become prevalent during the past six months.

So far, a list of more than a hundred such compositions has been compiled by Mr. Edmunds and submitted to the directors for their consideration. Included in the programs for the "music revival" week will also be a number of original compositions which are being written by the directors and members of their orchestras. A second list of more than one hundred and fifty selections has been made, all of which are placed definitely under the radio ban for the time being.

## FUN FOR FANS

### The Poor Fish

"Mother, please ask that man to get up."

"But, dear, why do you want him to stand up?"

"Because he is sitting on my jellyfish."  
—Life.

### But Not Radio Progress

A little girl ask her father. "Daddy pro and con mean opposites, don't they?"  
"Right!" he replied.

She said, "That must be why they speak of PROgress and CONgress."—Exchange.

### Lucky Not Electric Wire

Mrs. Smith (after ten minutes' conversation)—"Well, Mrs. Brown, I must be getting along to the plumber. My husband's home with his thumb on a burst pipe, waiting till he comes."—Good Hardware.

### A Chance for a Bargain

She: "I hear that letter postage is going up to three cents."

He: "Yes?"

She: "I'm going to lay in a goodly store of two-cent stamps."

—Vassar Vagabond.

### One Often Follows the Other

"See here," said the angry visitor to the reporter, "what do you mean by inserting the derisive expression 'Applesauce' in parenthesis in my speech?"

"'Applesauce?' Great Scott, man, I wrote 'Applause.'"—Boston Transcript.

### Careless of Her!

Young Lady (after violent dance)—  
"There! My heel's gone! That's done for me for this evening."

Youth—"Oh, bother! Don't you carry spare parts?"—Punch.

### Filial Loyalty

Father—"So the teacher caught you using a bad word and punished you."

Tommy—"Yes, and she asked me where I learned it."

Father—"What did you tell her?"

Tommy—"I didn't want to give you away, pa, so I blamed it on the parrot."—Boston Transcript.

### Striving for the Touch

The professor had asked time and again for the students to put more personal touch in their themes, so one of the papers which he received ended thus:

"Well, professor, how are the wife and kiddies; and, by the way, before I forget it, could you lend me five dollars?"—Penn Punch Bowl.

### Too Good a Mimic

"Where is that beautiful canary bird of yours that used to sing so clearly and sweetly?" asked Mrs. Weatherbee.

"I had to sell him," Mrs. Butlam said tearfully. "My son left the cage on the radio set and he learned static."—Earth Mover.

### A Head for Business

"Abie's cold is better and we've still got a box of cough-drops left."

"Oh, vot extravagance? Tell Izzie to go out and get his feet vet."—Ipswich Beacon.

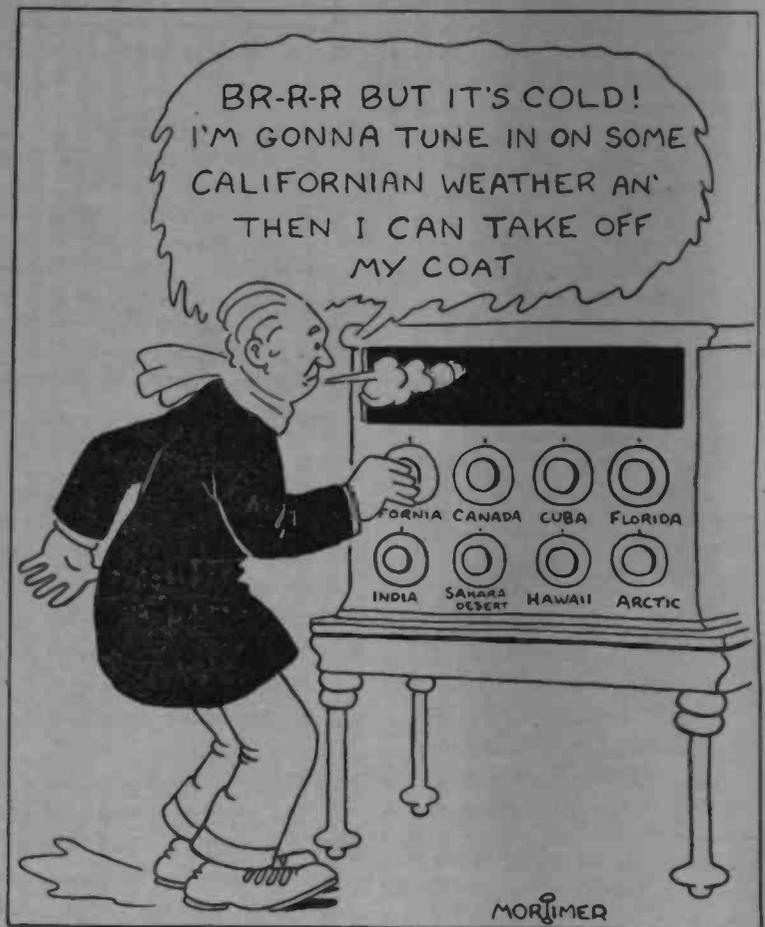
### What Advertising Does

"Mother," cried little Mary, as she rushed into the farmhouse they were visiting, "Johnny wants the listerine. He's just caught the cutest little black and white animal, and he thinks it's got halitosis."—Union Pacific Magazine.

### Insult to Circus

Little Boy: "Look ma, the circus has come to town; there's one of the clowns."

Ma: "Hush, darling, That's not a clown. That's just a college man."—Beanpot.



THIS KIND OF A RADIO OUGHT TO PROVE  
VERY POPULAR —By Mortimer

# When Shoemakers Built Radio

## Radio As a Child Had Pretty Bad Growing Pains

By C. B. SMITH, Stewart Warner Corporation

**S**OS YOUR old man." That is one of the most used replies these days when anybody gets a little bit fresh. However, it will hardly be said to radio for the reason which will appear.

As in the case of many darlings of popular favor, it doesn't do to inquire too closely into the ancestry of this art. Such curiosity is, perhaps, less excusable in this field of endeavor than in others. For there are some who might deny, with a certain amount of justice, that radio ever had any "old man" or other ancestors. It is more properly the "Topsy" of the electrical industry. It was brought into being by a miracle and continued in popularity by an even greater miracle. It has thriven for four years and built up stupendous fortunes through a wholesale application of the methods that made the rags-old-iron business a factor in the world's affairs.

### Not a Crime in Nevada

For the most part, its early pushers were well meaning gentlemen recruited largely from the shoe trades and the markets of the cloak and suit. These



Fig. 1. They Half Expected Radio to Spring This Old Gag

opportunists might have had trouble distinguishing between a variometer and a "B" battery, and they probably thought that induction was something punishable by law in all states except Nevada. But they knew that this radio-

thing in its little pine box, through some operation of sleight-of-hand quite beyond their ken was making music without a record or a motor. Obviously, a thing capable of such wonders was a device of almost limitless opportunity.

Most of the pioneers looked upon the crystal set (Fig. 1) as a device that must ultimately give one the wrong numbers, now so essentially the stock in trade of the wired telephone. And if while listening a thunder storm came up and they got a lightning shock from the aerial, it doubtless seemed to them that the singer at the other end was getting personal and had landed a knockout with his fist. They did not attempt to analyze the means by which this might be brought about. It was enough that a crystal set could be compiled of bell wire and cardboard tubing and sold to the gullible public for \$25—a haphazard condition that might well have been expected to produce the hit-or-miss industry that actually did result.

### Catch as Catch Can

Few moderns who look at radio through the medium of the great National Shows this year can realize the steps and stumbles that attended the progress of the alleged science to its present point. Strangely enough, radio has become honest. That, of course, was not through any fault of its own, for it started out bravely enough with a catch-as-catch-can policy of manufacture and sale that compared very favorably with wild-cat oil stock promotion and kindred operations. But it worked fairly well even from the very first, in spite of, rather than because of alterations and "improvements."

It stirred an unbelievable volume of sales, and it provoked a competition that gave "Value" a place alongside "Profits" in the bright lexicon of the shoe-shop engineers. A number of factors contributed to the financing of the industry—a sud-

den and energetic looting of savings accounts in the first phase, then shameless calls on the fire insurance companies in the second. A sudden stoppage in popular demand—something that no economist has yet explained except on the ground that folks had to learn through experience that our old friend

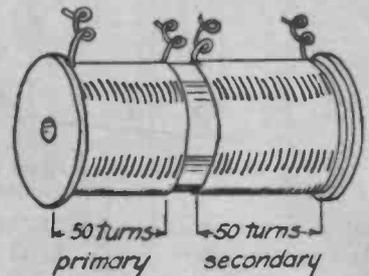


Fig. 2. This Was the RF Transformer Which Made One Builder Rich

"static" ruled over summer reception—gave plenty of business to the bankruptcy courts. And so ended the first year with radio somewhat dazed and battered but still blatantly vocal, ready to start all over again.

### Believed to be Madness

One manufacturer now of national importance, entered the field at that time. He had never been a manufacturer before. He had passed a number of lean years operating a sewing machine agency in a mid-western city and his only reason for interesting himself in what he believed to be a popular madness was the fact that had a bit of spare room at the end of his storage place on the second floor.

He learned, through conversation with a professor attached to the faculty of a local technical school that a radio frequency transformer consisted of a fifty-turn primary coil and a similar secondary coil wound on a small spool, Fig. 2. He called upon one of the repairmen to

handle the wire. Of course he had an old sewing machine and he began to wind transformers. Naturally he had no means of testing his coils. He had no way of telling how efficient (or inefficient) they were at the frequencies used in the broadcast band of that period.

**Luck of Half a Million**

But he made them anyway, and trusted to luck. How good the luck was might be gathered from the fact that when he decided to operate as a corporation in-

One can have nothing but admiration for the hardy pioneers who stepped in where angels feared to tread and who, unconscious of their task, produced a volume of effort only a little greater than that required to build the great pyramid (Fig. 3) and the Union Pacific Railroad, and squeezed into a few brief years the entire progress that has given radio its place with washing machines, speedometers, and other matter-of-fact devices that are the necessities of modern life. But you can foresee, as they

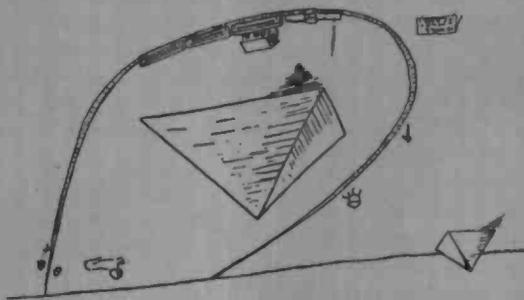
early automobile, lies in standardization. Until a few months ago it was nearly impossible to find any two radio sets—even those produced by the same manufacturer in the same day—exactly alike. Basic circuits might be similar in every respect and component parts might be matched with care and accuracy. But the performance of one set would be good and that of its twin brother would be too terrible to contemplate.

The reason for the discrepancy was not far to seek. Sets were more or less the output of individuals. In little factories one man—or sometimes one girl who last week might have been engaged in such deep pursuits as “Sewing buttons on the third floor”—each soldered every joint and guessed at the placing of every wire in a complete set. In larger factories five assemblers and wiremen might collaborate on the set. But in no case was there any semblance of that system which has made American manufacture famous throughout the world—that system of one way operation which took all the delicious uncertainty out of automobiling and shoemaking and what not.

**Top or Bottom—Which?**

Perhaps you don't know how important some little details are. Take a neutrodyne set (Fig. 4) for instance. If a connection runs from the top of the sec-

Continued on Next Page



**Fig. 3. The Energy to Build Pyramids and a Railroad System Was Expended in Early Radio.**

stead of an individual last year, he had a half-million dollars cash in the bank and a manufacturing plant that inventoried well over \$200,000.00.

The story is not fantasy. It is a bit of frigid realism from the histories of nearly all the successful parts manufacturers of a short time ago. The miracle of radio was repeated world without end for their special benefit.

One realizes in looking back at these matters that the actual magic of radio reception is no great marvel at all. It is only a moth-eaten card trick in comparison with the stupendous wonder that such business methods should have succeeded, and that the products of their success should have had anything but an ornamental value.

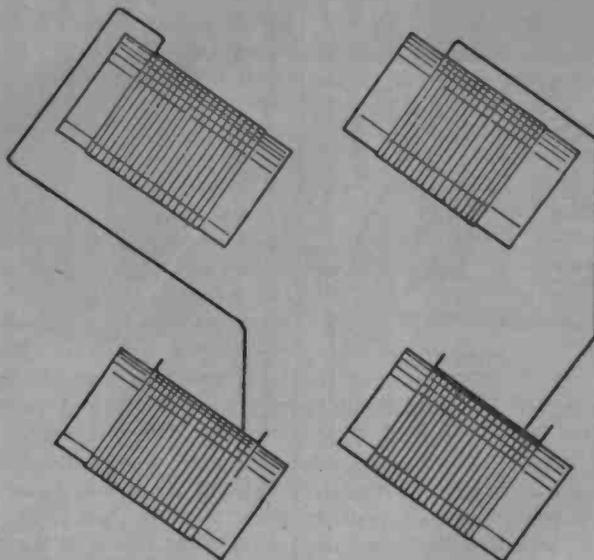
**Less Than No Current**

It would have been impossible to run a watch factory as yesterday's radio plants were run. One couldn't have made good shirts or shoes or shaving brushes with such a system or equipment. But electrical instruments capable of dealing with currents of a millionth part of a volt and less than no amperes at all came out of these basement work shops and somehow got through the work they were called upon to do.

could not possibly have realized, that such successes as theirs will seem quite trivial, when some order is brought out of the chaos which they contrived so artfully, and skill of design and assembly is added to the enthusiasm which was their principal—if not their only asset.

**Its Terrible Twin Brother**

The hope of radio, as that of the



**Fig. 4. This Slight Difference in Connecting a Neutrodyne Looks Small, But is Important**

# Now is the Time to Hear Europe

*You Don't Have to Wait  
For a National Silence Week*

An Interview from T. T. WILLIAMS

WELL, how did you come out in your attempt to pick up England last month? It seems that almost everybody was able to hear not only one, but a dozen or more broadcasting stations during these silent hours of International Radio Week. But unfortunately, the stations doing the sending were nearby neighbors working their regenerative sets so they broadcast a continual squeal.

For the past few years each winter has seen an annual attempt in the reception of foreign broadcasting stations. During the week set aside for these tests, all the American transmitters remain silent so that you may listen in to your heart's content, in order that new DX records may be made for your receiver.

### Crossing the Carrier Wave

A goodly number of broadcast listen-

ers last month heard the foreign stations in operation. Probably a great many more would have received these programs had it not been for the squeals set up by radiating receivers, whose owners intentionally kept their sets in

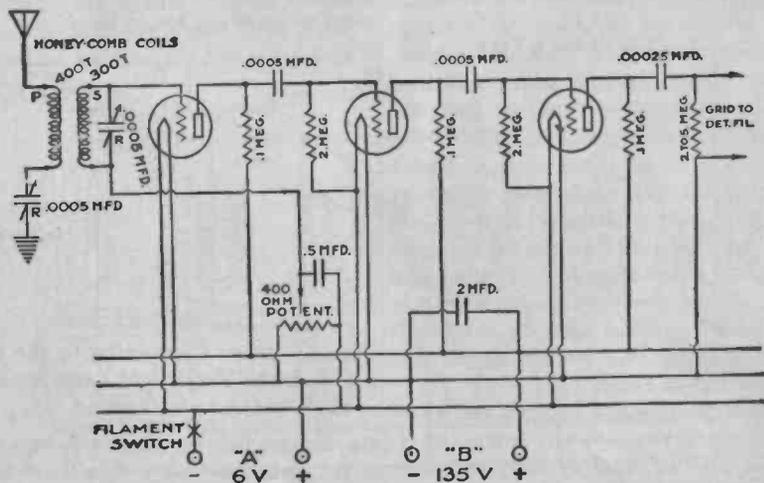


Fig. 1. This Type of Amplifier Will Work Well on Low Frequency (Long Wave) European Sets as Well as an Audio Amplifier

### WHEN SHOEMAKERS BUILT RADIO

Continued from Previous Page

and coil back to the first, shall we run the wire over the spool or under it? In ordinary electrical work of house wiring or the like or building an automobile or perhaps an electric motor, the workman would look at you out of the corner of his eye if you asked any such foolish question. But with radio it makes a difference. The amount of balancing which must be done to make the set work perfectly will vary considerably depending on the location of the various wires.

This year some few companies are applying to radio manufacture the principles that it took skilled engineers thirty years to work out—principles too long ignored in the radio industry. And the results are gratifying. One after another, at a rate of hundreds a day, these wireless sets start out as unidentified screws and bolts at one end of

a conveyor (Fig. 5) and end as beautiful instruments on test boards that leave nothing to guesswork.

### Has Been the Close Ally

One after another they are made to demonstrate that they match in every microvolt of output, in every factor of amplification and in every test of quality. Those in which the unavoidable human uncertainty has produced a variation from the standard are sent back to be completely dismantled. Sets that pass

the last inspector go out to the consumer rather than to the so-called service station that has so long been the close ally of the factory.

So far there are only a few producing concerns in the United States employing such methods. But they will not long enjoy that distinction. The tremendous advantage in cost and quality can be combatted only when competitors decide to employ systems less old fashioned than that used in the building of Noah's Ark.

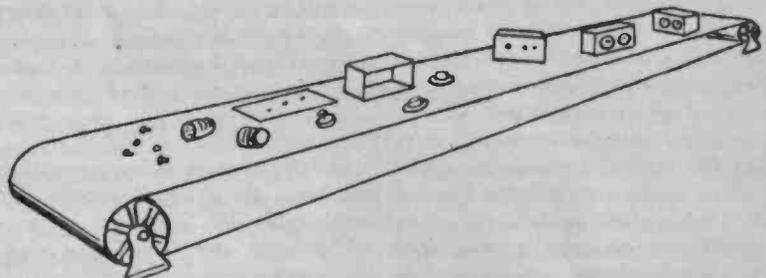


Fig. 5. The Modern Way is to Start Down the Line with Parts and End Up with a Finished Set

oscillation, thereby hoping to cross the distant stations' carrier wave. Thus it meant that a whole nation had a single radio idea—to hear a foreign program.

But why is it necessary for everybody in America to listen to these foreign signals on the very crowded and narrow band from 550 to 1200 kc. (545.1 to 249.9 meters)? The real high power transmitters of Europe, which really offer the best opportunity, are not situated within this waveband, but rather between 100 to 200 kc. (3,000 to 1,500 meters).

#### Don't Wait for a Year

For instance, the one super-power station in England is that at Daventry, which transmits 25,000 watts at a frequency of 188 kc. (1,600 meters). Such a station does not need to be waited for until the 1927 National Radio Week, but may be tuned in almost any good night by a set designed to pick up such a low vibration speed without danger of being interfered with by the broadcasting of the over 500 sending stations in the United States.

With this thought in mind the writer has built a very efficient long-wave receiver and amplifier system; and after it has served its purpose, a slight construction modification will make it an excellent audio amplifier.

#### Resistance Like Short Circuit

The device is simply a low radio frequency resistance coupled amplifier. Undoubtedly you are aware that this form of transferring the energy from one tube to another is very successful on audio frequency, but that it is not usually recommended at the high vibration speed of the radio broadcast band. The trouble is that the resistances themselves and the wiring acts like condensers and to a large extent short circuit any vibration of a higher speed than 500 kilocycles. As the broadcast band reaches from 550 to 1200 kc., you will appreciate that this method is unsuited for ordinary receivers.

But as just pointed out, the powerful foreign stations do not have the typical American hustle and rush. They operate at the comparatively slow speed of 100,000 oscillations instead of 1,000,000 as in America. This reduced rate removes the objection of the short circuit of the signals since the small capacities

already referred to will not short circuit an appreciable current at the lower wave speeds.

#### When Coupling Gets Tight

In Fig. 1 there is shown a complete wiring diagram of this device together with its electrical values. The input tuner is an ordinary double coil honeycomb set and mounting. Its primary and secondary windings are of 400 and 300 turn sizes, respectively. These are mounted in line with each other and spaced quite close together. It is something of an advantage to be able to vary

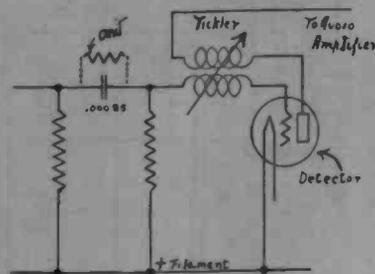


Fig. 2. When Connecting to the Detector, the Usual Grid Leak Around the Condenser is Omitted.

the distance between them, although this is not really necessary. The closer they are together, the tighter the coupling. A loose coupling increases the selectivity but beyond a certain amount, it reduces the loudness.

These coils together with the .0005 mfd. condensers are right for the wave band between 90 and 210 kilocycles (3,300 and 1,430 meters). This takes in the broadcasting of a number of large European stations. Best results will be obtained from a long antenna system, say about 200 feet including lead-in.

The only real change between radio and audio frequency resistance coupled amplifiers lies in the value of coupling condensers—in this case it is .0005 mf., while .10 mf. will make it an audio amplifier. Coupling resistors are of the values shown.

#### Using High Tube Factor

No. 199, 201A or hi-mu tubes, such as the Daven Mu-20 may be employed. The latter tubes give somewhat better signal strength and distance, in view of the greater voltage amplification per stage, as would be expected, since the tube amplification factor is almost three

times that of ordinary 201A tubes.

It will be noticed that the grid return from the first tube is brought to the tube filament through a potentiometer. In this way oscillation can be controlled at will by applying a varying grid-bias.

In the plate circuit of the last amplifier tube it is to be noted that both the coupling condenser and leak resistance values are changed. In this way the radio frequency amplifier output may be led directly to the detector tube grid and filament without an additional grid leak and condenser.

#### This Leak is Omitted

This is shown better in Fig. 2, which takes up the story where it was left off at the right hand end of Fig. 1. The grid condenser in the average set is shunted by the grid leak as appears in dotted lines. This leak as already mentioned, is to be omitted. But notice that the one which takes its place is connected not to the "A" minus, as with the first two leaks in the set, but to the plus filament.

If the user so desires, a coil may be connected in series with the detector grid, Fig. 2, and by coupling it to a plate coil it is seen how regeneration may be added in a very simple manner. The audio amplifier may be any type, in fact your present set and detector will do quite nicely.

#### TEN YEARS OR ONE HOUR

Once again radio has been instrumental in bringing together brother and sister who had been separated since childhood, neither of whom knew of the whereabouts of the other for the past ten years.

WTIC, Hartford, which has been in the habit of co-operating with the Chief of Police in the City of Hartford on matters of this kind, recently broadcast a message telling that a young man was anxious to learn the whereabouts of his sister.

Two days later a message came to the studios of The Travelers' Insurance station at Hartford, stating that the writer had heard the broadcast and as he was a neighbor of the sister he was very anxious to pass on to the young man the required information.

The peculiar phase of this incident is that the missing girl was located in Waterbury, only an hour's ride from the home of her brother.



knob had to be wiggled around a little more to keep the station coming in just right. But that is all a thing of the past. Who is using vernier rheostats any more?

Vacuum tubes are no longer critical as to filament temperature. The detector tube was formerly the fussy one, but now the blame thing works the moment we turn the rheostat to the first notch. If the filament adjustment is no longer critical, why under the sun do we want any variable adjustment? Why can't we put in some sort of fixed resistance that will introduce exactly what is required?

**Ready for Next Year's Tubes**

There is another point. Not only are we confronted with the necessity of sim-

ing on 3, then the drop in "E" is 1½ volts.

**Same Current as Tube**

Now we have found what pressure is required on the equalizer, the next thing is to notice the current which passes through it. In every case it is in series with the filament and so takes the same amount of current as the latter. This will be ¼ amp. for 11, 12 and 201A tubes, and 1 ampere for the 200 detector.

To find the value of the resistance of the equalizer, which is what we are after divide the voltage by the current. As an illustration, with the 201A we have found that the pressure is 1 volt and the current 1/4 ampere. Divide 1 by 1/4, and the answer is 4 ohms of resistance. In the second case mentioned

sockets, all he has to do is to get a set of resistance tubes and he can slip them in place in an instant.

The possibility of changing the resistance quickly has an advantage when substituting one of the new power tubes in the last step of an audio amplifier. As the filament takes more current than the ordinary bulbs, the rheostat setting would not correspond to its previous value. Slipping in the proper resistance unit instantly changes over the circuit for the new style of filament.

**Different Kinds of Tubes**

The best way to understand the use of the tube equalizer system is to consider a few practical applications. In Fig. 2 there is shown the filament circuit of any common tuned radio fre-

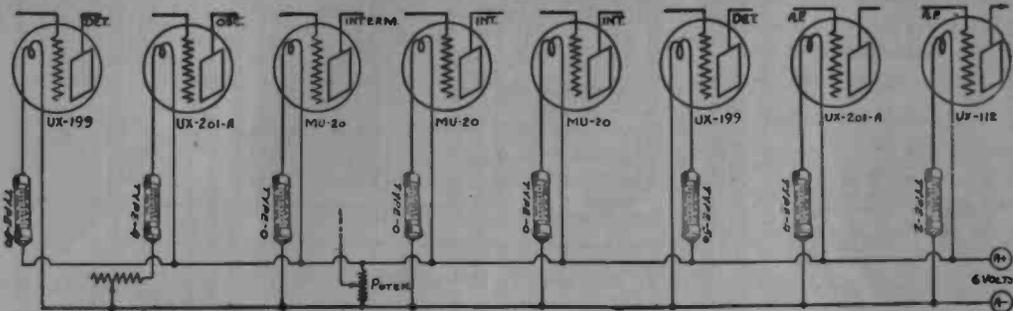


Fig. 3. An Eight Tube Set with the Simplicity of the Filament Hook-Up Well Illustrated. Different Values of Resistance Serve the Various Tubes

licity in receiver operation, but we are perhaps approaching the day when there will be a special tube in each and every position of a radio receiver; as a matter of fact, we are now in the midst of this movement. How then are we to design receivers which will permit immediate use of any of these newer tubes which are and will be available? If we are to use a system of fixed resistances or, as they are sometimes called, ballasts or equalizers, we must have a series hav-

ing above, with the 199 tube and dry cells, we have 1½ volts divided by 1/16 ampere equals 24 ohms. This same process will give us the needed resistance of any ballast or equalizer.

There are several manufacturers who put out resistors and their mountings to take care of changes which may be made in the wiring of sets. One of these for instance, is known as the Elkay tube equalizer system. The mountings for such units are fastened permanently in

quency receiver with the exception that conditions have been made a little more difficult by assuming that it is desired that different tubes be used. In the two radio stages, two 201A tubes are hooked together, but as some sort of a volume control is desired, a rheostat is inserted which with a type 2 unit solves the problem. The type figure refers to the number of ohms of resistance.

In the detector socket a UX-199 is used, so a type ballast 50 is specified

# Noises in Your Radio Set

## *Some are Hard to Eliminate But Others are Easy*

By JESSE MARSTEN

WHEN driving at night the glaring headlights of an approaching car certainly add more light, but in spite of that they make it much harder for you to see. In the same way various noises coming from your loud speaker form a curtain of sound and it is unpleasant to try to hear through it to pick up the program.

One of the principle problems confronting radio engineers—and for that matter all communication engineers—is that of securing at the receiving end a perfectly quiet background against which the received signals will stand out in clear relief. The problem is not unlike that which is presented in the opera and concert hall where the signals contend with the coughers

they succumb only to the application of sound engineering principles.

The problem of noise in the broadcasting system is harder than in the other communication methods, for ex-

the two we have the whole chain of apparatus and the ether through which the sound and its electrical counterpart travel, which includes the microphone, its amplifier, the telephone or telegraph



tenna, the receiving set and loud speaker. Obviously all the noise problems incidental to telegraph and telephone communication and radio communication are present in the broadcast system.

**The Illusion is Spoiled**

The noise problem is furthermore aggravated by the very high objective which broadcast engineers have set for themselves; that is, to create the illu-

masking the effects of noise so that it is negligible compared to the signal. This is not really noise elimination nor noise reduction. This method is raising the signal to such a high level, while not affecting the noise, that the signal overwhelms the noise, and so the latter is not heard though it actually exists. This is practically as good as actually eliminating the noise, but it is costly. It is therefore used only when the dis-

tribution, whereas the signal would. Thus by increasing the power of the signal sufficiently over the noise level, the disturbing effect of noise may be reduced to a negligible quantity. It may therefore be stated that to utilize the good effects of increased power in overcoming noise, the increase must occur at a point in the system ahead of where the latter gets in.

**Stepped Up 1,000,000 Times**

Fig. 2 shows how this works out. Here we have a singer addressing the microphone in a natural tone of voice with a loudness which we may call 1. The speech amplifier steps the energy received from the microphone by a factor of perhaps 100. So far the loudness is 1 times 100 or 100. From there the music goes to the power amplifier which has a further factor of say 200. Here we have 100 times 200 or 20,000 for loudness. The transmitter gives it another boost of 50, which multiplied by 20,000 has an answer of 1,000,000. This tremendous energy goes out to the aerial and from there is radiated into space.

The music of course is spread out North, South, East and West, not to mention up and down. There is so much of all outdoors that it is not surprising when you learn that by the time the waves have reached your particular aerial, the power is cut down to one one-hundred-millionth, (1/100,000,000) of what it was at the beginning of its journey. Reducing the broadcast loudness by this factor we get 1/100th of a unit as the volume picked up by the receiving aerial.

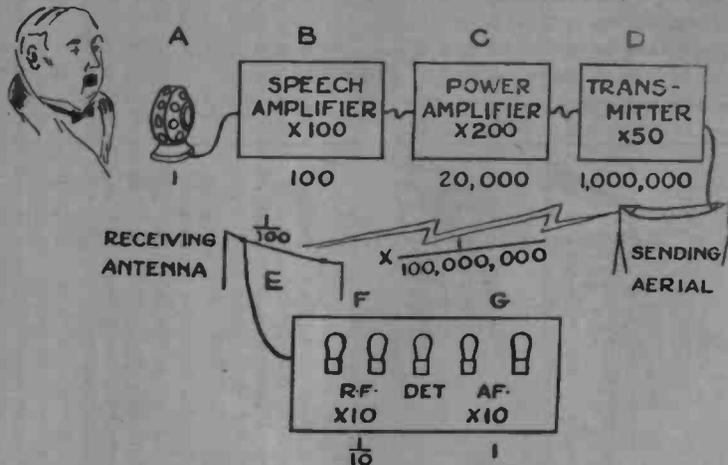


Fig. 2. Here Are the Main Parts in the Radio Chain. The Factors of Loudness Are Fairly Representative

sion of the artist performing directly before you, his audience. But extraneous noises and sounds other than those it is intended to transmit prevent such an illusion, for these noises are never heard in a direct performance of artist to audience. They furthermore reduce the intelligibility of the direct sounds transmitted, and distract the attention of the listeners, causing a loss in both interest and pleasure. If the noise is very bad, it becomes necessary for the listeners to concentrate heavily on the program to hear it with any benefit. The listener is thrown into a frame of mind which is anything but pleasant, and the creation of an agreeable illusion is completely spoiled, even though, let us assume, the quality of transmission and reception is perfect.

There are so many places in the broadcast system where noise may enter, and so many different causes for the noise, that no general remedy can be given for its elimination. The cure will generally depend upon the cause. In any case, however, the addition of power, if it can be supplied at the proper points, and in sufficient quantity, is capable of

turbance cannot be reduced by other methods.

**The Noises Are Boosted, Too**

It is essential that the extra power be introduced at the proper point of the broadcast system. If it is added after the disturbing noises have entered it is of no avail as far as these disturbing noises are concerned. For obviously

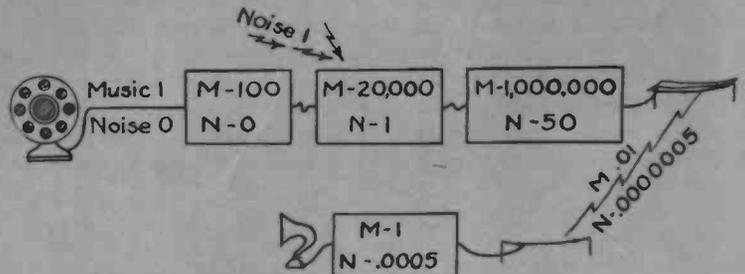


Fig. 3. Here a Noise Enters the Power Amplifier (Fig. 2) But the Effect on Your Loud Speaker is Nothing

these noises will be amplified by the additional power, as well as the signal, and so no advantage is to be gained.

But if the noises entered the system after the addition of power, then they would not have the additional amplifi-

**May be Louder Than Life**

Let us suppose that your set has an amplification of 10 in the radio frequency and detector part. This will increase the 1/100th just mentioned up to 1/10th of a unit. The audio frequency

again multiplied by ten brings it back to 1, the same loudness with which the music was sung originally at the broadcasting studio. If your receiving set is more powerful than these factors would indicate you may get it even louder than the original performance.

The above all assumes that no noise has accompanied the music. But suppose as in Fig. 3 the power amplifier has a sputtering tube or other trouble so that noise of a unit loudness (1)

coincide in part or in whole. Once the disturbance gets in, therefor, anything we do to the one similarly affects the other. If we chop out part of the noise, we almost inevitably slice off part of the signal, and thereby introduce distortions of one form or another.

**Ripples Riding on Swell**

In this connection you may wonder why we cannot use some sort of wave trap to clear up our tones. For in-

cannot be used with a receiving set to discourage unwanted sounds. The answer is indicated in Fig. 6. The upper curve shows a wave of music. It is like 5A except for two things. In the first place, it is *audio* frequency, and so is a thousand times as slow as the other one. If this were shown to the same scale as Fig. 5, it would stretch out for perhaps a couple of hundred yards.

**Dull Instead of Rich**

The other difference is that instead of being a regular and constant wave called a harmonic, it is an irregular vibration and contains the quality or "timbre" which distinguishes a violin from a piano or flute. If it should be run through a filter it would come out like Fig. 6B, and would sound like a tuning fork—dull and flat—instead of having a rich tone like the original instrument.

We may therefore state first that noise correctives should be designed to prevent the entrance of a disturbance, and second that if it cannot be prevented from getting in, the corrective—which will probably be increased power—should be applied at a point in the

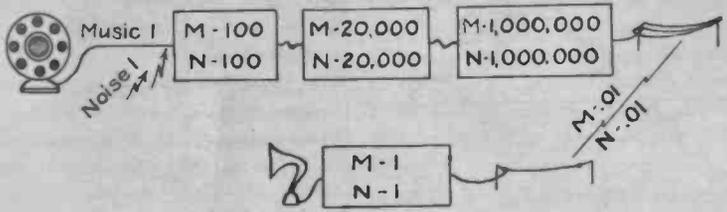


Fig. 4. But This Time the Noise Creeps in at the Microphone. The Result is That it Spoils the Program

occurs in its vitals. The power amplifier increases this loudness to 50 by the same amplifying factor as was mentioned above. Dividing by 100,000,000 as before we get a result of five ten-millionths (.0000005). After passing through your aerial and receiving set, the music just as before has a loudness of 1, but the noise is only five one-hundred-thousandths (.00005). Of course this is so small that no ear is able to hear the noise at all, but the music comes clear as a bell.

**Talked Out Loud in Studio**

That is what happens when the noise sneaks into the system rather late in the journey to your home. Now let us see the result when it starts at the beginning, Fig. 4. Someone talks in the studio just as loud as the artist. (We shall have to fire the studio director for this.) This is, both music and noise each has a loudness of 1. If you trace through the resulting volumes in the various parts of this system you will see that the loud speaker reproduces both noise and music in equal volume. This shows that the need of concentrating on the early stages in any prevention of interference.

After a noise has once entered the system it is extremely difficult to eliminate it, or reduce its influence by correctives applied beyond its point of entrance. The reason for this is that the various frequencies of noise and signals

stance in Fig. 5A we have a wave which is built of a heavy ground swell but lots of little ripples are riding on top. The main wave is the one radiated by the transmitter and carries the music while the wavelets, called harmonics, are slyly inserted by a poor transformer. Such a

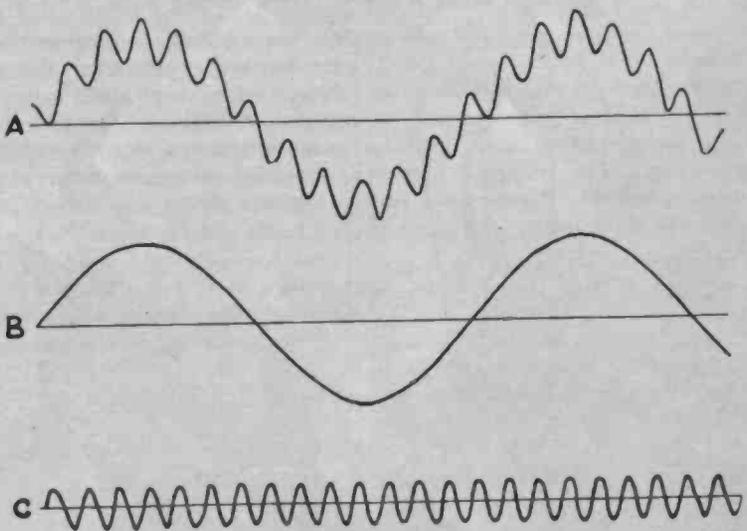


Fig. 5. A Harmonic Suppressor or Filter Takes the Bad Wave, A, and Separates it Into the Good on B, and the Ripple, C

combined oscillation when run through a wave filter leaves the main vibration, B, to go out to a delighted world while the ripple, C, is suppressed in the condensers and coils.

If this works so well with a broadcasting wave, you may wonder why it

system preceding that at which the noise enters.

**Static is Bad Actor**

Before going into a consideration of the various causes and forms of noise encountered in the broadcast system, it

will be worth while illustrating the general remarks of the above paragraphs by means of a specific example. Let us consider static. This enters the broadcast system at the receiving antenna. From its very nature it probably cannot be prevented from entering at that point. Practically all the correctives applied at the receiving station have proved at least partly unsuccessful. Those that have reduced the static usually have likewise somewhat reduced

hiss." This noise is peculiar to the carbon mike and is quite appreciable and becomes worse with deterioration of the instrument.

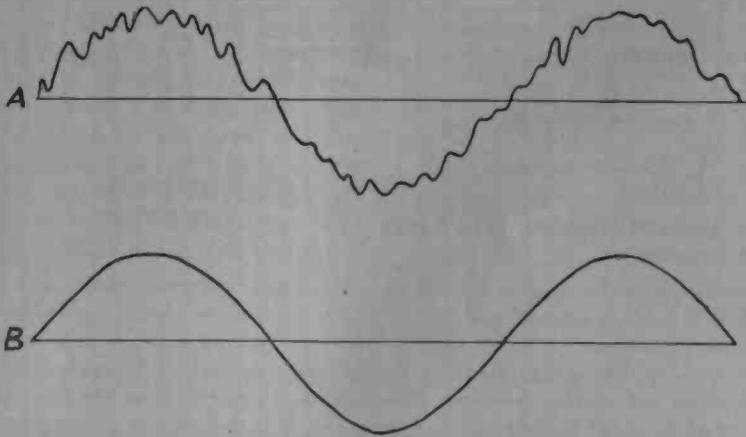
In a good carbon transmitter the hiss is tolerable only because the unit is a relatively efficient converter of sound into electricity, and gives a very loud signal compared to the noise. While the amount of hiss may conceivably be decreased by development of the carbon, and while the annoying effects of the

vice. It must be kept thoroughly dry, for example, since it takes but a small amount of moisture between the condenser plates to cause enough leakage to create considerable noise.

**Leaks up to 20 Megohms**

The construction of the amplifier for a condenser transmitter is also a very delicate proposition. For example, grid leaks of the order of 20 megohms are used and these must be absolutely noiseless. The condenser transmitter requires such a tremendous amount of amplification that the minutest noises are magnified thousands of times and become very disturbing, whereas these same noises could be disregarded when using a carbon microphone amplifier. When all these details are properly taken care of the condenser microphone is a noiseless affair.

The reason why condenser microphones are not used more universally is that they are, after all troublesome, requiring much more care and attention than the others, though certain stations, principally WGY, are using them very extensively. The magnetic microphone is not yet fully developed for practical use in this country, but it has quite a vogue in Europe. From a practical operating point of view the magnetic microphone would be the most desirable quality could be made



**Fig. 6. The Filter of Fig. 5 Won't Work on the Audio Frequency Wave, A, As it Would Make it Sound Like a Tuning Fork, B**

the signal, and so generally effected little gain.

One exception to this may be noted, namely correctives which have employed the directional effect in radio transmission. The receiving antenna structures involved, however, are such as to make them impracticable

hiss can assuredly be decreased by increasing the efficiency of the microphone (not a simple task without destroying quality of production), the noise itself cannot be eradicated. Thus a broadcast system employing microphone stations

our best

ing noises. Such tubes must be discarded. Most of such noise is probably due to what are termed "microphonic" tubes. They are especially susceptible to all kinds of vibration and shock. If the tube is not properly mounted, the elements inside are made to vibrate and the oscillations of these elements, fila-

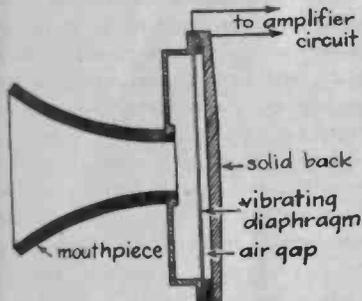


Fig. 7. A Condenser Type Microphone Has No Hiss Caused by Carbon, and is Very Quiet.

ment, grid, and plate cause a ringing noise, Fig. 8.

**Cord is Given a Shake up**

If the tube is mounted rigidly so that it cannot vibrate as a whole, when subjected to shock or oscillation, then those parts of the tube less rigid will take up the vibration. These parts are obviously the filament and grid which are made of very fine wires. The motion of either of these elements will cause considerable noise, as may be verified by tapping the detector tube in your receiving set. The only remedy for this is to mount the tubes so that the shock is taken up before it can get to the internal elements of the tube.

Some form of spring or rubber suspension for the tubes must be employed. Even in this case noise due to vibration of the tube is encountered due especially microphonic

plates of vacuum tubes is a potential source of noise. Plate energy is usually furnished by either "B" batteries, a DC generator, or some other medium for providing direct current, for example from an alternating current rectifier. "B" batteries must be watched very carefully. A single bad cell in a 45-volt block may drop the total voltage by only 1½ volts—a circumstance in itself totally negligible—but it may produce a veritable bedlam of noise, and also it may cause the amplifier to generate oscillations audible as squealing noises. The only remedy is to check the performance of the batteries frequently and carefully and to replace suspicious ones as fast as they show the least signs of misbehavior.

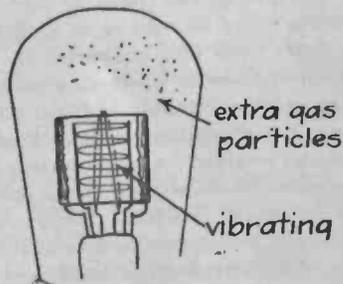
When a direct current generator is used to furnish plate voltage to the tubes of an amplifier a different problem presents itself. A DC generator is supposed to deliver pure direct voltage. Actually its direct voltage is always tainted with a trace of alternating voltage, because the DC generator really is a member of the AC family. This taint manifests itself as an extremely annoying and conspicuous rippling or humming noise which may be low or high pitched or both, depending upon various factors. There is only way to cure this noise: to use between the generator and the vacuum tube selective circuits which permit the pure direct current to flow to the tubes unmolested, but which hinder and absorb the flow of alternating current. Electric filters make such a selection possible and by its proper use and design it is possible to destroy completely every vestige of noise due to this alternating current ripple

through them. Such units must be carefully guarded against.

There is yet another link between the microphone and transmitting antenna which is a prolific source of noise if not properly engineered. This is the wire line Fig. 10, between a remote control point—a concert hall, theatre, hotel, etc.—and the broadcasting station, or the one employed when a program is being sent from one broadcasting station to another. The effect of imperfect contacts has been mentioned above and applies equally well in this case. Assuming that there are no imperfect contacts in a pair of telephone lines and barring the effects of lightning there is only one condition in which this telephone pair will not be subject to noise problems, and that is when the pair is removed to considerable distances from all other electrical lines and circuits.

**Stick up Their Ugly Heads**

Under these ideal conditions the telephone line will be perfectly quiet for it cannot be subject to any outside electrical disturbances. Whatever else may be done to the line under such circumstances, for example twisting them together, or separating them, or having



But that is the way telephone wires are used. They run on the same poles as other telephone lines and telegraph circuits, electric lighting lines or power wires may be on the same poles or nearby poles and so on. The telephone pair is therefore subject to all sorts of numerous disturbances, which act on its wires and induce voltage in them, and these

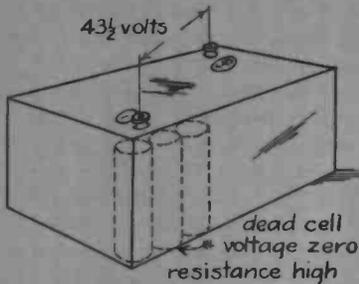


Fig. 9. One Cell is Dead. Although This Drops the Voltage Only a Little, It Spoils the Music

voltages cause current to flow in the wires and so cause noise.

#### When the Currents Balance

Obviously we cannot prevent such inductive interaction between wires, because this is due solely to their proximity. However, by the most painstaking engineering the effects of such interactions may be reduced to a negligible figure. The idea underlying the reduction of noise in telephone wires may be termed the Principle of Circuit Balance. A simple illustration will show what this involves. A telephone pair has two wires. Each of these wires is subject to outside electrical disturbances. If we can arrange matters so that the same disturbing voltage is induced in each wire of the pair, and if the two wires are exactly alike in every respect, the same current will flow in each wire. These currents oppose each other and so produce no effect in the circuit. The problem in keeping noise out of wire lines is that of keeping the wires and circuits properly balanced. The slightest unbalances will result in noise.

The two wires of a pair should have exactly the same resistance. This is especially important when, as is frequently the case, telegraph communication between stations is held over the broadcasting wires. In such cases the balance is considerably improved by the use of specially matched apparatus at each end of the line. Unless the balance

is very nearly perfect the telegraph clicks will be heard with the broadcasting signals. There must be no grounds on either wire of the pair, and there must be no cross-connection between the two wires.

#### Pair Must Change Places

Broadcasting wires are checked every day with a meter or other line testing apparatus for these faults. The wires of a pair must be so transposed that induction from other circuits balances out. In so-called cables the two wires of a pair are twisted together, and in open wires on poles they are transposed, that is the positions of the two wires are interchanged at regular intervals along the line. This results in the inductive effects balancing out. It not only is necessary properly to dispose the two wires of the broadcasting pair, but it is also important that the lines of the interfering circuits be properly balanced, for example the wires of a neighboring telegraph or power circuit.

In spite of all these careful safeguards noise may enter the line. For example the variable conditions produced by rainy weather and snow may result in serious disturbance, which it is not possible to eradicate. In cases where

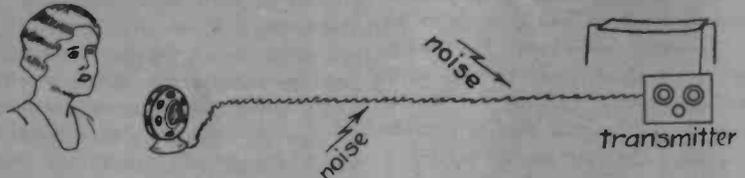


Fig. 10. A Remote Pick-Up Sometimes Brings in Noise from the Connecting Wires

the noise cannot be reduced we must resort to increased power properly introduced into the line. If this power is introduced at a point where it raises the program to a very high level, but does not raise the noise, then the former may ride over the noise successfully. This is one of the functions of the repeater or booster stations used on long broadcasting wires.

#### One Remedy—Brute Force

This covers, so far, the chief sources of noise at the transmitting end. The signal which leaves the transmitting station travels thru the ether medium and arrives at the receiving station antenna. Here the first noise problem encountered is that of static. In spite of all real

attempts and quack nostrums static persists. While we cannot actually eliminate it completely at present there is at least one remedy—brute force. Power and more power introduced at the proper point in the system, namely at the transmitter, is an effective way of dealing with this problem now.

In the receiver we are confronted with much the same problems as in the amplifier previously discussed. Microphonic and gassy tubes, dirty and poor contacts, noisy resistances and leaks, improper tube mounting, rundown batteries—all contribute their share in making reception unpleasant and intolerable. The same effort and care must be exercised here as in the transmitting amplifiers to reduce all disturbing noises to a minimum.

To one who is conversant with this problem and who appreciates that the sources of noise are legion, the wonder of it all is that there should be so little noise at all—neglecting bad static. Eternal vigilance is the answer. This involves a knowledge of the problems involved, their diligent prosecution for solutions, and the last but not least, constant and unflinching attention to what seem to be petty and annoying details.

The best broadcasting stations now present their programs against a desirable and practically silent background.

**GRAVITY BATTERIES.** Tested by Bureau of Standards. Runs 1/4 amp. tube for 2400-3200 hrs. No acid, sulphating or weekly attention. Price \$6.60 for 6, size 6x8, 3-lb. zincs, &c., 6.36 volts in series. Extra zincs, 6 for \$2.65. Blue vitriol, 25 lbs., \$2.65 (3-lb. per cell). Shpg. wght. crated 75 lbs.

**BALLOON AERIAL** for best DX. London-Paris with 1 tube. Write for literature. Hydrogen procured in tanks or made in jug. Price \$5 plus pstg. (5-lb.), large reel, gas fixtures, extra antenna wire, instructions, 3 30-in. balloons, etc. Satisfaction assured.

**CHIMNEY AERIAL.** Protected by asbestos, large 6-in. cage construction. Inconspicuous, chimney high and super-sensitive as an inside aerial. Price \$2, plus pstg. (3 lb.), 75 ft. heavy gauge coil antenna. Just drop it down chimney.

**INSULATED RIBBON WIRE.** To be wound edgewise for maximum inductance in making radio coils. Equivalent to No. 24 round wire. \$4.50 per lb.

EVERETT SCANLON, RADIO SPECIALTIES, LAKEWOOD, RHODE ISLAND.

# Direction of Development of Radio

## *What We May Expect in the Next Few Years*

An Interview with DAVID SARNOFF, General Manager, Radio Corporation

**Y**OU know the old song, "I Don't Know Where I'm Going, but I'm on My Way." That is perhaps not quite as pleasant as the other ditty, "Show Me the Way to go Home." So if it is possible to point out how radio is headed in its development, it may save broadcast listeners considerable time and money.

In discussing the progress and direction of radio development, let us begin with that branch of the art which forms such a vital part of our international communications. For after all, wireless telegraphy is the father of radio.

### Drawing Strands are Invisible

The year 1925 closed with the United States in the undisputed position of leader in world-wide wireless. From our powerful transmitting stations we have drawn the leading nations of the world toward us by invisible strands of communication. Radio circuits are now in operation between the United States and England, France, Germany, Italy, Poland, Sweden, Norway and the Argentine. Across the Pacific we are connected with Japan, Hawaii and the Dutch East Indies.

But the art of radio communication still challenges our imagination. It is not enough, measured by the possibilities of the art, that radio has lowered the rates in all classes of international messages; it is not enough that it has speeded up to a remarkable extent the service of messages across the seas; that it has established direct links with countries hitherto connected only by numerous relays through foreign countries; it is not enough that in the direct flashing of a message through the air, radio protects communication from censorship or interference by intervening countries. Since the successful demonstration of the photo-radiogram transmission early this year, when photographs and facsimile messages were sent not only across the country,

but over the Atlantic Ocean, and later, half way across the Pacific to Hawaii, our engineers have continued unceasing development in this direction.

### Lost in Flight to Hawaii

This service was demonstrated in the most dramatic fashion when the thrilling news arrived one day last September that Commander Rodgers and his crew, lost for nine days in their seaplane flight to Hawaii, were safe in Nawailihi Harbor. It would have been

letter and word for word into a completed sentence and paragraph, will open a new era. Letters, drafts, notes, checks, contracts and other commercial and legal documents could then be almost instantaneously reproduced thousands of miles from the sending point, and thus greatly add to the momentum of business, economy and convenience.

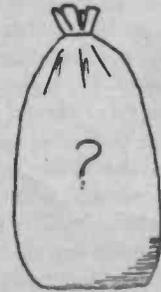
Already we are operating photo-radiogram circuits from Honolulu to San Francisco, and from San Francisco to New York daily for test purposes, and



\$ 300,000,000



\$ 350,000,000



\$ 500,000,000

Fig. 1. The Output of the Radio Industry is Increasing So Fast That it May Reach Half a Billion Sooner Than You Think.

many days ordinarily before an intensely eager public in the East would have had photographs of Commander Rodgers and his brave crew through newspaper publication.

The transmission of a photograph of Commander Rodgers from Honolulu and a picture of seaplane PN-1 as it was being towed into the harbor, transmitted over a distance of more than five thousand miles, was accomplished by the Radio Corporation of America in twenty minutes. On the same day the pictures were published by nearly every leading newspaper in the East.

### No More Woven Letters

The perfection of this system to a stage of commercial success will be an extraordinary event. The day when a facsimile message can be flashed across the seas instead of woven letter by

very soon service by this method to and from Europe will be opened upon a commercial scale.

### The Florida Land Boom

And the industry has developed almost as fast as a land boom in Florida. Consider that less than five years ago there was only one broadcasting station in the United States organized for the service of a public program, and that today there are over six hundred dotted throughout the country. Secretary Hoover has estimated that more than five millions of American homes are equipped with radio sets, and that approximately twenty-five million people listen in nightly to the programs of music and speeches broadcast through the air.

Consider that in 1920 the total expenditure in the industry was little

more than one million dollars for the year, and that in 1924 the sales of radio apparatus and supplies exceeded \$300,000,000. For the year 1925, our statistical studies indicate a total of approximately \$350,000,000. And it will not be long before radio will be a half-billion dollar a year industry. See Fig. 1.

#### It Made the Big Noise

Consider the phenomenal advance made by radio in the direction of service to the public, since the almost forgotten days of five years ago when phonograph or player piano music constituted the "big noise" of the broadcasting program. To-day the great symphony orchestras of the country and the leading artists of the operatic stage and concert hall serve the listening public.

Nevertheless, there are those who ask "Where do we go from here?"

Perhaps the next turn in the road may come into sight if we follow some of the directions which radio has been taking, as a service, as an art, and as an industry.

I begin here, for it must be recognized that upon the sending station is dependent the future both of the art and the industry. The social revolution created by radio broadcasting will become more apparent as time goes on. Five years ago the man who even once during his lifetime heard the living voice of the President of the United States was among the privileged few of his fellow citizens. To-day President Coolidge can speak, and has spoken, simultaneously, to an audience of approximately 25,000,000 people. Five years ago it was a mark of distinction, confined to residents of metropolitan areas, to attend an opera or listen to a great symphony orchestra. To-day millions in this land are able to tune in by radio and listen to concerts broadcast by leading operatic stars and symphony orchestras.

#### Ladies Attending Prize Fight

In less significant respects also has radio affected the social outlook. Pious ladies, who would be shocked at an invitation to attend a prize fight, have found themselves thrilled by the description of a championship contest broadcast by radio. Hardened sinners, who could not be dragged to the doors of a church,

have surrendered themselves to the lessons of prayer brought to their homes by radio. I am even told that some ambitious men are learning to cook, as a result of the household talks broadcast regularly from many stations. But the element of *entertainment* thus far has been the predominant appeal of the broadcasting program.

And yet the fact remains that entertainment is but one field of public appeal from which broadcasting may draw. Radio, as the latest and greatest means of mass communication known to man, must be essentially popular in appeal, but its true mission, I desire to emphasize, is that of service, of which enter-

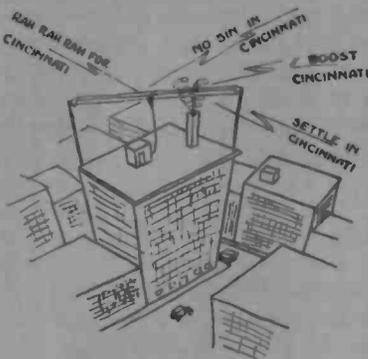


Fig. 2. Many Cities Are Now Supporting a Municipal Station.

tainment is but a part. Motoring began as a sport, but the automobile industry reached its greatest stability when the motor car became an essential element of transportation. The telephone was a toy at the beginning and a novelty later on. To-day it is a point-to-point communication service, of incalculable utility to business and the home. But it required more than fifteen years to develop the automobile to the transportation stage, and over a quarter of a century to make the telephone a general service in the home.

Broadcasting service clearly is destined to cover the following elements:

#### A Lifetime in an Hour

**Music**—The invisible audience which greets a great singer during one concert from the broadcasting studio is many times greater than the aggregate audience which even the most famous artists could hope to face in a lifetime. No other means has given to the indi-

vidual artist so wide an opportunity for recognition.

**Entertainment**—Radio has a distinct function to perform in the field of entertainment. In no other way can the home be made happy with as wide a range of entertainment and at so little cost.

**Political Education**—Hardly any subject should be, or could be, made of more universal appeal than political education. Many will recall the thrill of the first national conventions broadcast by radio. Popular interest in government would be enormously increased, if great national issues were fixed for debate by Congress at special night sessions and sent out by radio. Similarly issues debated at State Capitols might be broadcast by local stations.

#### Colleges are Already Alive

**General Education**—Radio already has penetrated into millions of homes in the United States. It is not improbable that within the next five years the radio audience in this country will reach more than 50,000,000 people. Some of our great universities are already alive to the tremendous opportunity for educational influence that radio offers. And I look forward to the day when the Board of Education of every big city in the United States will include in its activities a special extension course to be broadcast by radio from local stations.

**Information and Instruction**—Recently it has become increasingly clear that the great events of the day from this time forward will not only receive newspaper, but radio presentation, as well. Beyond this there are the services to special classes of the population—like market prices and agricultural information so vital to the farmer—which no other medium can convey so promptly. Lectures on household economics, child welfare, public health, and other subjects are program features still subject to systematic development.

#### Problem Solves Itself

And now, it may be asked, "How is this elaborate structure of service to be permanently supported? There is no direct tax upon the listening public; there is no governmental operation of broadcasting, as prevails in other countries."

My answer is that the problem has begun to solve itself.

Notwithstanding the fact that most broadcasters have found no way of obtaining direct payment from the listening public, the indirect returns are, in many cases, sufficiently impelling motives for them to continue sending. Already there is a long waiting list for the privileges of the air; the problems of congestion and interference within the limited waveband available for broadcasting have become so serious that Secretary Hoover has found it necessary to suspend the further issuance of transmitting licenses.

**Six Elements in List**

The elements of permanent support for broadcasting in the United States are becoming clearly defined in the following list:

1—*The Radio Industry*: Whether by individual or organized group effort, the radio industry must and will continue to contribute, for it is clear that without broadcasting there can be no radio industry.

2—*Commercial Stations*: Radio, by virtue of its mass appeal, is bound to become an important economic force; there is a definite place in business for this character of service. The doctrine of *public service* enunciated at the recent Washington Conference, and the force of self-interest, I believe, will determine the situation, for every broadcasting station knows that the loss of public good will means the forfeiting of confidence. Of course, no advertiser will be so blind to his own interests as to forget that only public acceptance can make his message of any value.

**Harvard and Yale Endowed**

3—*Educational Support*: The day will come, I believe, when every metropolitan Board of Education will have an appropriation for radio; when such great educational institutions as Harvard and Yale in the East, and universities and colleges in other parts of the country will have endowments for special broadcasting services that will carry the sphere of their influence far from the lecture room.

4—*Organized Social Support*: Many millions of dollars are spent annually in the United States for the promotion

of important social services, the improvement of public health, child welfare work and similar causes. Radio offers a means of public contact upon a scale unapproached by any other medium. Men and women who have devoted vast sums to the creation and support of cultural, educational and social endowments will not fail to see great opportunities for public service which radio makes possible.

**Cincinnati Starts Something**

5—*Community Broadcasting*: Cities and states throughout the country have spent large sums in the past ten years to tell the American public about their



Fig. 3. When the New Bound Brook Super Broadcasting Station Opened, the Mail Was as Above.

progress, their possibility and their needs. Perhaps Los Angeles and Miami were the first. But the Chamber of Commerce of Cincinnati, I believe, already has seen the handwriting in the heavens and business men of that city only recently have contributed generously to the support of a great broadcasting program from Cincinnati, Ohio, Fig. 2.

6—*Institutional Broadcasting*: Under this heading I include newspapers, department stores, and other organizations which have found in radio an important means of developing their prestige and of obtaining public good will.

These are among the permanent bases of support upon which broadcasting service is being erected.

**Areas Have no Choice**

With all that has been done along these lines, however, the fact remains that the country as a whole is not yet adequately served. There is a multiplicity of radio entertainment in some parts of the country, while other parts of the country are but poorly served. In the larger metropolitan centers the radio listener has a wide choice of programs; in other parts of the country he

is restricted to the offerings of the nearest local stations. Certain areas as yet remain completely uncovered by the useful range of any good broadcasting station.

Here lies the true significance of high-power broadcasting. The furor of discussion created by my proposals at the Washington Radio Conference in 1924 with regard to the erection of high-power broadcasting stations has subsided and there is now eager interest in what super-power may do towards the improvement of broadcast reception.

**Half of Bound Brook Power**

In the meantime, I may inform you that preliminary tests already carried out by our engineers, and conducted at approximately half the available power of our new broadcasting station at Bound Brook, indicate that the claims made for high power transmission will be fully met. Much remains to be done before we can say that we have even an insight into certain puzzling phenomena of radio transmission. But this much I can say:

If the evidence of nearly 50,000 letters, 97 per cent. of which are commendatory, thus far received by the Radio Corporation of America gives a reasonable cross section of public opinion, the experimental demonstrations of super-power broadcasting were extraordinarily successful.

**5,000 Watts is "Low Power"**

We did not expect to bridge the transitional period from low to high power without occasional complaint, justified or otherwise, of temporary interference. The time is still fresh within the memory when the five kilowatt station was feared as a menace to broadcasting. Today, no opposition on this score is heard, and 5 kilowatt stations are classed by many as "low power." But we did not hope for the results that actually have been achieved in the elimination of complaints.

Following upon engineering advice and assistance rendered by our organization, investigation discloses that not more than one-eighth of one per cent. of dissatisfied listeners registered objection against the operation of our super-power station, after they had adopted

simple measures to attune their sets to the new conditions of reception.

#### Musical Center at Crossroads

Super-power broadcasting, controlled by proper engineering conditions, will open a new era for the general radio listener in the United States. It is as impossible, practically and economically, for 600 local broadcasting stations to give the supreme character of program that may be organized by a group of super-power stations as it would be to

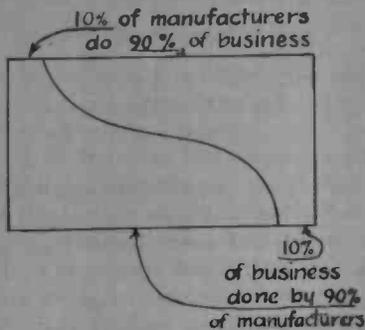


Fig. 3. Autos Are Made as Shown Above. Is Radio Coming to it, Too?

erect an operatic or musical center at every crossroad in the country.

And yet the fact remains that the farmer and his family in their prairie home and the small town dweller are entitled to as good a broadcasting service as is available to those who live in any metropolis, for unlike the mountain which would not come to Mahomet, there is that virtue in radio, that it can bring the city to the farm. Its mission from the high-power station is eventually to transmit to every home in the country the music, the entertainment and the educational influences developed in the great centers of population.

#### Local Stations are Permanent

Not only public but national interests demand a system of nation-wide broadcasting. For regardless of the number of local stations—and the local station, like the local newspaper, theatre and concert hall, will remain a permanent institution—there is need for a system of national broadcasting, ready for any public emergency, with facilities adequate to cover the entire country and to reach across the ocean whenever desired.

True, a sufficient number of stations to cover a considerable part of the country may be, and often are, interlinked by wire to act as one transmitting unit, but the fact must be faced that whereas the President of the United States may pick up his telephone in Washington tonight and talk across the continent to San Francisco, he could not without vast preparation, large expense and the voluntary co-operation of many broadcasting stations owned and operated individually, talk to even half the nation by radio. High-power broadcasting from a suitable number of stations connected by wire or linked eventually by short-wave radio relay would give the country a national system to supplement the services already offered by local broadcasting stations, and the system of interconnecting local stations by wire now in effect.

#### Crashing Through the Barriers

Last, but not least, are the problems of natural or atmospheric interference in radio transmission. Thus far the art has developed but one solution: Power—enough power from the broadcasting station to over-ride the barriers in the air and crash through the electrical disturbances now beyond man's control.

The principles accepted at the Fourth National Radio Conference in Washington this year, under the leadership of Secretary Hoover, will go far to develop broadcasting as a great and growing service to the American public. Radio is just emerging from the chrysalis of experiment and development to the solid basis of service. Much has been done in the creation of a web of local broadcasting stations that now dot the country; more will be done by the establishment of a national service, and the consequent extension of our broadcasting facilities to girdle the world. The programs that will soon come to us from the nations of Europe will only emphasize the need and purpose of further communication. For when we have brought Europe to our homes, South America and the Orient will still beckon.

#### Putting America in Lead

Now let us turn to the radio industry. Commercially speaking, this industry is the most dramatic enterprise in

business history. It might be said to have begun less than six years ago, when the Radio Corporation of America in 1919 was formed to take over foreign controlled wireless interests in the United States and give to America its well-deserved leadership in a new and great system of communications.

The first broadcasting station in the United States, organized for the regular service of a radio program to the public, was erected by the Westinghouse Electric and Manufacturing Company in East Pittsburgh, Pa., in 1920. This was at a period when the most intense laboratory activity, conducted by the great electrical and communication interests, was in progress. Radio engineers were working at fever heat in the inventive processes, which soon gave to this country an undisputed position in the art.

#### A Blockade is Threatened

The U. S. Patent Office was besieged with claims and counter claims. A gigantic battle for patent supremacy loomed upon the horizon. The diverse ownership of patents, methods, apparatus and circuits involved in the manufacture of radio apparatus and used in radio telegraph and radio telephone communication, threatened to create a blockade in the art.

In the immediate period that followed it seemed as if everyone who could turn a lathe and even some who couldn't, rushed, pellmell, into the radio industry regardless of patent rights, fitness or experience. At one time, over three thousand manufacturers of radio supplies and equipment were listed in the United States. To many these were glorious days of rising demand and unchecked inflation. The public apparently accepted anything that was offered in the name of radio.

#### Rode in on the Crest

As in every new industry, there were those who built for permanency upon the solid basis of safe financing, continued laboratory experiment and sound industrial development, and there were those who rode in upon the crest of "high finance," craving for a hectic industrial life, even if a short one.

The responsible factors in the industry saw clearly that the safe road to follow was the well-trodden path of eco-

conomic and industrial experience. They set out to grapple with the fundamental problems that confront every new industry, viz.:

- 1—To develop the art from the experimental to the practical stage.
- 2—To raise the standard of broadcasting so that the industry would be built upon a solid foundation.
- 3—To provide the necessary distribution system for radio products.

**46 Per Cent a Year**

The best industrial parallel of the growth and development of radio is in the automobile industry. In the automotive business, the period of experimentation, which extended from 1895 to 1903, manifested the same symptoms as have been evident in these first years of radio. The period from 1903 to 1916 constituted, I understand, the period of development in the automobile industry. During that period production increased at the rate of 46.5% per annum.

The period of stability, it seems, did not begin until 1916. This is manifested by a decline in the rate of production more commensurate with the demand, and the concentration of production in the hands of a comparatively few manufacturers. More than 90% of the total production of motor cars is now in the hands of less than 10% of the manufacturers by number, Fig. 4.

**Told by Dun and Bradstreet**

All of this is no more than the phenomena of economic progression. It is typical of every basic industry. The commercial casualties which occurred among automobile manufacturers during this time form a considerable part of the vital statistics of commerce, as recorded by Dun and Bradstreet.

It would have been easy indeed, during the period of liquidation, for the leading manufacturers in the radio industry to follow the sales tide if they were indifferent to the further loss and disorganization which would have resulted from such practice.

It would have been easy indeed to join the chorus of "Stabilization" when the radio art called for further experimental development. It would have been easy to concentrate upon production, regardless of the inadequacy of the apparatus produced. It would have been easy to pile on immediate profits regard-

less of future losses, by producing and selling radio apparatus upon an experimental rather than a service basis.

**Not Following Easy Path**

Records prove that industrial history generally repeats itself. Those who have not followed the easy path, but instead are contributing to the art and pursuing sound and financial and sales policies, and those who are helping to raise broad-



Fig. 5. Although Phonograph and Radio Started Out Differently, They Are Now Happily Mated

casting to higher levels, either by better operation of broadcasting stations or the contribution of improved broadcasting programs, will find that the radio industry is entering upon an even more prosperous era than has passed.

Radio bears a constructive relation to many arts and also industries, but in the combination with the phonograph industry, it has achieved the perfect flower of union.

Nowhere in the annals of business does quite such a parallel exist. The phonograph was a prosperous and soundly established industry when radio development loomed in its path.

**Meeting Other Half Way**

Radio brought more than the old phonograph could give, but both industries soon recognized the mutual relationship; both served the public with the arts of music and entertainment, Fig. 5. Radio receiving sets and phonograph recording devices had technical problems in common. Both made their primary appeal to the home. Each advanced half-way to meet the other in problems.

To-day they are happily married in the same cabinet. Radio has given to the phonograph its achievements in the electrical art, both in recording and re-

producing. The electric phonograph that has thus been born and the combination phonograph-radio receiving sets in their housings of splendid cabinets, which the leading factors in the phonograph industry are now distributing, have created a new service for the home.

**Has the Great Artists**

The phonograph industry in turn, through its contact with the great artists of the day, with years of technical experience in the study of acoustics and the well-organized distribution and trade channels at its command, will make a great contribution to the radio industry.

The great progress made in the development of radio receiving devices during 1925 are only now becoming apparent, as the latest products achieved by the art are being made available to the public.

The marked improvement in broadcasting, both from the standpoint of technique and of programs, will soon be demonstrated on a wide scale by high-power broadcasting.

The selective processes which have been going on in the upbuilding of distribution systems will be marked by stronger and better equipped retail sales channels, by servicing arrangements and by modern time-payment plans.

I look forward to a period of sounder, better and more prosperous development of the radio industry in 1926 than in any preceding year.

**A CORRECTION**

The article "This 'B' Eliminator Won't Burn Out," in our January 15th issue carried the author's name as McMurdo Silver. This was in error, and should have been Vance.

**A Slight Omission**

A few minutes after an alarm of fire was given in a hotel, one of the guests joined the group that were watching the fire, and chaffed them on their apparent excitement. "There was nothing to be excited about," he said. "I took my time about dressing, lighted a cigaret, didn't like the knot in my necktie, so tied it over again—that's how cool I was."

"Fine," one of his friends remarked, "but why didn't you put on your trousers?"—Everybody's Magazine.

# Are They Pirates or Protectors?

## Station WJAZ is Using A Wave Not Assigned It

An Interview by Commander E. F. MacDONALD

(EDITOR'S NOTE—This article is being presented as of interest to our readers, but we do not guarantee the accuracy of the statements nor take any part in the controversy.)

THE old saying has it that "What is one man's meat, is another man's poison." So most any famous person has followers who hail him as a liberator and also opponents who call him a tyrant.

In the same way Station WJAZ of Chicago is at present the center of a big controversy. They have been called "Pirates of the Air" (Fig. 1) because they are operating on a wave which has not been assigned to them by the government. On the other hand, many broadcasters especially the smaller ones, hail them as deliverers, as they are fighting the battle of those who are having difficulty getting a satisfactory wave and time assignment.

### Without a By-Your-Leave

The story was first told as far as known in the Chicago Daily News. According to them the government right to regulate the use of the air by broadcasters was tested for the first time by orders from the attorney general in the prosecution of the Zenith Radio Corporation (WJAZ). It seems that this station had only a very small opportunity to put its programs into the ether, and when they found a Canadian wave length unoccupied, they calmly adjusted their transmitter to vibrate at that frequency without the formality of by your leave to the Department of Commerce.

The Government sent district attorney Olson to prosecute the case and he announced that if he could find that they had committed anything actionable he would invoke the law to its fullest extent.

### They Might Fall in Line

Station WJAZ is licensed to use 930

kilocycles (322.4 meters), but they were found on 910 kc. (329.5 meters) by Federal Supervisor, E. A. Beane of the ninth district. The Government naturally felt that if one station was taking a wave which had not been given it by the authorities at Washington, perhaps others would be tempted to do the same thing.

The Government is reported as not

punishing the Corporation or certain of its employees for operating its radio broadcasting station WJAZ for more than two hours per week, the time allotted to it by the Secretary of Commerce.

### Protecting the Weak Ones

If the Government does take some action it will not be a surprise to us, as



Fig. 1. Is Station WJAZ a Pirate Which is Trying to Scuttle the Rules of the Dept. of Commerce?

sure that any specific laws have been violated. However, if such is found to be the case they will probably institute injunction proceedings and suspend the station's license or those of the operators. So much for the information contained in the Chicago Daily News.

How much this is worrying the station itself may perhaps be gathered from Fig. 2, which shows one of our artists, George Smith singing "Yo-Ho-Ho, and a Bottle of Wave Lengths." Fig. 3 shows another scene of the actors in a play "The Pirates" which was recently presented from WJAZ.

Various people have asked me about these articles appearing in the public press, from which it appears that the United States Government is about to institute some sort of legal proceedings against Zenith Radio Corporation, of which I am President, with the idea of

we notified the Washington authorities that we intended to go on the air for the purpose of making a test case in order to determine whether or not there is such a thing as "freedom of the air." Indeed the smaller sending stations feel that in making a test case we really are protectors of both the weaker local stations and also the public (Fig. 4).

But before bringing this matter to issue, we made every effort to obtain from the Secretary of Commerce some fair and reasonable division of time. I spent weeks in Washington with my attorney, Irving Herriott, pointing out the various channels that were open. All our efforts met with failure. The Department even refused to permit us to use a wave frequency that another station enjoyed and offered to us.

### Is He Abusing It?

We feel that not only we, one of the



Fig. 2. Although Sued by the Government, This Station Does Not Seem to be Much Scared

which the Secretary of Commerce is responsible, he is to-day asking Congress to pass legislation which will confer upon him even broader powers of discretion than those which he now claims to have.

**Two Out of 168 Hours**

As a further indication of the extent of this abuse of this alleged discretionary power, I want to point out the fact that the Secretary of Commerce has licensed 27 broadcasting stations on one particular wave frequency, yet permits other stations to enjoy an exclusive wave with no time limit. It is obvious that 27 stations cannot operate simultaneously on one frequency and be heard. In our own particular case he has licensed us to operate only two hours each week and has licensed another station to operate on our wave length the remaining 166 hours each week (Fig. 5) and even our little two hours is subject to cancellation at the request of the General Electric Company.

The public is justly complaining about the congestion, yet if there were an equal division of time and wave bands, and no favoritism shown, all could be heard and the public would receive real service without interference. In the litigation which, according to newspaper accounts, the Government is about to institute, there will be envolved necessarily the right of citizens of this country to use the air and have a fair division of it, but there will also be presented this question: If the Government has the

pioneers in radio broadcasting, but scores of other stations have been discriminated against. The Secretary of Commerce claims to have wide discretionary powers in the division of time between the broadcasting stations. I question whether or not he has such discretion, but if he has, I wish to state that in my opinion he is abusing this discretionary power, not only in our case, but in many others, to the detriment of the public and the radio industry.

The present chaos and congestion in the air which makes it almost impossible for the listener with the average radio set of limited selectivity to separate one broadcasting station from the other is not due to the great number of broadcasting stations in United States, but is the result of the improper use of the discretionary power which the Secretary of Commerce claims to have in the division

of wave lengths and operating time, and in spite of this chaotic condition for



Fig. 3. Another View of "The Pirate," Which Made Quite a Hit When Broadcast from WJAZ

right, shall it regulate in favor of monopoly and against the independent interests and the public generally?

The radio public to-day is fully aware of the fact that certain interests now claim to have what virtually amounts to a monopoly of many exclusive wave bands.

the broadcasters is obtained, Zenith will consider its efforts well worth the sacrifice, even though it might itself be unsuccessful in obtaining a reasonable share of the time for its own use.

Law That Makes Pirates

Our action has been referred to in the press as "Piracy of wave band not

apologies to the Honorable Lloyd George. I say, "What finger wrote the law that makes us pirates in the free air of America?"

In conclusion I wish to state that our position is that we fight for principle rather than for personal gain.

BIG STATION HAS MOVED

Remember that Station WJZ is no longer broadcasting from New York City, but is using the high power experimental station, 2XAR, in Bound Brook, N. J. If you are using a loop antenna (which is directional), unless you are located on a straight line which passes through New York City and Bound Brook, you will not receive maximum signals on the old loop setting. Try turning your loop when tuned in on WJZ, and see if you cannot turn down your filament rheostats, thereby reducing battery consumption.

CUTS SNOW BALL TARGET

The morning gymnastic classes conducted by Arthur Bagley and broadcast by WEA, New York, WCAP, Washington, WEEL, Boston, has gained adherents for many and varied reasons. But there are still some arguments previously unknown which induce radio listeners to arise early and cavort about under Mr. Bagley's direction, as indicated in a letter just received by WEA.

A gentleman in New Jersey requests an exercise chart in order that his "bay window" may be reduced during the winter months and his prominence as a snowball target diminished thereby.

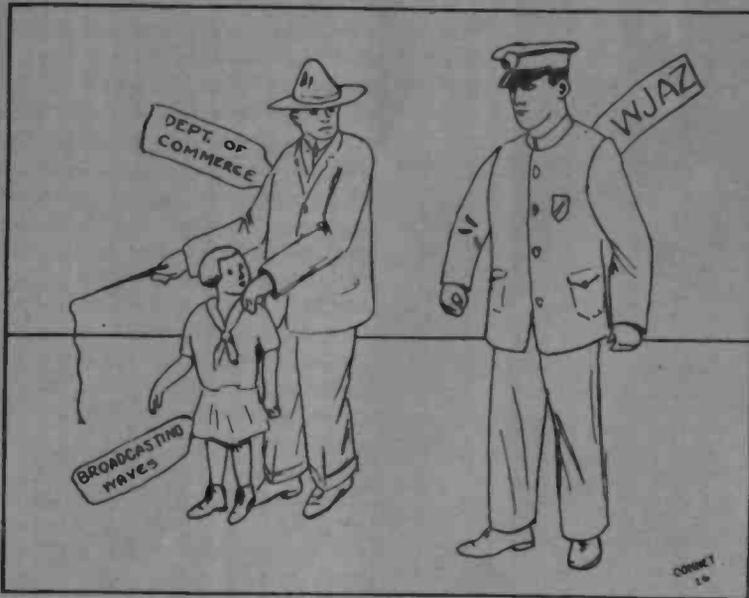


Fig. 4. Some of the Smaller Stations Hail WJAZ as a Deliverer and Rescuer

News Service at Top

In my opinion any institution other than one whose business is to disseminate news should have nothing which approaches an exclusive right to any wave band. News agencies are in the nature of public utilities, and their use of the air is of vital interest to the public generally. Such broadcasting should necessarily be given preference over music and other entertainment, but I say that none other than such should be given preference.

With the idea of settling one of the greatest questions presented by the development of modern science, Zenith Radio Corporation intends to litigate in every way possible the questions involved. We naturally desire a reasonable division of time for our own broadcasting station, but if we can by litigation settle the question of freedom of the air and a fair and equitable division of time in the interests of the public and

in use by any broadcasting station in the United States." With reference to this, I am reminded of the statement by one of the most eminent leaders in England's politics, who in discussing the land laws of his country said "What finger wrote the law that made us trespassers in the land of our birth?" With

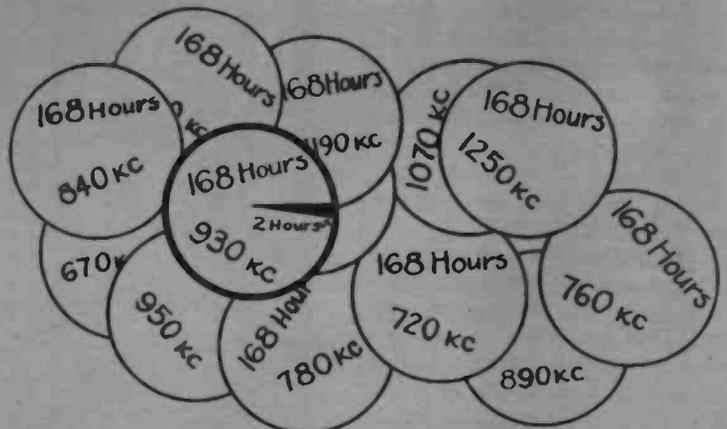


Fig. 5. Out of All the Hours in a Week, Only Two Were Assigned on One Wave to This Station



# EDITOR'S LOUD SPEAKER

## EUROPE BADLY SPOTTED

Reports have been slowly filtering in that the International Broadcasting Week was quite a success in every respect except in picking up European stations.

Many of our readers are wondering why the results this season were in general not much better than those of a year ago. There are probably two causes which are at work. Both of them are quite powerful.

### Picking Up Iceland

The first of these was the requirement that reception from abroad be verified by various official stations. To be sure the earlier trials were supposed to be checked up on, but at that time one fan's word was as good as another's and if a radio set seemed to be trying to register a shiver, the owner felt justified in saying that he picked up Iceland, and who would say he was mistaken?

But this season one had to record the time and the selection of any foreign broadcasting that was picked up. This had a very deleterious effect on many of the long distance sets particularly the single tube variety which in previous years were able to hear London quite easily. As a matter of fact, we have not heard of a single case of a one-tuber which was able to survive this terrible blight.

### Sun Has Skin Disease

The other reason for the difficulty which the majority of sets experienced in getting across the water was due to sun spots. The astronomers tell us that every 11 years the center of the solar system has a bad epidemic of some kind of skin disease which is revealed as dark patches on the

otherwise extremely bright surface of the sun. The cause of these disturbances is not known.

However, they are tremendous in extent, many of them being considerably larger in diameter than the earth. Occasionally one

year interval. The last manifestation was in 1915, and so the students of the heavens knew we were due for another this spring.

### Cause the Aurora

These spots apparently send



**HORN AND MIKE**

In the early days of radio broadcasting, a telephone transmitter was used with a large brass phonograph horn to pick up the music and voice. In this picture, there is shown one of the very first radio microphones used in broadcasting. In contrast to that, there is shown the very latest type of a microphone, as used in the WLW broadcasting studio. It has a new type of signal system which informs the artists when to "prepare" and when to "broadcast."

is big enough to be seen by the naked eye when observed through a piece of smoked glass or an old kodak film. Some spots occur from time to time during every year, but the greatest activity occurs quite regularly at the 11

out a tremendous stream of negative electrons. It is thought that these tiny charged particles are largely responsible for the Aurora Borealis or Northern Lights. At any event, this year the Aurora has been very marked

and with it are many electrical effects which are profoundly disturbing to radio transmission.

Currents in the surface of the earth are caused, which interfere not only with radio, but also with land lines. The American Telephone and Telegraph has reported that at times these currents have been so large that it has been difficult to use their long distance toll lines. Such circuits are locked up entirely in metallic wires and do not depend on the transfer of energy through the ether.

**Chances Are Slim**

Currents big enough to mess up a wired conversation would certainly have a big influence on the ether waves which have no wires to guide them. In competition with the faint whispers which might come from across the water during radio week, such earth currents have a power thousands or perhaps millions of times greater. The chance of getting through them to pick up broadcasting from England is certainly rather slim.

This condition was known ahead of time and it is unfortunate that in such a case nothing can be done to help matters. For a period of several months the activity of the sun spots will be at a maximum and summer and warm weather will be here before conditions improve much.

**HOW HARTFORD HANDLES IT**

When they deliver you a registered letter you don't care much who the messenger boy is who brings it. It might seem in the same way that the person who announces the name of a number on the program of a broadcasting station would be unimportant to the listeners.

However, such is not the case. Some of the popular announcers are well known by name and voice through half the United States. They display a lot of individuality, too. Some have developed the art of making up a

program to a point where it is way ahead of the average.

For instance, here is a little thing that is done by Station WTIC, Travelers' Insurance Company of Hartford. At the tail end of the afternoon list we read:

3:30 P. M.—Concert by Symphony Orchestra.

5:00 P. M.—Silent.

That word "silent" with the time is a small matter but it is a big help to anyone who might be prevented from tuning in during the early part of the afternoon. The concert at half-past three might perhaps last only an hour or less. But it is evident to the reader that if he can get back to his set even as late as 4:30, he can still pick up a half hour of good music.

We wish the other stations would adopt this idea of telling when they are going off the air.

**RIVERS RUNNING BY**

There is the story of the stupid looking boy who was found sitting hour after hour on the bank of a river. "Why are you here so long?" he was asked. "Oh, I want to get across and I am waiting for the river to run by."

Few people would want to delay as long as that. But up till recently there are quite a number of would-be fans who were afraid to buy a radio because they were waiting until they stopped improving them. It will be quite a while until that state is reached.

**Long Wait Ahead**

The estimates made by the Government as to the total number of radios now in the United States reached the surprising total of over five million. During this past year there was a big increase, but the tide is still coming in stronger than before. It looks as if 1926 were to be the banner year. People have begun to realize that if they wait long enough they will be sure of getting a better set than can be bought right now, but that it is foolish to forego all the pleasure

and satisfaction which would be obtained by getting an up-to-date set right now.

You see the fact is, as has often been mentioned before, that there is no big improvement in radios which are known to be coming through the factories of the big producers. There are plenty of detail changes and refinements on the way which will improve slightly on the present production, but they will not make very much difference in the operation of the receiver.

Of course this does not mean that the end of progress is in sight. There is perhaps a revolutionary change which may be in the mind of some inventor right now. However, it takes time and a lot of it to perfect an invention, experiment with it until the best sizes, windings, etc., are discovered and then finally make jigs and dies and machine parts to put it on a production basis. Experts say that it will be probably a year or two before any great change could be put through this long process.

It looks as if the biggest development for 1926 would probably be in the improvement of programs and the technical end of the transmitting stations so that the character of entertainment and education picked up will be way ahead of last year.

**TIME BETWEEN CHARGES**

The capacity of storage cells is rated in ampere-hours. Thus a battery with a 100 ampere-hour rating is of sufficient capacity to deliver, when fully charged, one ampere for 100 hours before it is necessary to charge it again, or two amperes for 50 hours, 1/2 ampere for 200 hours, etc. If a radio using one 200 type tube and two 201-A type tubes be run from a 60 ampere-hour storage battery, the number of hours service between charges may be calculated as follows:

2—201-A tubes require..... 1/2 ampere  
1—200 tube requires..... 1 ampere  
Total current used..... 1 1/2 amperes  
Capacity of battery equals 60 ampere hours. 60 divided by 1 1/2 equals 40, the total number of hours service between charges.

# R<sub>x</sub> DR RADIO PRESCRIBES.

**NOTE:** In this section the Technical Editor will answer questions of general interest on any radio matter. Any of our readers may ask not more than two questions, and if the subjects are of importance to most radio fans they will be answered free of charge in the magazine. If they are

of special interest to the questioner alone, or if a personal answer is desired, a charge of fifty cents will be made for each answer. This will entitle the questioner to a personal answer by letter. However, if the question requires considerable experimental work, higher rates will be charged.

**Question.** There have been some schemes recently for putting a voltage on the grid return without using a "C" battery. This consists of a resistance inserted in the connection between "B" minus and "A" minus. Is this a good idea?

**Answer.** Such a hook-up accomplishes the result of giving you as much grid bias as you like by merely adjusting the resistance which you mention at the proper value. However, there are two serious objections to such a connection. In the first place the amount of grid bias will vary with the current flowing through the plate circuit. The more tubes you have working, and the higher the filament voltage is adjusted, the greater will be the grid bias. Audio waves coming through the set also give variations in biasing voltage which keep in step with the waves themselves and in this way cause distortion.

An even more serious objection to this scheme is that the value of the bias

voltage which is obtained in this manner is subtracted directly from the "B" in its effect on the plate. Thus if you have a "B" battery which has fallen to 40 volts and you have a grid bias of 5 volts, the net amount of "B" available for the plate circuit is only 40 minus 5, or 35 volts. The cells of "B" which are really supplying equivalent of "C" battery run down much faster than they would if used in the ordinary way as a "C," owing to the fact that they pass all the plate current of the tubes, whereas a standard hook-up uses no current through the "C." For these reasons, the scheme suggested is only a makeshift, and a poor one at that.

**Question.** In the descriptions of the fight between broadcasters and music copyright holders, there have been several references to the copyright law as applied to talking machines. What is this regulation?

**Answer.** By act of Congress, any composer or copyright holder of music who permits any one talking machine record

manufacturer or piano roll maker to reproduce his composition, is required to release the copyright to all manufacturers who desire it. The uniform price to one and all is established at two cents for each record or music roll.

**Question.** Why is it that a bad "B" battery will sometimes cause a whistle in the set?

**Answer.** "B" batteries go wrong in one or both of two ways. The obvious way which it is easy to measure is that of falling voltage. Thus the pressure will drop from 45 volts in a new unit to about 34 volts when the battery should be discarded. If, however, it is continued in use, the potential keeps on falling till it reaches 0 as a limit. Besides this the internal resistance keeps increasing as the unit is used. It is this increase in resistance which causes a voltage in the plate circuit, and so a sort of feed back action which creates the howl or squeal which is sometimes heard when the "B" batteries are kept running beyond their useful life.

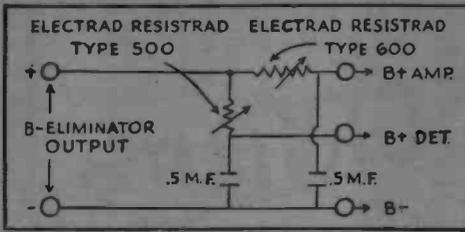
## HAVE JOINED THE GANG

Answering many questions, S. L. Rothafel, (much better known as "Roxy,") whose intimate style of broadcasting has gained him thousands of friends throughout the radio world, announces that there are several changes in the personnel of "His Gang" which appears Wednesday evenings before the microphone of WEAJ, WCAP, WJAR, WEEI, WWJ, WLJB and WTAG. "Roxy's Gang" has been one of the

most popular radio groups ever since he first presented his programs a few years ago. Their cooperative spirit, fine musicianship and the intensely human note continually sounded by their leader, the genial "Roxy," have all combined to make this a feature that knows no rival in broadcasting circles.

With a nucleus of artists who have been with him since the beginning Roxy has carefully selected the members of "The Gang" which has done much to add to the attainment of its

present reputation. To Gamby, the dancer and singer, and Douglas Starbury, baritone; Frank Moulan, comedian; "Daddy" Jim Coombs, baritone; Geoffrey O'Hara, popular song writer; Duke Yelman and his orchestra; Florence Mulholland, exceptional contralto; and Frederick Fradkin, violinist, the old standbys of the Gang, have now been added Adrien da Silva, tenor; Jack Oakley, bass; Ann Robinson, soprano; Helen Clark, mezzo soprano, and several instrumentalists.



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**Y**OU will be surprised at the improvement in your reception made by these new-type Resistrads. They insure smooth and noiseless variable resistance—accurate, dependable and sensitive to your slightest adjustment. A few turns of the knob give you an available voltage variation equivalent to a B Battery with 100 taps.

By using Electrad Resistrad Type 500 to control detector plate voltage, and Electrad Resistrad Type 600 to control amplifier plate voltage, you can adjust your eliminator to operate any kind of receiver with maximum clearness and volume.

Ask your dealer to show you Electrad Resistrads. If he hasn't them, send us his name and we will see that you are properly supplied.

- Electrad Resistrad Type 500—10,000 to 1 meg-ohm, for detector plate control—\$1.50.
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I prefer to place my secret within the easy reach of everyone. Therefore, the price I am going to ask for VI-FLECT—my wonderful method of memory-building, which I have developed and perfected during my 30 years of constant study and application is ONLY \$5.00. Let nothing stand between you and a successful, happy, prosperous future. If it is not convenient to enclose the money, or if you prefer, I will mail your copy of VI-FLECT and you can hand the small amount to your postman when he delivers the package. The important thing is—SEND NOW.

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Dear Sir: Please send me my copy of VI-FLECT for which I enclose \$5.00. I will try your VI-FLECT method of memory-building for 10 days, and if it does not increase my memory 100% I am to return it and you are to give me my money back without argument.

Name .....

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# Radio Dealers!

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RADIO PROGRESS offers an especially attractive proposition for dealers who are willing to devote a portion of their time to securing subscriptions for this magazine.

We receive many letters from fans stating that they are unable to secure the magazine regularly, and forwarding their subscriptions. There is no reason why you can not develop business along these same lines.

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## *Radio Progress*

*8 Temple Street*

*Providence, R. I.*

*P. O. Box 728*

# It Was Little Ruth's 9th Birthday

Ruth MacDonald already had a radio set. It was a single-tube affair and worked very well, so that she was able to bring in outside stations all by herself. But she wanted more distance and louder music.

Mr. MacDonald had heard about the RADICLEAR kit for adding another tube to a radio set. He had an idea, although his daughter was so young, she ought to be able to follow the easy directions which come with the kit. So for a birthday present he spent \$6.00 for the outfit. She was tickled to pieces. With no tools but a screw driver, a pair of pliers and a drill, she was able to hook-up this amplifier complete all by herself.

She was very much pleased with the performance of the set, but the greatest delight came from the fact that she put it together herself.



The hook-up for the RADICLEAR Transformer can easily be followed by any one who is intelligent, even if he has no experience at all with radio. The kit includes the famous RADICLEAR  $3\frac{1}{2}$  to 1 ratio audio transformer and also a socket, rheostat, four-spring jack, binding post, wire and instructions.

Of course, the big thing about this kit is the transformer itself. The coils are wound on a Universal machine and the insulation between layers has been especially developed for this use—that is one

reason which accounts for the very small losses in the windings. You hear the result as unusually sweet music.

The Taylor Electric Company,  
1206 Broad Street,  
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Please send me the following by parcel post. (Mark which one you want.)

Radiclear Audio Transformer @ \$3.95

Amplifier set complete @ \$6.00

(Socket to fit.....tube)

Audio Crystal @ 25c.

Gold Plated Cat Whisker @ 15c.

I enclose \$.... to pay for these.  
(These above prices include the postage.)

Send them to me C. O. D. I will pay the above price plus postage.  
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