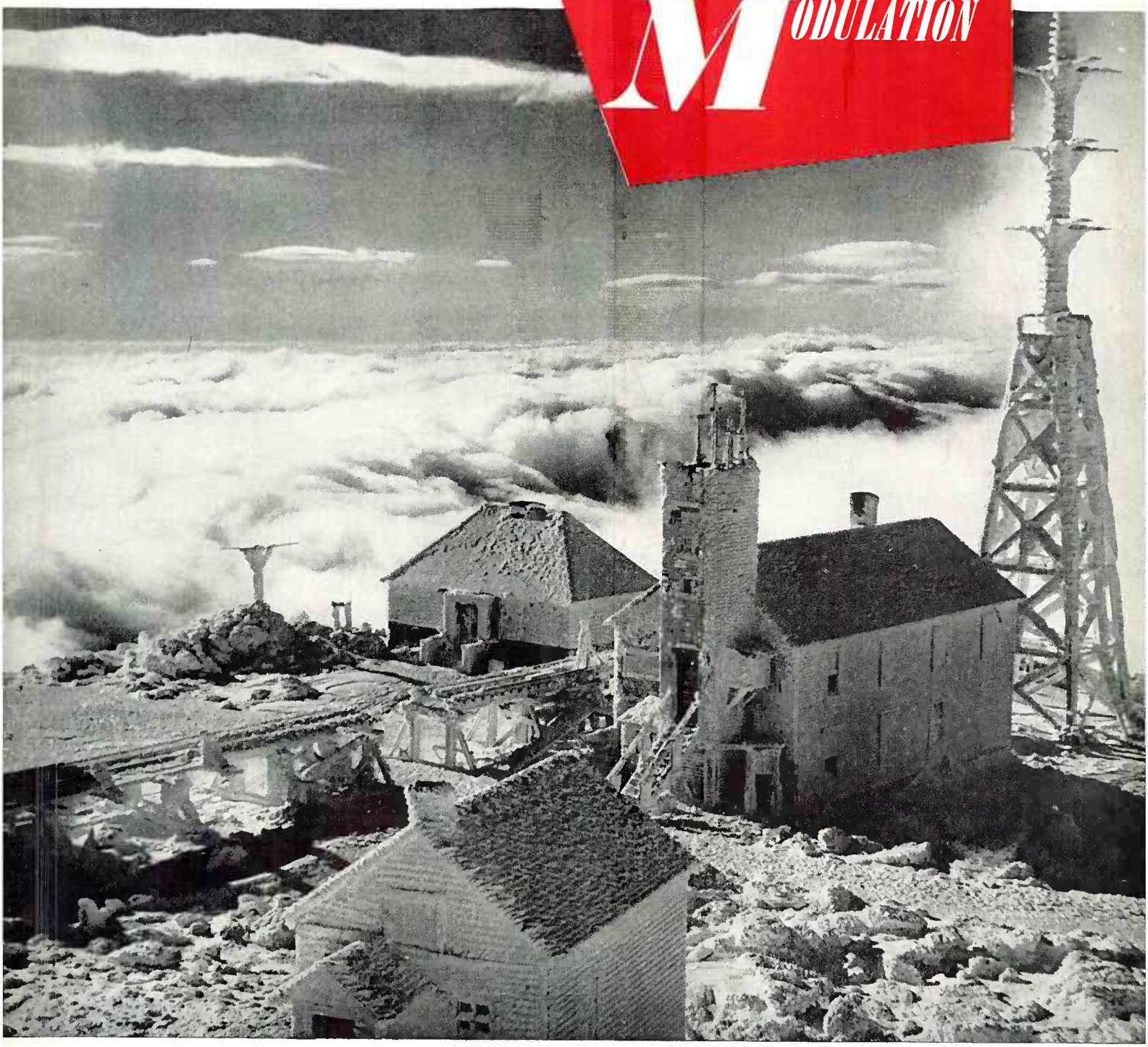
THE JOURNAL OF

FREQUENCY MODULATION



FM AS I SEE IT by FCC Chairman Paul A. Porter

PLANNING AND BUILDING AN FM STATION by Paul A. deMars

FEBRUARY, 1946

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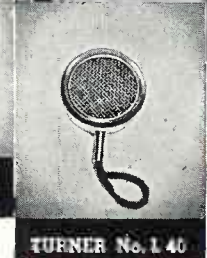
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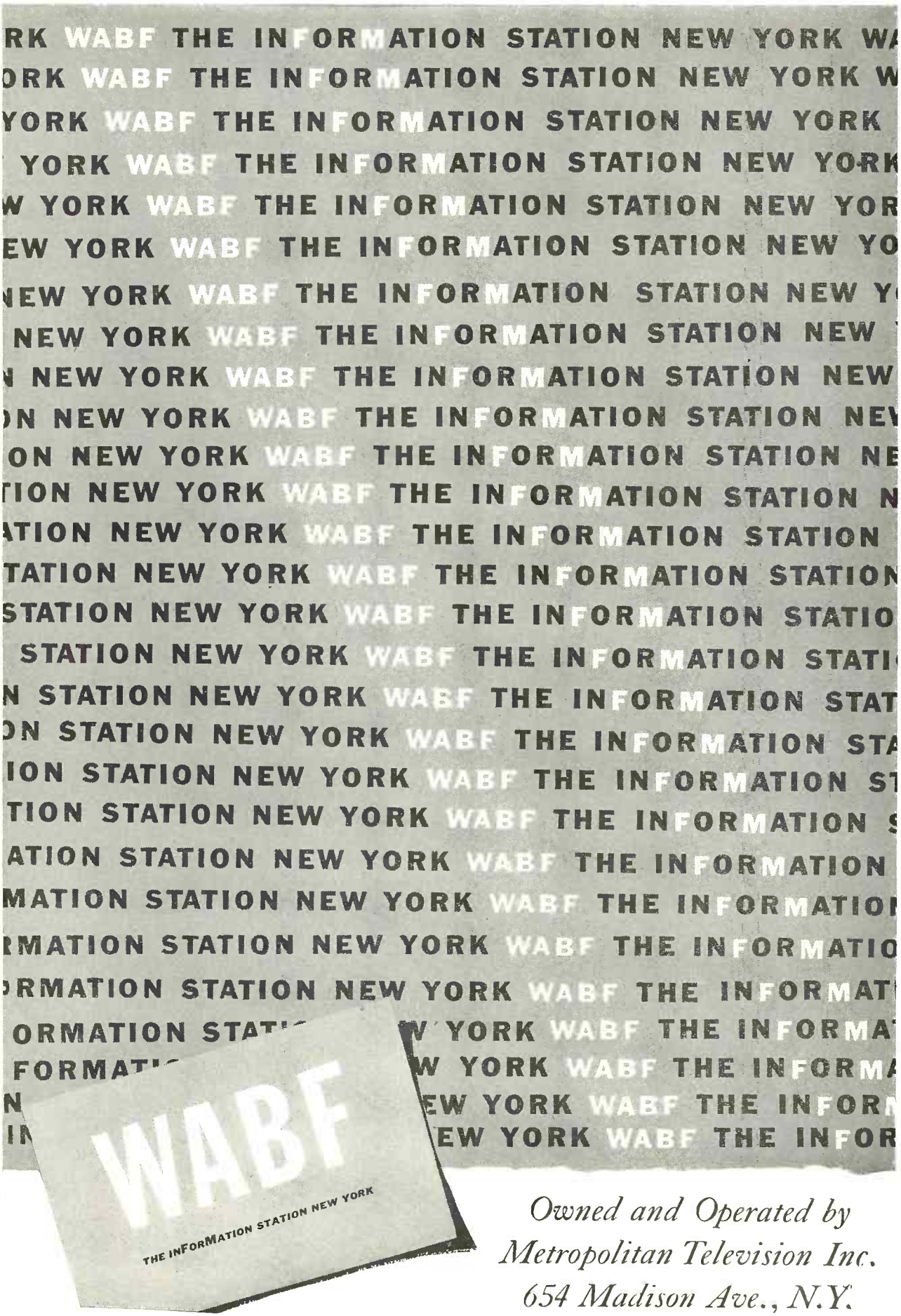

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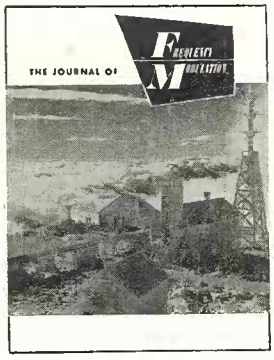
ON THE COVER: At summit of 6,300 ft., Mt. Washington near Sargents Purchase, N. H., where winds often sweep at 180 miles an hour and temperature drops to 40 degrees below zero, is transmitting plant of Yankee Network's WMTW. Antenna structure is just back of famed Mt. Washington Meteorological Observatory. Small structure at left background is generating plant at terminus of cog railroad. At left of generating plant is horizontal dipole used by snow-icebound Yankee staffmen for communication with outside world.



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A New Industry . . . A New Journal

GRADUALLY but inexorably, FM is destined to become the basic medium of aural broadcasting in the United States.

The new vistas opened up by this great new development stagger the imagination. Thousands of additional stations will be built, all capable of superior signals, many emphasizing community and specialized interests, the whole of them destined to give the radio listener greater diversity and a wider choice of programs.

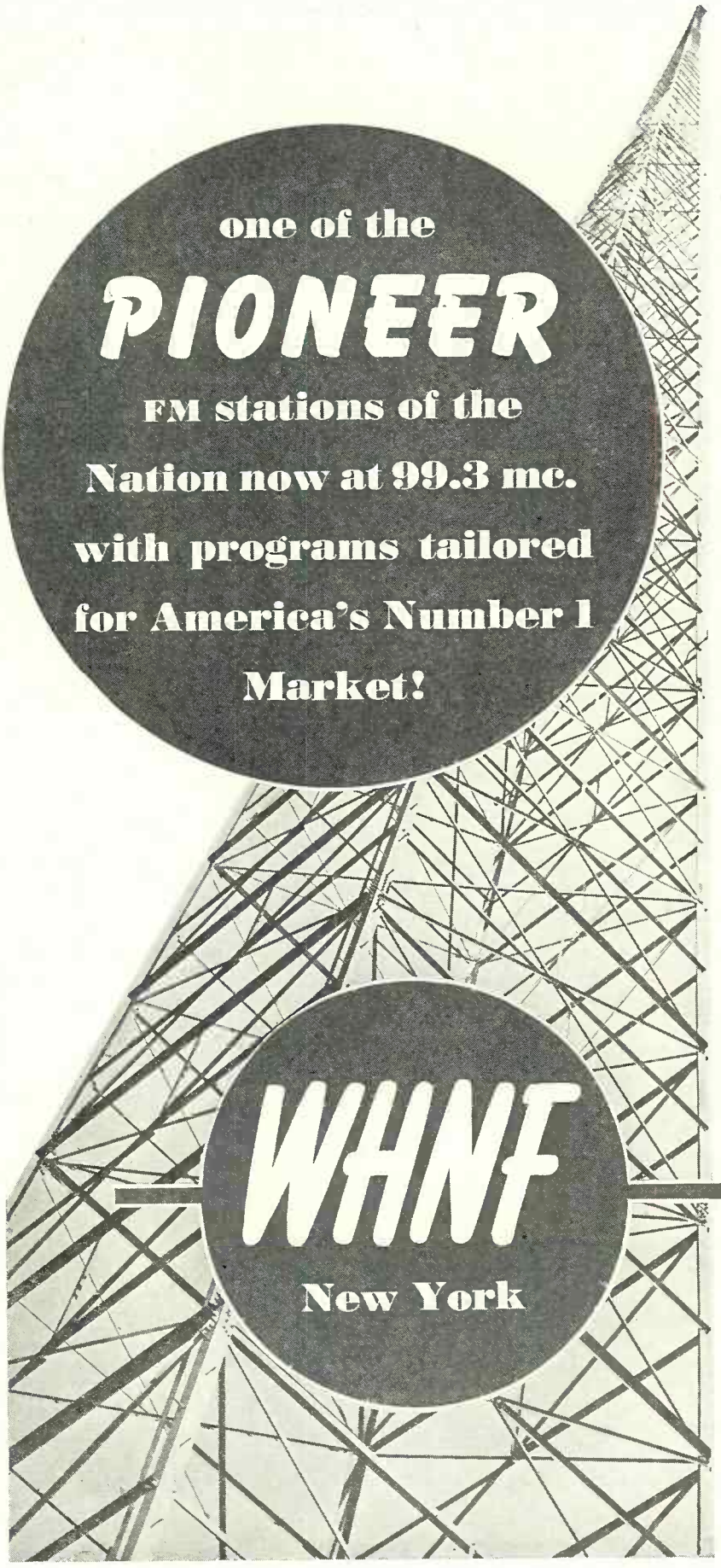
Considering the increased knowledge of radio learned during the war and the simplified equipment devised under wartime stresses, and taking into account the willingness of new capital and new people to enter the field of broadcasting, we may well expect that FM will make faster strides even than standard broadcasting, which is only 25 years old and which it will largely displace.

In the confident belief that we are on the threshold of a new era in American broadcasting, this publication is being launched as the journal of the FM broadcaster, advertiser and technician. Its executives and staff are mostly old hands at radio journalism. Every man jack among them has seen war service, mostly overseas, some in the Signal Corps, some with the great Army publications *Yank* and *Stars & Stripes*. Nearly all of them are young, zestful converts to the new radio arts, eager to grow with an industry that beckons just such youth.

In their youth, in their zest, in their eagerness, I believe they truly epitomize the great new art and industry that is FM.

With this dedicatory issue, we make this promise to our readers: that we will grind nobody's ax, play nobody's game but that of the FM industry as a whole as it comports with proper public service. Our guiding light will be the simple principles of good journalism.

Martin Codel



With towering antenna atop the famous Palisades overlooking New York, WHNF *has been serving New York* FM *audiences since June 1, 1942*

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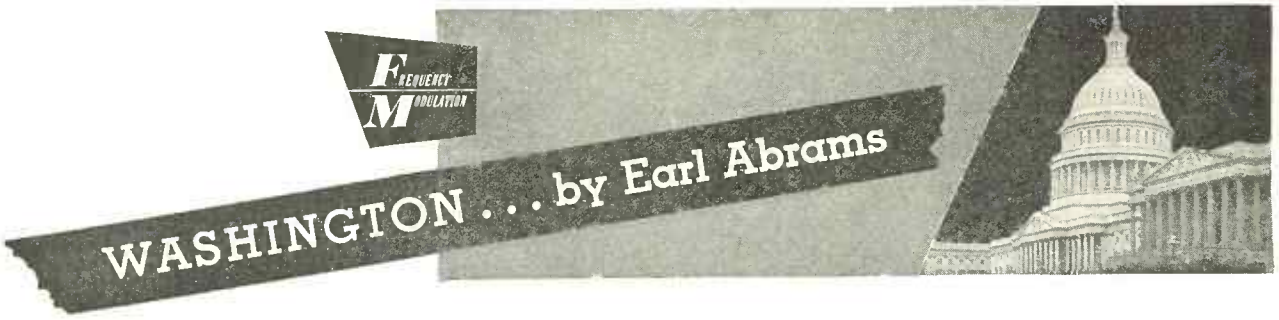


CLOTHING THE FM SKELETON

• For years, FM has been dancing around the laboratory and research breadboards, its open circuit like a skeleton unclothed.

On the Hudson's Jersey side, just above New York, at Alpine, Major Edwin H. Armstrong has been testing and redesigning and testing again. Over in Meriden, Conn., Dr. Franklin M. Doolittle's WDRC-FM has for nearly seven years been transmitting FM programs, duplicating largely his AM station at Hartford—perhaps the first FM station to go on the air on regular schedule. Out in Kansas City, Everett Dillard's KOZY has been sending its signals out day after day, to be picked up by the adventuresome few local listeners with FM receivers.

Then, of course, there are the two pioneer Yankee Network radiators at Paxton and atop Mt. Washington, FM's great showpieces, which for a long time (as FM's life is measured) have been serving the crowded population areas of New England.

Settlers Follow Trail Blazers

Today, those pioneers and the less than 50 other early commercial FM licensees are being joined by an increasing host. New settlers are following the trail blazers. The skeleton is being clothed.

Into the broadcasting field, via FM, within the next five years or so are to come an anticipated 2,000 to 3,000 operators. Soon the broadcasting industry may well amount to half FM broadcasters; within the decade, FMers may well outnumber present AM broadcasters, for FM, if we are to believe its proponents, will eventually displace all standard regional and local operation. The good will drive out the bad.

Who are these FM broadcasters? Can we see among the ranks of those who are in, or who want in, the personality profile of the broadcasting industry of a few years hence?

We think we can.

Most of the applicants for FM, of course, are existing AM operators—even including many high power, clear channel AMers who have least to fear from FM but who are going into the field as "insurance." It's only the smug and the shortsighted broadcaster who hasn't seen the light.

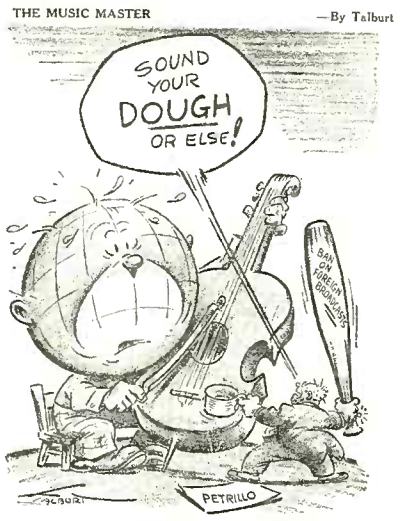
As 1946 began, several hundred FM applicants had been patted on the head by the Federal Communications Commission with what it called "conditional grants." Essentially that meant that, barring unforeseen complications, they were in.

Something like 25% of these grantees were newcomers to the broadcasting art. Newcomers, in the sense that they are not affiliated with AM.

They, the independent FMers, then, may give us a clue as to who is to be who in FM.

What jumps out and hits us in the eye immediately is that newspaper publishers are, far and away, the leading figures among those proposing to crash radio via FM. Just to name a few of them, large and small:

The Atlanta Constitution; New Orleans Times-Picayune; Baltimore Sun; Nashville Banner and Tennessean; Tulsa World and Tribune; Ontario (Cal.) Daily Report; Freeport (Ill.) Journal-Standard; Lawrence (Kan.) Journal-World; Haverhill (Mass.) Gazette; Claremont (N.H.) Eagle; Wilmington (N.C.) Star-News; Newark (O.) Advocate; Bethlehem (Pa.) Globe; Brownsville (Tex.) Herald; Wausau (Wis.) Record-Herald.



Scripps-Howard Newspapers

Publishers, some of whom fought broadcasting so bitterly in the '20s and early '30s, have opened their eyes to what they have missed and are jumping aboard the new radio bandwagon.

Even among the pioneer FM licensees, newspaper owners are prominent—nearly all of them, of course, also in AM but indicating an awareness of progress that bodes well for their future operations. They are: Chicago Tribune (WGNB); South Bend Tribune (WSBF); Baton Rouge Advocate & State Times (WBRL); Worcester Telegram & Gazette (WTAG-FM); Detroit News (WENA); Superior Telegram (WDUL); New York Times (WQXQ); Rochester Times-Union (WHEF); Winston-Salem Journal and Twin City Sentinel (WMIT); Columbus Dispatch (WELD); Philadelphia Bulletin (WPEN-FM); Pittsburgh Post-Gazette (WMOT); Salt Lake City Tribune and Telegram (KSL-FM); Milwaukee Journal (WTMJ-FM).

And, of course, there's Eugene Meyer's Washington Post with W3XO, the Jansky & Bailey developmental FM purchased last year which he seeks now to convert into a commercial.

Newcomers Largely Publishers

Among the applicants for new FM stations—and there are almost 800 now—publishers in or out of AM account for 50% more or less.

Jack Knight, whose Miami Herald got into radio by purchasing into WQAM, seeks to parallel that and his other newspapers in Chicago, Detroit and Akron with FM. Scripps-Howard's chain of a score of newspapers and a handful of AM stations seeks the limit in FM—outlets in Cincinnati, Cleveland, Pittsburgh, Indianapolis, Memphis and San Francisco. The Speidel chain wants FMs in Poughkeepsie, Cheyenne, Reno and Monterey, Cal. The Newhouse group, new to radio, wants voices for its newspapers in Jamaica, L. I., West New Brighton, N. Y. (Staten Island), Newark and

(*Continued on page 48*)

Another First

for that Baltimore independent

W-I-T-H FM

The first FM station to operate in Maryland.

W I T H

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FCC Chairman Porter Says:

"American engineering genius has cut through the technical barriers in the path of this new industry. Now it is the turn of the electronic mass-production field to take over. . . .

"No one who has ever heard the interference-free, full-bodied, crystal-clear tone of FM can ever again be quite content with the limitations of AM. . . .

"FM should be one of the earliest and brightest boons of the reconstruction era."

FM AS I SEE IT

By PAUL A. PORTER

The Chairman of the Federal Communications Commission sizes up the prospects for the new art, and finds them good.

THE waiting years are over. Daydreaming and doodling turn into action. A vast new industry arises in the wake of the tragedies and triumphs of war. America gets a new voice. FM is on its way.

There are many harbingers of success for this new broadcasting enterprise. But if any other omen were lacking, we could be reassured by the entry into the field of a new magazine like this one. Magazine publishers, traditionally gifted with David Harum-like shrewdness, are not prone to backing a horse which, as they say in Kentucky, doesn't show good "early foot."

American engineering genius has cut through the technical barriers in the path of this new industry. Now it is the turn of the nation's aces of the electronic mass-production field to take over. All eyes are now turned to the assembly line for the flow of transmitters and receivers needed to tool up this burgeoning new department of broadcasting.

There are heartening manifestations that the manufacturers are determined not to enact the role of the weak link in the FM chain. A recent canvass of manufacturers made by the Commission revealed encouraging progress in the production of the lower-powered transmitters and the availability of some 10 and 50 kw transmitters by summer. Antennas and consoles seem to present no problem.

By the time FM towers begin to dot the landscape, receivers should be in the hands of the public in satisfactory volume. While there is considerable preoccupation at the moment with supplying AM sets to a radio-hungry market, I am sure that there will be reasonable synchronization of receiver production with transmitter production. I feel that word-of-mouth advertising will be a tremendous factor in stimulating the demand for FM receivers. No one who has heard the interference-free, full-bodied, crystal-clear tone of FM can ever again be quite content with the limitations of AM.

Prudent Buyer Wants FM, Too

With FM in the offing for hundreds of communities, prudent customers will think twice before making large investments in receivers which will not bring in FM as well as AM.

For the benefit of the public, I would also like to record here once again that this new broadcasting service will be coming to them over the most efficient channels for that particular type of radio service that the Federal Communications Commission could find in the spectrum. That band of frequencies was selected after the most comprehensive public hearings and thorough-going deliberations in the Commission's history.

This reconnaissance of the spectrum to discover the most interference-free highways for FM has insured the soundest technical foundation stone on which a vast superstructure can be reared through the years.

One of the hopes aroused by the invention of FM was that it would open an era of abundance in the ether. To a large extent this has been realized.

The Commission's allocation plan provides for approximately 1,500 Metropolitan and Rural stations. Under this plan the larger American cities can have from 50 to 100 per cent more FM stations than their present number of AM stations. (Slightly more than 1,000 stations have now been authorized in the standard band.) In addition to these allocations, there will be available channels for thousands of Community stations.

And right here I would like to make a prediction. At this writing, I note a strange tendency on the part of the broadcasting fraternity to look down their noses at the Community channels. They see it as a sort of consolation prize in the allocation sweepstakes. Their sights are set for the Metropolitan or the Rural channels. My prediction is that one of these days, not very far off, they are going to realize the true worth of these channels and the rush will be on and the Community station will come into its own.

Class IV or local stations in the standard band are fought and bled over for the creation of profitable broadcasting properties. Yet the coverage of the FM Community channel is markedly superior. The whole trend of broadcasting points to the steady upward climb of the local station. My own belief is that whatever expansion accrues to the standard station will accrue to the FM station in fuller measure. This great reservoir of Community

channels opens up new and exciting vistas for local service programs all over the nation and for the stimulation of local trade through increased opportunities for local advertising.

Fundamental policy questions confronted the Commission in its task of blue-printing the FM structure. What was to be the role of AM? Should it be circumscribed so that newcomers might have a bigger field? Would program duplication by the AM interests help or hinder FM growth? Should channels be reserved for veterans?

In the end, after the most serious deliberation, the Commission resolved these problems in favor of giving immediate FM development the green light. It did so with its eyes open and fully aware that in doing so, it unavoidably was endorsing the existing broadcast structure with which it is dissatisfied in many particulars.

Initial Impetus from AM

Of course, only the future will reveal the soundness of our decision to permit FM to receive its initial impetus from AM. But as of today I am still persuaded that FM will become a nationwide service faster, will have fewer growing pains and will be of greater benefit to the public than if we had chosen any other course.

In the light of the fears of AM domination that have been expressed and in view of the Commission's open Sesame, I confess I am somewhat surprised that more AM owners have not joined the procession. About one-half of the AM licensees are still hold-outs.

Veterans and other newcomers not in a position to make the necessary elaborate preparation required for a full-dress application have benefitted from the Commission's provision for preliminary applications containing only a minimum of engineering data.

Furthermore, I think it is apparent that the greater good of the vast majority of veterans will be served by the increased job opportunities which will result from getting a large scale industry like FM off to an early and substantial start.

Bearing in mind the grave responsibilities it has, in order to avoid the haphazard growth of standard broadcasting and all the evils that ensued, the Commission has endeavored to insure a logical, orderly growth for FM. For example, despite the leeway it has given AM to enter the FM field, it has taken precautions and is prepared to take such further steps as may be necessary from time to time to enable FM to realize its fullest potentialities.

The 300 grants to FM applicants which have been made up to this writing have been conditional grants and they will not be made final until the applicants satisfy the Commission as to their program plans and other operating policies.

In those cases where there are more applications than available frequencies, the Commission is holding public hearings so that the fullest information may be developed to enable it to determine the best qualified. The Commission wholeheartedly welcomes the submission of any facts from the public bearing upon the qualifications of any applicant or licensee. Licenses are granted for only one year. In considering applications for renewals, the Commission will have an opportunity to check promise against performance and to recapture any channel which is not being employed in the public interest.

Neither Nightmare Nor Bonanza

I don't know how the historian of the future will appraise the conditioning of the infant FM. There are some today who see FM as an underprivileged child. There are even hints of conspiracies to follow the Greek custom of abandoning the child on a mountain top exposed to the wild animals. There are others who fear that FM may become the poor little rich girl. Some say it needs more of a mother's care and others are alarmed lest it be tied too much to mother's apron strings.

My own view is that FM's status is not the perfectionist's dream. Neither is it the licensee's nightmare, nor his bonanza. FM as now designed is a practical, workable system susceptible of being built into a service of tremendous public benefit to the nation and to afford jobs and profits to thousands of Americans who invest their time and money in its development.

FM should be one of the earliest and brightest boons of the reconstruction era.

INSIDE radio circles, it is generally conceded that Chairman Porter is giving the FCC the best administration in its stormy dozen years of existence. That goes even among those who may sometimes disagree with the Commission's policies and rulings or, as is more often the case, with public utterances of some of its members.

Paul Aldermandt Porter at 41 is one of the youngest top administrators in the Government, and one of the ablest. The frequent rumors about new jobs for him, ranging from the White House secretariat to Senator from Kentucky to big posts in private industry, attest to the fact that many see him destined for more big things. To all these rumors, his laconic reply usually is, "I have no present intention of resigning." But few expect him to remain through his present term, which expires in 1949.

Son of a Baptist minister, he was born in Joplin, Missouri, October 6, 1904. His father had a call to a pastorate in Kentucky the following year, and he spent his childhood and youth there, attending Kentucky Wesleyan 1923-26 (during which time he served as a reporter on the *Lexington Herald*) and then being graduated from the University of Kentucky Law School in 1928. One year's fling at law in the little town of Central, Ky. persuaded him he preferred journalism, so he became editor of little dailies in Mangum, Okla., and LaGrange, Ga. In 1933 he came to Washington to do publicity work for the Agricultural Adjustment Administration. Soon he was back in law, as special counsel to AAA Administrator Chester Davis.

In 1937 Columbia Broadcasting System's Washington office beckoned him as counsel, and he worked the next five years with Harry Butcher, who later was to become General Eisenhower's naval aide and confidant. Soon after Pearl Harbor, President Roosevelt called him back into the Government as deputy administrator of the OPA in charge of rent control. In June, 1943 he became associate administrator of the War Food Administration but within a month he was sent in to pinch hit as associate director of the Office of Economic Stabilization.

He was appointed to the FCC chairmanship to succeed James Lawrence Fly in November, 1944 after handling campaign publicity for the Democratic National Committee. He performed the latter job with such notable diplomacy that he became—and still is—one of the Washington press-radio corps' favorites. A sparkling raconteur, he throws a pat quip into even the most serious hearings or conferences which he conducts with none of the stiff restraints that often betoken Federal officialdom.

Planning *and Building an* fm *station*

by Paul A. deMars

The former chief engineer of Yankee Network and builder of its two pioneer FM stations provides some pertinent facts and offers some sound and needful advice.

THE technical characteristics of FM broadcasting which permit the establishment of thousands of new stations serving small and large communities has directed the attention of many to serious consideration of owning and operating new FM facilities. It is therefore timely and appropriate that the principal facts, considerations and procedures involved in the planning and establishing of an FM broadcasting station be presented.

Radio is regulated by the Federal Communications Commission, which was created by the Communications Act of 1934. This act, among other things, directs the FCC to effect fair, efficient and equitable distribution of radio service to each State. It authorizes the Commission to issue licenses, and modifications and renewals thereof, to applicants financially, technically and legally qualified in accordance with the conditions set forth in the Act, and to determine that public interest, convenience or necessity would be served by the granting thereof. The Act further directs the Commission to classify radio stations, prescribe the nature of the service to be rendered, assign bands of frequencies, determine locations, regulate the kind of equipment, promulgate rules and regulations and establish engineering standards.

APPLICANTS for construction permits, licenses, renewals of licenses and modifications thereof are required to submit detailed information concerning citizenship, financial resources, partnership agreements, details of corporate structure, technical information on equipment, the location of the facilities requested, the estimated service area, and the population proposed to be served.

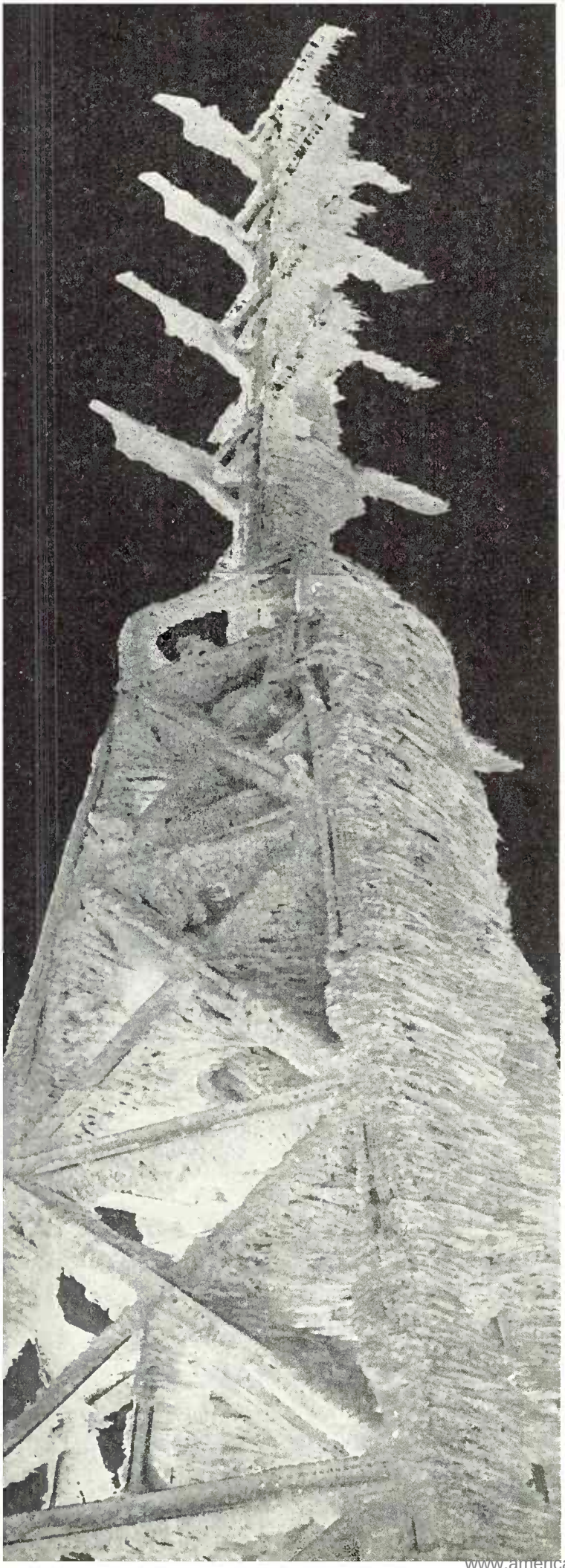
In promulgating the rules and regulations and standards governing FM broadcasting, the FCC has attempted to carry out the fair, efficient and equitable distribution of this type of radio service in accordance with the technical and economic considerations that govern the service that can be rendered. Three classes of stations are authorized. They are Community class stations, Metropolitan class stations and Rural class stations. These several classes of stations are intended

Mr. deMars

No man knows his FM better than Paul Alva deMars, who supervised the expenditure of about $500,000 of Yankee Network's money in constructing its pioneer WGTR at Paxton, Mass., and WMTW atop Mt. Washington in New Hampshire. Recently discharged from the Navy, where he served as a radio specialist, Comdr. deMars was Yankee's chief engineer from 1930 to 1942. He is now associated with Raymond M. Wilmotte, Inc., as a Washington radio consulting engineer.

deMars was introduced to Maj. Armstrong in 1936 by another veteran engineer and FM enthusiast, Paul F. Godley. Invited to attend a lecture by FM's inventor, deMars was deeply impressed by the proposed new system of broadcasting and struck up a friendship with Maj. Armstrong that has carried them together through the pioneering days of FM. After the June, 1936 hearings on high frequencies held by the FCC, deMars told his chief, John Shepard 3rd, what he thought about FM. He was authorized to go ahead and build an experimental setup. Within a few years he had both the Mt. Washington and the Paxton stations in operation.

Of French Huguenot stock, Paul deMars was born in Lawrence, Mass., January 2, 1895, was graduated from M.I.T. in 1917. During the last war he was a master sergeant in the Army overseas. He is justly proud of the "showcase" plants he built for Yankee, which along with Maj. Armstrong's own Alpine transmitter and Dr. Franklin Doolittle's early WDRC-FM did so much to prove the early case for FM.



to provide FM broadcast facilities to meet the needs of the principal types of areas to be served; namely—the smaller cities, towns or communities, the metropolitan areas and the surrounding territory, and the predominantly rural areas, respectively. The three classes differ principally in the extent of coverage provided.

FM is assigned channels in the VHF spectrum. Coverage is proportional to the effective radiated power (transmitter power times antenna power gain) and the height of the antenna above the surrounding terrain. The FCC Standards of Good Engineering Practice contain a propagation curve which gives the so-called ground wave signal range for FM broadcasting for various transmitting antenna heights. This data is the computed field intensities over flat terrain under average atmospheric conditions. It is useful as a guide and an arbitrary administrative standard for estimating station coverage. To the very short waves used in FM, hills and mountains are obstacles, in effect causing radio shadows and thereby reducing coverage. To correctly estimate coverage in hilly or mountainous country a detailed study is required, taking into consideration all factors which affect VHF propagation.

The prospective FM broadcaster's first step is a study (in collaboration with his engineers) of the area proposed to be served to determine the class of station appropriate to serve the area, taking into consideration all technical and economic factors. The following characteristics with respect to coverage of FM broadcast stations may be taken as a guide.

The field intensity considered necessary for FM service according to FCC standards is as follows:

Built-up city areas or business districts in cities having over 10,000 population	1,000 mv/m
Rural areas	50 mv/m

FOR the purposes of allocation the United States is divided into two areas—the first area (Area 1) includes South New Hampshire, all of Massachusetts, Rhode Island and Connecticut, Southeastern New York as far north as Albany-Troy-Schenectady, all of New Jersey, Delaware, the District of Columbia, parts of Maryland and Eastern Pennsylvania as far west as Harrisburg. This area may be extended if the demand for frequencies exceeds the supply. The second area (Area 2) embraces the remainder of the United States. Rural class stations are not authorized in Area 1.

The Commission has established a maximum radiated power height of antenna formula (250 watts-250 feet) for Community class stations that results in urban coverage for about ten miles (1,000 mv/m) and rural coverage for a distance of about 32 miles (50 mv/m) under ideal conditions. However, the rules and regulations permit a minimum separation of co-channel stations of 50 miles, and an adjacent channel

ICE-CLAD ANTENNA of WMTW atop Mt. Washington, a closeup view. No effort is made to de-ice since low temperatures and high winds prevailing during winter months render this impracticable. Ice does not affect signal appreciably, according to Yankee engineers.

WINTER CREW preparing to inspect Mt. Washington FM tower.

separation of 35 miles for Community class stations. When the demand for this class of station results in allocation with minimum separation, the interference-free service area is limited to about ten miles.

THE COMMISSION'S ALLOCATION plan for FM stations for the United States for use as the basis of allocation for metropolitan and rural FM channels is based upon an effective radiated power of 20 kilowatts and antenna height of 500 feet above average terrain. When not limited by interference, urban coverage of Metropolitan class stations will extend to about 32 miles and rural coverage to about 60 miles over flat terrain under average atmospheric conditions. In sections of the country, however, where the demand for FM stations exceeds the available channels, the separation of stations may be reduced to a point where the interference-free service is restricted to about 30 miles as it already is for all practical purposes in Area 1. The Commission emphasizes that this allocation pattern is tentative only and that departures will be made wherever it is found desirable to do so. From a practical standpoint, however, the foregoing coverage figures represent a fair estimate of the minimum and maximum coverage that can be expected under ideal conditions, with less coverage attainable in hilly and mountainous regions.

Rural class stations are required to serve an area that is substantially greater than Metropolitan class stations, and the area must be predominantly rural. This class of station, therefore, must use the maximum effective radiated power and height of antenna that can be justified economically.

Where high natural elevations are available for transmitter sites, and 20 kilowatts or more effective radiated power is employed, ranges of 75 miles or more appear possible under favorable conditions of terrain. However, propagation characteristics and tropospheric fading impose a practical limit to the distance that reliable service can be rendered in the FM band even from high antennas. Reliable service to a distance of 100 miles, even if not precluded by interference from co-channel and adjacent channel stations, is probably possible only part of the time due to transmission vagaries causing signals to vary widely in intensity at distances beyond the optical horizon and drop below useful values frequently.

The Commission proposes to allocate substantially the same facilities for the coverage of each designated service area. All stations serving a given community, metropolitan area or region will be authorized to use transmitting facilities that result in substantially the same coverage in their respective service areas. This policy achieves equality of competition between stations serving a given area with respect to coverage.

Having determined the class of station desired, the prospective FM station operator will consider the cost of construction and operation of the proposed facility.

Recently the FCC made a study of the cost of equipment for FM stations at the request of the Senate Small Business Committee. Exclusive of real estate, studio and transmitter buildings and furnishings, tower construction, installation costs, engineer and attorney fees, the average costs were published to be as follows:

250 watt station	$ 9,508.00
1 kilowatt station	$14,758.00
3 kilowatt station	$17,858.00
10 kilowatt station	$27,308.00
50 kilowatt station	$80,558.00

Since these figures represent only the bare cost of the essential equipment, they are misleading as to the actual cost of constructing an FM station for any of the three classes authorized.

FROM PERSONAL EXPERIENCE in the construction of broadcast stations, the writer believes that the *total* cost involved establishing *complete* FM broadcast facilities in the three classes authorized will be more nearly in accordance with the following:

Community class station	$15,000 to $ 25,000
Metropolitan class station	$60,000 to $100,000
Rural class station	$85,000 and up.

Many factors can modify the above estimate, but the prospective broadcaster is warned that usually the result is increased cost and that in practice lower costs will be the exception.

The height of the transmitting antenna above the surrounding terrain is the most important single factor

(*Continued on page 50*)

ONE always stands out...

and in Philadelphia it's **WFIL**

Yes, you've seen it happen many times.

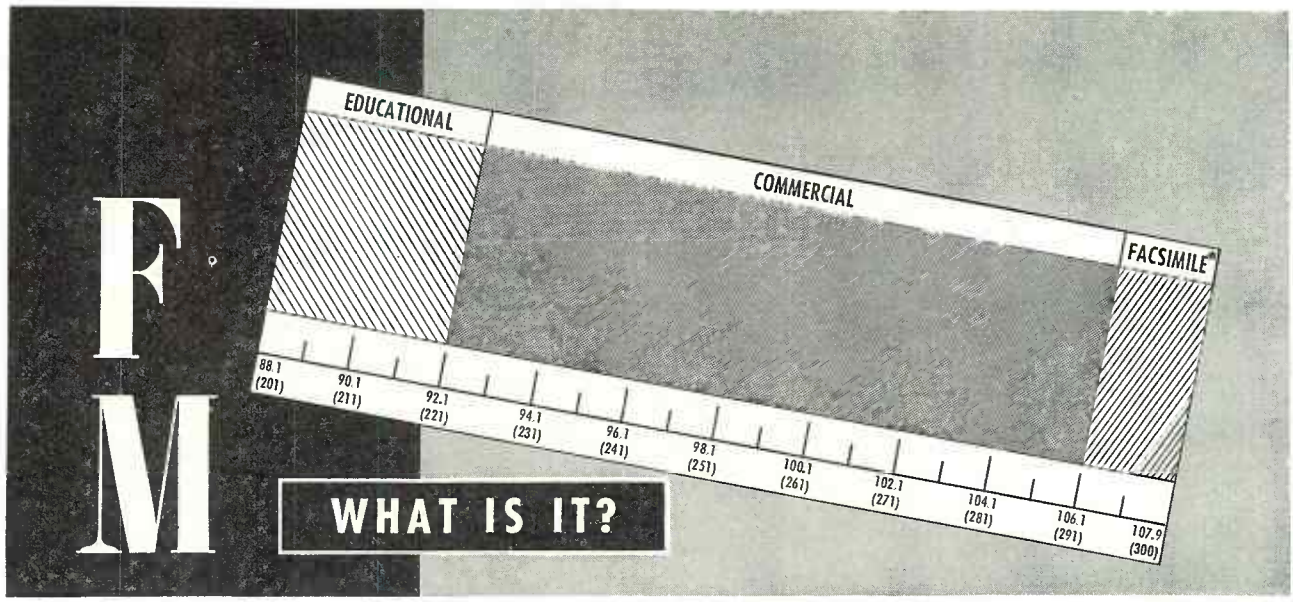
Out of a bevy of beauties, a string of race horses, a set of golf clubs or a collection of paintings—*one* will always stand out.

With those who know "The Philadelphia Radio Story," one station stands out for many reasons. Better programming—better promotion—better merchandising—and better public service features are building better listening in *more* homes and a better advertising buy for *more* advertisers on WFIL.

Any apperceptive advertiser knows, too, that you can look to WFIL for stand-out performance in the future. FM is one of the better broadcasting services in which WFIL has already made great strides. For future sales in the nation's third largest market, check now with WFIL, the ABC Affiliate in Philadelphia or the Katz Agency in New York.

First Again . . . . ICE HOCKEY
NOW EXCLUSIVELY BROADCAST OVER
WFIL-FM

WFIL-FM
First IN COMMERCIAL **FM** IN PHILADELPHIA



Commercial FM in Area I

By DR. O. H. CALDWELL

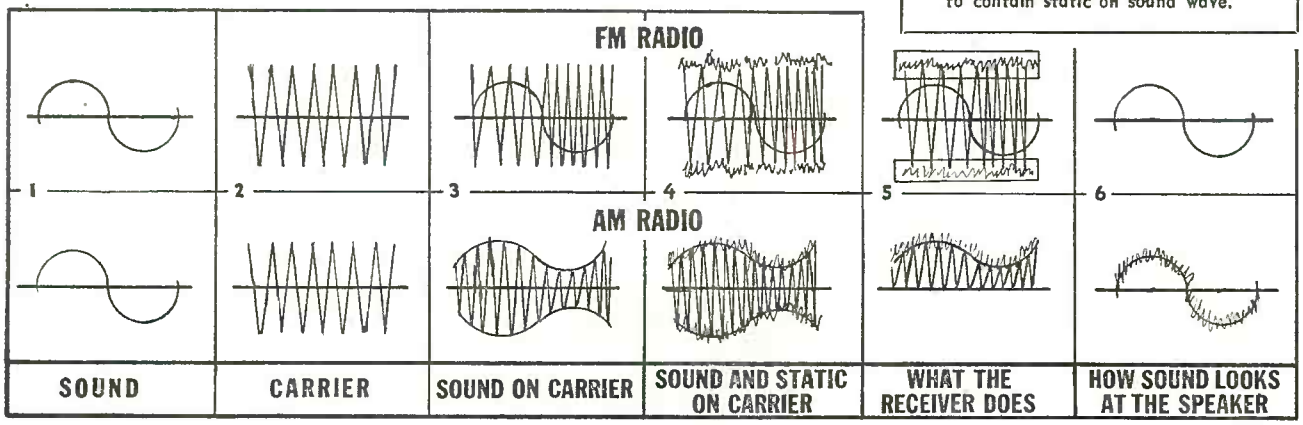
ALTHOUGH Frequency Modulation interests have spread the gospel of this new transmission, the prospective consumer audience is generally unaware of the advantages of this new form of radio propagation. In a study recently made, it was determined that only one in seven of the general public had heard of FM. This poor response indicates the approach on the part of manufacturers and broadcasters so far has only confused the public; what is needed is a greater simplification of FM's versatility and efficiency.

To the ardent radio listener there is nothing more destructive to his enjoyment than having a nearby vacuum cleaner aligned with the audio component of the carrier frequency. It is the job of the manufacturer and the broadcaster to point out that static-free or noise-free reception is characteristic of the FM receiver. The prospective listener should understand that FM is not a gadget or device to be coupled onto the old set, but is a completely new form of radio transmission. FM should not be construed as AM all dressed up.

In FM the sound waves are reproduced by momentary changes of modulation of the frequency of the carrier wave. This is in contrast to the ordinary standard broadcasting (amplitude modulation or AM) in which the amplitude or volume of the radio carrier wave is continuously being modulated. If broadcasting is to be compared to a light blinker message system in which dots and dashes of light are to be sent, AM can be compared to switching the light on and off to produce the signals, while FM would have as its analogy the changing of the color (or frequency) of the light, the brightness of which remains uniform.

FM, the improved system of broadcasting now being introduced, has as its outstanding advantages (1) the elimination of practically all static and interference, both natural and from man-made sources; (2) absence of background noise, attaining complete silence in the set itself, and (3) since the frequency bands assigned to this service are wider than allotted the AM band, a wider range of audio frequency response is obtained. High notes and overtones in musical selections and voice can be reproduced, giving greater fidelity and naturalness.

1. Electrical sound wove leoving the microphone is same as in conventional rodio.
2. FM corrier before it accepts sound wave is similar to AM carrier.
3. After carrier is moduloted, height of FM carrier remains the same while frequency changes in accordance with sound much like an accordion. AM carrier, however, vories in height.
4. Stotic attaches itself to moduloted carrier, affecting only carrier in FM, but both sound and carrier wove in AM.
5. Whereos the FM receiver is designed to trim off the distorted portions of carrier wove, the upper holf of moduloted wove is used in AM rodio.
6. Discarding carrier wave, the FM set eliminates static and reproduces a cleancut signal; AM rodio continues to contain static on sound wave.



$600,000,000 MARKET

By Frank Mansfield

Director of Sales Research, Sylvania Electric Products, Inc.

Mr. and Mrs. Radio Listener want FM. They will buy FM-AM combination sets during the first two or three postwar years and will pay $600,000,000 extra for them.

BETWEEN V-E and V-J Day, radio listeners didn't change their minds about those new radios they said they wanted and would buy. When Stewart, Brown Assoc., the research organization which conducted the survey on which this article is based, asked the members of the 1800 canvassed homes, who were scientifically balanced for age differences, geographical distribution and income groups, what their opinions were on FM, their answers indicated a tremendous new market for FM receivers during the first two or three years.

The new market will probably mean a demand for 10,700,000 FM sets (either separately as FM or, more likely, in combination with AM) out of a total demand for 17,400,000 sets. Listeners say they will pay an extra $600,000,000 for the new FM receivers. This indicates that about 60% of all immediate postwar sets should be designed to receive FM programs.

This should be good news to both set manufacturers and FM broadcasters. It clearly indicates that the existing 432,000 FM sets, including some 35,000 AM sets equipped with translators, have created a trend of preference for FM programs. In addition, many non-FM owners who have heard FM programs want new sets. Since most of the existing FM receivers were purchased after 1940—and in view of the enormous public interest that has been engendered in this new art and the blessing given to it by the FCC—the trend toward FM has been stimulated rather than retarded during the war.

When we asked FM owners what they liked about FM reception, they each gave us an average of 2.6 answers. Heading the list was, *less static and noise*—an answer given by 84.9%. Second on the list was, *greater realism*—claimed by 60.5%; while *less advertising* was mentioned by 47.7% and *less interference* by 37.2%. *Better programs* were considered important by 19.8%. *Preference for FM because AM reception was poor in their locality* was the reason given by 14.0%.

Of particular interest to those responsible for FM programs, is the combined total of 67.5% who said they like FM's better programs and less advertising. Combined replies mentioning less static and noise and greater realism gave us a figure of 145.4%, which is a pretty good score for the FM technicians and the FM set manufacturers.

Those who said that AM reception was poor in their locality doubtless gave but a small clue to the total number of listeners who face similar conditions throughout the country. Our survey did not include rural areas beyond the limited range of existing FM transmitters. In many rural areas, during a large part of the year, AM reception is poor compared to the quality we are accustomed to in urban and nearby sections.

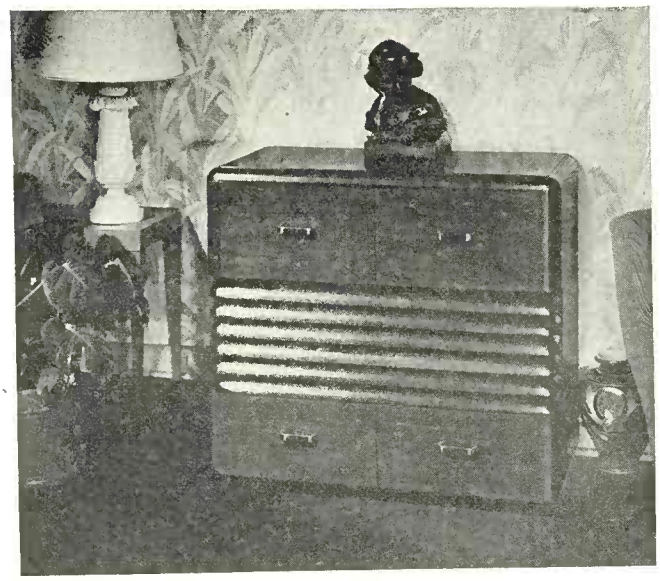
While we wanted to learn what FM owners think is good about FM, we also wanted to learn what they don't like about it. We found that static and noise from auto ignition was considered objectionable by 36.0%; interstation noise, by 20.9%; unstable tuning, by 17.4%; tuning difficulties, by 16.3%. Other disadvantages cited included outside antennas, mentioned by 11.6%, and the lack of push-button tuning mentioned by 8.1%.

In addition to answering our direct questions, many FM owners volunteered their own answers. In this group, 18.6% said they thought there were not enough stations; 11.6% felt that

War-Weary Radios Beg for Replacement

Any dealer will tell you that he has an enormous backlog of orders for radios, and awaits only a steady flow off the assembly lines to put the newest and best in post-war receivers into the homes of his community. During the war a high proportion of sets fell into disrepair, with few men available to service them. Today, with the advent of FM-AM combinations, they are considered obsolete, and the public would rather buy than fix.

In the main, FM receivers already put on the market have been grabbed up by the metropolitan consumer who has access to FM programs. Rural distribution still is virtually non-existent. Of the 395,000 sets sold before the war, not more than 75,000 were non-AM combinations. It is estimated that 120,000 of them are in the New York area; 80,000, Chicago; 35,000, Boston; 25,000, Detroit; 21,000 Milwaukee; 20,000, Philadelphia.

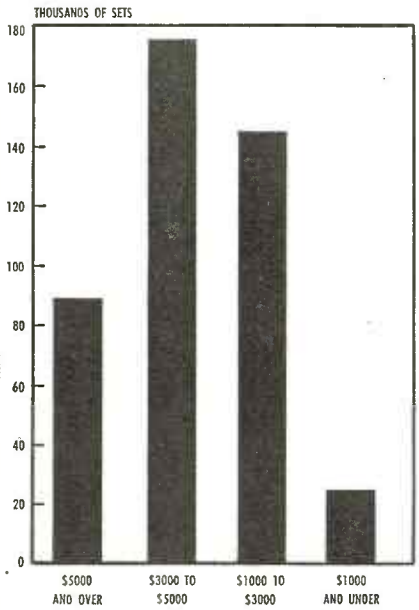


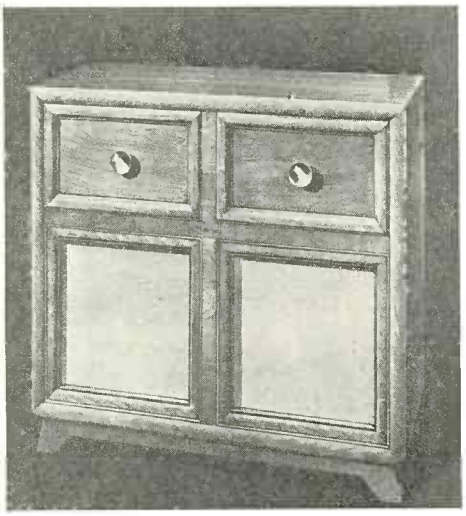
MODERNISTIC TOUCH in AM-FM combination model in line with new trends.

DISTINGUISHED EXAMPLE of modernistic design incorporating FM as well as AM.

FINEST engineering far FM incorporated in a smart cabinet.

Total number of existing FM receivers in the different urban family income groups.





AN AUTOMATIC phono-radio with antique motif. Includes Standard and FM bands.

programs lacked variety; 4.7% complained of signal fading; 11.6% gave other miscellaneous reasons. Slightly more than one-fifth were unable to think of any unfavorable features.

Realizing that FM set owners represent only 1.4% of all set owners today, we surveyed a good sample of the 13.9% of radio listeners who do not own FM sets but have heard FM programs. This group was divided into 68.5% who said they had heard FM programs in the homes of friends; the 18.6% who have heard FM in retail stores; the 9.3% who have heard programs in broadcasting stations; and the 3.6% who have heard FM elsewhere.

Reasons why non-FM owners prefer FM follow those of actual FM owners very closely: 70.4% of those interviewed said they preferred FM; 21.2% said they could not tell the difference between FM and AM; and only 4.4% didn't know or qualified their answers.

A full two-thirds of the non-FM owners stated that they want an FM set postwar; 23.2% have not made up their minds one way or another; only 10.2% say they don't want an FM set. The desire for FM varies, however, in different income groups and in different geographical areas.

Distribution of postwar demand for

(*Continued on page 44*)

EVERYTHING NEW FOR FM —

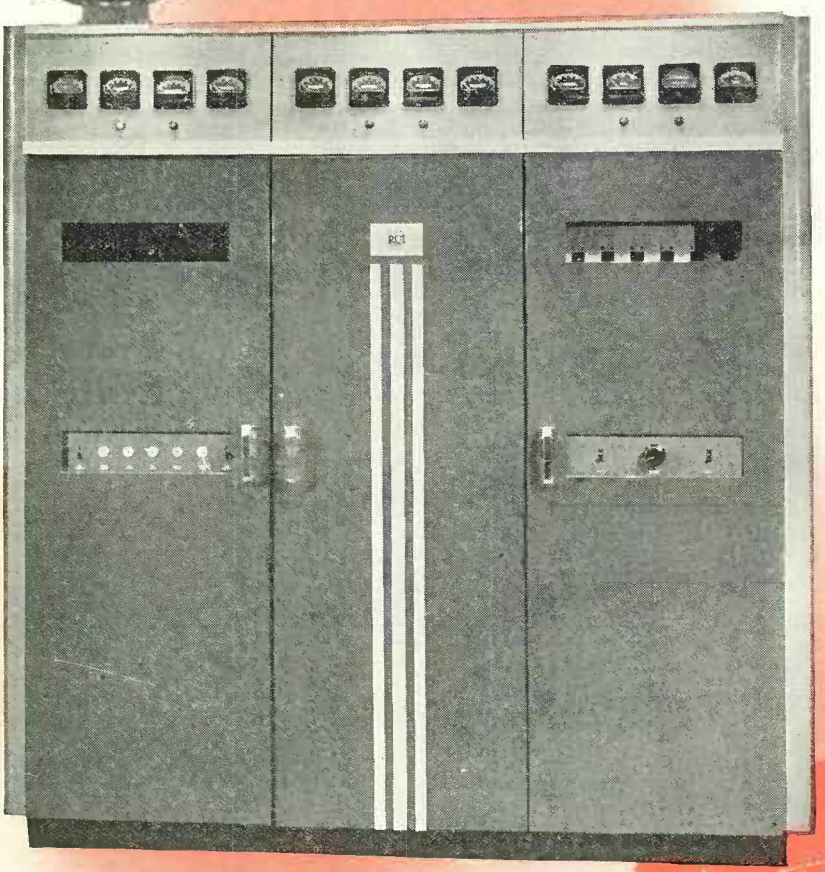
for NEW operating economy....

NEW RCA POLYDIRECTIONAL MICROPHONE

(Type 77D)—The polydirectional feature helps you obtain better balance, clarity, naturalness, and selectivity in studio pickups.

By means of a screw adjustment at the back of the microphone a variety of non-directional, uni-directional, and bi-directional characteristic patterns can be produced. Undesired sound reflections can be quickly eliminated merely by switching to the proper pattern. A three-position, VOICE-MUSIC switch permits the selection of the best operating characteristic.

This lightweight, multi-purpose microphone is finished in two-tone umber grey.



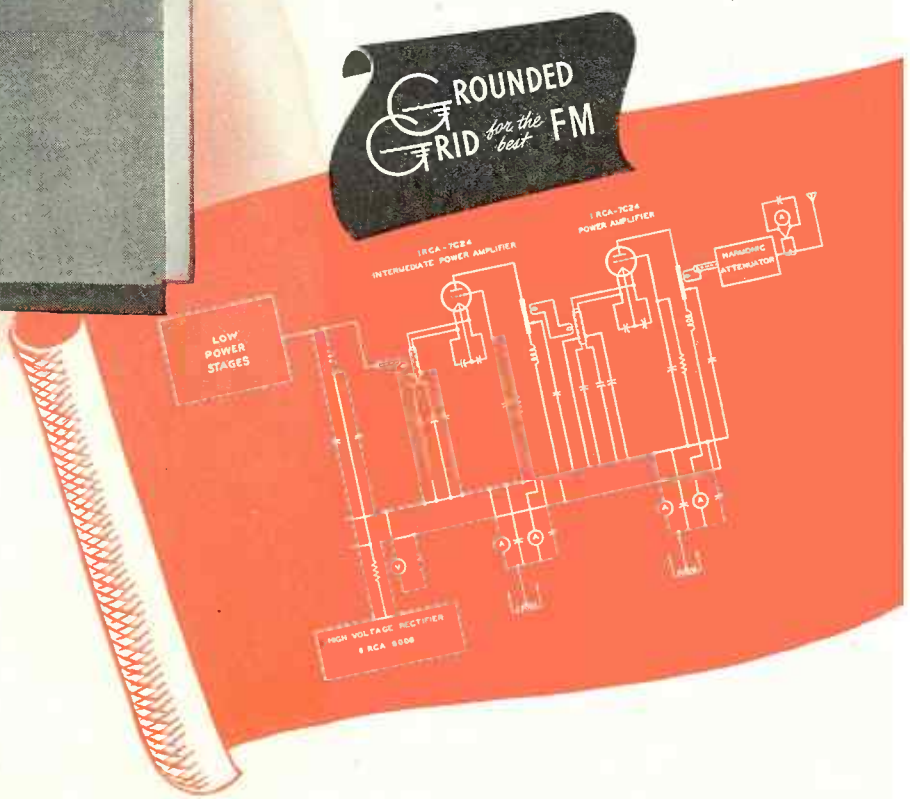
NEW RCA TRANSMITTERS

RCA's line of FM transmitters (250 watt, 1, 3, 10, 25, and 50 kw) are completely new from exciter to power amplifiers—new circuits, new tubes, and a new type of construction.

The frames of all power sizes have been standardized thus assuring uniformity of dimensions, appearance, and easing installation problems. When increased power is desired, you merely add an amplifier. Appearance is equal to that of a single unit. Curved-end pieces add to the finished appearance.

A new, hollow base frame provides space for inter-unit wiring, and eliminates the need of wiring through units or conduits in the floor.

Air filters, flush-mounted centralized control panels, and concealed hinges are other features of the new RCA construction—*standardized* to assure you a better product at lower cost.



NEW CIRCUITS

The new RCA Grounded-Grid amplifier circuits are at once simpler and more stable than any heretofore employed. As the name indicates, the grid of the tube is at r-f ground potential (instead of the filament as in conventional transmitters). The drive is applied between cathode and ground, either element being at the necessary d-c bias potential.

Special tubes have been developed for these circuits. Neutralization is either unnecessary, depending on frequency, or, if necessary, very easily achieved.

Other advantages: easier tuning, fewer tube types to stock, smaller, less-expensive tubes, lower operating costs, less distortion, and better program quality.

RCA's new "Direct FM" circuit for the exciter is something entirely different, too.

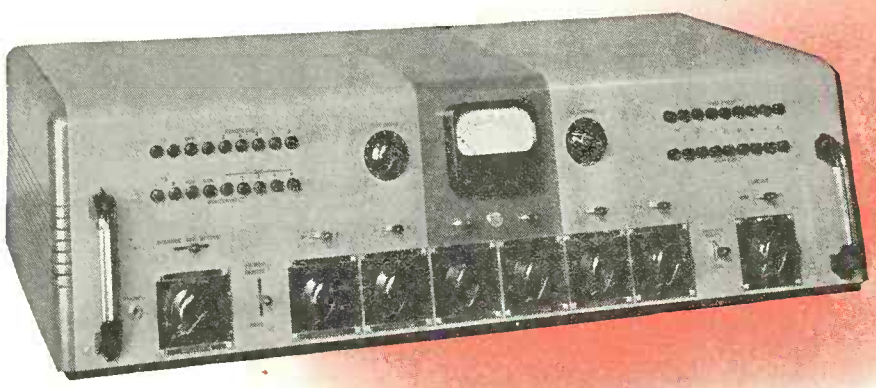
—from MICROPHONE to ANTENNA

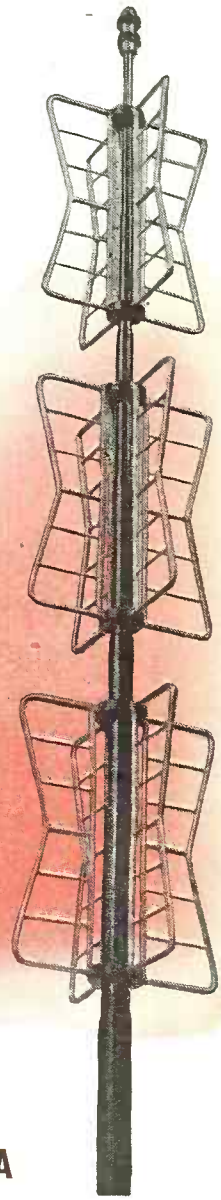
NEW convenience, and NEW performance

THE NEW RCA equipment shown here is merely indicative of the advances that have been made by RCA in FM broadcast equipment. Similar improvements have been made on every item that goes into a completed broadcast station, including test and measuring equipment, monitoring assemblies, turntables, and recorders.

The resumption of broadcast-equipment construction, after wartime restrictions, offered us a unique opportunity to design an entirely new line—integrated in every detail. The various units incorporate all the latest FM improvements that have grown out of RCA's advanced war work on communications equipment for the armed forces.

If you are planning to build a new FM station, we believe that "RCA all the way" will help you to make it a *better* station. You will be assured of the same efficiency, convenience, operating economy, and performance that have made RCA's AM equipment the undisputed first choice of broadcast stations for the past decade. Radio Corporation of America, Camden, N. J.





NEW RCA CONSOLETTE

(Type 76-B2)—Provides a complete high-fidelity audio system for FM, AM, and television at a price even the smallest station can afford.

Compact (39 by 17 by 10½ inches), it includes all the amplifying control and monitoring equipment needed to handle two studios, an announcement and a control-room microphone, two turntables, and six remote lines.

It enables simultaneous auditioning and broadcasting from any combination of the studios, turntables, or remote lines. The talk-back system is independent of program channel—no feed-back. Emergency amplifier and power supply circuits help prevent time off the air.

Differs from two previous RCA models now giving satisfactory service in more than 300 stations primarily in its frequency response—now extended to 15,000 cycles.

NEW RCA SUPER TURNSTILE ANTENNA

The advantages of this antenna make up an impressive list. A few include: high-gain, permits the use of a lower transmitter power for a given coverage, full performance at any frequency from 88 to 108 mc, handles up to 20 kw, easy to install, wide band, pretuned at factory, no field adjustments whatever, a standardized low-cost "packaged" item—comes complete, de-icer units easily added, fewer end seals, entire structure can be grounded.

In addition, it has the usual advantages of any turnstile antenna: an inherently circular field pattern, low wind resistance, and simple, inexpensive, single-pole mounting.

The antenna, because of its relatively high gain and extended band width, is also ideal for television. Naturally, since it is of the turnstile type, both sound and picture transmitters can be fed into the same antenna.

FM BROADCAST EQUIPMENT

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DIVISION, CAMDEN, N. J.

The Pioneer Commercial FM Broadcasters of the United States

• These are the first FM Licensees and Construction Permit Holders (53) as authorized by the FCC before wartime equipment freeze. Most are now operating on old or new frequencies, or both. All are Metropolitan Class except those indicated with asterisk, which are Rural. Dagger (†) indicates Area II station has been assigned power less than authorized by rules; FCC states it is studying question of operation with higher powers.

CALIFORNIA

City	Call Letters AM Affiliation	Licensee P. O. Address	Principal Executive in Charge	New Frequency (Channel No.) Radiated Power	Old Frequency Power	Transmitter Location Date Established
LOS ANGELES.....	KHJ-FM KHJ	Don Lee Broadcasting System 5515 Melrose Ave.	Thomas S. Lee Lewis Allen Weiss	99.7 mc (259) 4.8 kw†	44.5 mc 1 kw	Mt. Lee August 11, 1941
LOS ANGELES.....	KTLO (CP)	Metro-Goldwyn-Mayer Studios Inc. Culver City	Louis B. Mayer Herbert L. Pettey (N. Y.)	100.1 mc (261) 4.8 kw†	....	Santa Monica Mts. .....

CONNECTICUT

HARTFORD.....	WDRC-FM WDRC	WDRC Inc. 750 Main St.	Dr. Franklin M. Doolittle Walter Haase	94.3 mc (232) 7 kw	46.5 mc 1 kw	Meriden, Conn. May 13, 1939
HARTFORD.....	WTIC-FM WTIC	Travelers Broadcasting Service Corp. 26 Grove St.	Travelers Insurance Co. Paul W. Morency	93.5 mc (228) 9.5 kw	45.3 mc 1 kw	Avon, Conn. November, 1940

ILLINOIS

CHICAGO.....	WBBM-FM WBBM	Columbia Broadcasting System 410 N. Michigan Ave.	William S. Paley H. Leslie Atlass	99.3 mc (257) 10 kw†	46.7 mc 10 kw	1 N. LaSalle St. December 17, 1941
CHICAGO.....	WDLM WMBI	Moody Bible Institute 820 N. LaSalle St.	Will H. Houghton Henry C. Crowell	99.7 mc (259) 20 kw†	47.5 mc 1 kw	Addison, Ill. 1943
CHICAGO.....	WGNB WGN	WGN Inc. 435 N. Michigan Ave.	Chicago Tribune Frank P. Schreiber	98.9 mc (255) 20 kw†	45.9 mc 3 kw	435 N. Michigan Ave. September, 1941
CHICAGO.....	WWZR	Zenith Radio Corp. 6001 Dickens Ave.	E. F. McDonald, Jr. Ted Leitzell	98.5 mc (253) 12 kw†	45.1 mc 50 kw	135 LaSalle St. February 2, 1940
CHICAGO.....	WEHS WHFC	WHFC Inc. 6138 W. Cermak Rd.	Richard W. Hoffman Marie Clifford	100.1 mc (261) 12 kw†	....	105 W. Adams St. November, 1945

INDIANA

EVANSVILLE.....	WMLL WEOA	Evansville on the Air Inc. 519 Vine St.	Alvin Q. Eades Clarence Leich	94.7 mc (264) 20 kw	44.5 mc 10. kw	203 NW. Fifth St. August, 1941
FORT WAYNE.....	WOWO-FM WOWO	Westinghouse Radio Stations Inc. 925 S. Harrison St.	Westinghouse Electric Co. Paul E. Mills	95.9 mc (240) 20 kw	44.9 mc 1 kw	925 S. Harrison St. October 15, 1942
INDIANAPOLIS.....	WABW	Associated Broadcasters Inc. 445 N. Pennsylvania Ave.	Rudolph M. Crandall Ben Tamney	94.9 mc (235) 20 kw	47.3 mc 1 kw	445 N. Pennsylvania Ave. October 1, 1945
SOUTH BEND.....	WSBF WSBT	South Bend Tribune 225 W. Colfax Ave.	F. A. Miller Franklin D. Schurz	101.3 mc (267) 20 kw	47.1 mc .5 kw	Ironwood Rd. May 10, 1943

LOUISIANA

BATON ROUGE.....	WBRL WJBO	Baton Rouge Broadcasting Co. 444 Florida St.	Charles P. Manship, Jr. J. Roy Dabadie	96.1 mc (241) 20 kw	44.5 mc 1 kw	Roosevelt Rd. May 7, 1941

MAINE

PORTLAND.....	*WMTW WNAC(Boston)	Yankee Network Inc. 21 Brookline Ave. (Boston) (Portland Studios pending)	William F. O'Neil John Shepard, 3rd	98.1 mc (251) 10 kw	43.9 mc 5 kw	Mt. Washington, N. H. December, 1940

MASSACHUSETTS

BOSTON.....	WBZ-FM WBZ	Westinghouse Radio Stations Inc. 275 Tremont St.	Westinghouse Electric Co. Wilmer C. Swartley	100.7 mc (264) 20 kw	46.7 mc 10 kw	Hull, Mass. July, 1941
SPRINGFIELD.....	WBZA-FM WBZA	Westinghouse Radio Stations Inc. Hotel Kimball	Westinghouse Electric Co. Wilmer C. Swartley	97.1 mc (246) 20 kw	48 mc 1 kw	E. Springfield August 29, 1939
WORCESTER.....	WTAG-FM WTAG	WTAG, Inc. 20 Franklin St.	Telegram & Gazette E. E. Hill	102.7 mc (274) 20 kw	46.1 mc 1 kw	Holden, Mass. June 17, 1940
WORCESTER.....	WGTR WAAB	Yankee Network Inc. 32 Mechanic St.	William F. O'Neil John Shepard, 3rd	103.1 mc (276) 9.5 kw	44.3 mc 50 kw	Paxton, Mass. July, 1939

MICHIGAN

DETROIT.....	WENA WWJ	Evening News Association 615 Lafayette Blvd.	William J. Scripps E. K. Wheeler	96.9 mc (245) 10.5 kw	44.5 mc 50 kw	Penobscot Bldg. May 9, 1941
DETROIT.....	WLOU WJLB	John Lord Booth 10 Witherell St.	John Lord Booth John Lord Booth	96.5 mc (243) 20 kw	44.9 mc 10 kw	10 Witherell St. .....

MINNESOTA

DULUTH— SUPERIOR, Wis.....	WDUL WEBC	Head of Lakes Broadcasting Co. 4th Ave. & Superior St.	Morgan Murphy Walter C. Bridges	92.3 mc (222) 20 kw	44.5 mc 1 kw	Duluth April 8, 1940

(*Continued on page 24*)

MISSOURI

City	Call Letters AM Affiliation	Licensee P. O. Address	Principal Executive in Charge	New Frequency (Channel No.) Radiated Power	Old Frequency Power	Transmitter Location Date Established
KANSAS CITY.....	KMBC-FM KMBC	Midland Broadcasting Co. Pickwick Hotel	Arthur B. Church Karl Koerper	97.9 mc (250) 20 kw	46.5 mc 1.5 kw	Power & Light Bldg. June, 1944
KANSAS CITY.....	KOZY	Commercial Radio Equipment Co. 406 W. 34th St.	Everett L. Dillard Robert F. Wolfskill	99.9 mc (260) 20 kw	44.9 mc .4 kw	406 W. 34th St. August 16, 1942

NEW JERSEY

ALPINE	WFMN	Maj. Edwin H. Armstrong 435 E. 52nd St., New York	Maj. Edwin H. Armstrong Perry Robinson	98.9 mc (255) 6 kw	43.1 mc 55.6 kw	Route 9W, Alpine 1939
NEWARK.....	WAAW (CP) WAAT	Bremer Broadcasting Corp. 11 Hill St.	Irving R. Rosenhaus	94.1 mc (231) 13.5 kw	....	West Orange, N. J. .....

NEW YORK

BINGHAMTON.....	WNBF-FM WNBF	Wylie B. Jones Adv. Agency 60 Exchange St.	John C. Clark Cecil D. Mastin	96.3 mc (242) 10.5 kw	44.9 mc 3 kw	Nr. Binghamton August, 1942
NEW YORK CITY....	WABC-FM WABC	Columbia Broadcasting System 485 Madison Ave.	William S. Paley Artbur Hull Hayes	96.9 mc (245) 5 kw	46.7 mc 3 kw	500 Fifth Ave. December 1, 1941
NEW YORK CITY....	WABF	Metropolitan Television Inc. 654 Madison Ave.	Ira A. Hirschmann L. L. Thompson	98.5 mc (253) 15 kw	47.5 mc 1 kw	795 Fifth Ave. November 2, 1942
NEW YORK CITY....	WBAM WOR	Bamberger Broadcasting Service Inc. 1440 Broadway	Alfred J. McCosker Theodore C. Streibert	96.5 mc (243) 15 kw	47.1 mc 10 kw	444 Madison Ave. September 27, 1940
NEW YORK CITY....	WEAF-FM WEAF	National Broadcasting Co. 30 Rockefeller Plaza	Niles Trammell Frank Mullen	97.3 mc (247) 1.6 kw	45.1 mc 1 kw	Empire State Bldg. August 8, 1944
NEW YORK CITY....	WGHF	William G. H. Finch 10 E. 40th St.	William G. H. Finch	99.7 mc (259) 7.2 kw	....	10 E. 40th St. January, 1946
NEW YORK CITY....	WGYN	Muzak Radio Broadcasting Station Inc. 70 Pine St.	Palmer K. Leberman Carl J. Schaeffer	96.1 mc (241) 4 kw	44.7 mc 3 kw	70 Pine St. December 11, 1941
NEW YORK CITY....	WHNF WHN	Marcus Loew Booking Agency 1540 Broadway	Loew's Inc. (MGM) Herbert L. Pettey	99.3 mc (257) 20 kw	46.3 mc 10 kw	Cliffside Park, N. J. June 1, 1942
NEW YORK CITY....	WNYC-FM WNYC	Municipal Broadcasting System Center & Chambers Sts.	City of New York	94.5 mc (233) 15 kw	43.9 mc 1 kw	Center & Duane Sts. September 21, 1943
NEW YORK CITY....	WQXQ WQXR	Interstate Broadcasting Co. Inc. 730 Fifth Ave.	N. Y. Times, John V. L. Hogan Elliott M. Sanger	97.7 mc (249) 11.5 kw	45.9 mc 1 kw	122 E. 42nd St. November 8, 1939
ROCHESTER.....	WHEF WHEC	WHEC Inc. 40 Franklin St.	Clarence Wheeler Gunnar Wiig	98.5 mc (253) 20 kw	44.7 mc 3 kw	Mt. Read Blvd. February 1, 1940
ROCHESTER.....	WHFM WHAM	Stromberg-Carlson Co. Sheraton Hotel	Ray H. Manson William Fay	98.9 mc (255) 20 kw	45.1 mc 3 kw	89 East Ave. November 1, 1939
SCHENECTADY.....	WBCA	Capitol Broadcasting Co. Inc. 408 State St.	Leonard L. Asch H. E. Blodgett	101.1 mc (266) 6 kw	44.7 mc 1 kw	New Scotland, N. Y. July 17, 1941
SCHENECTADY.....	WGFM WGY	General Electric Co. 1 River Road	R. S. Peare G. E. Markham	100.7 mc (264) 6 kw	48.5 mc 3 kw	New Scotland, N. Y. February 6, 1940

NORTH CAROLINA

WINSTON-SALEM	*WMIT WSJS	Gordon Gray P. O. Box 2093	Gordon Gray Harold Essex	97.3 mc (247) 200 kw	44.1 mc 3 kw	Clingman's Peak, N. C. June 1, 1942

OHIO

COLUMBUS.....	WELD WBNS	RadiOhio Inc. 33 N. High St.	Edgar T. & Richard S. Wolfe { Richard A. Borel { Lester H. Nafzger	94.5 mc (233) 20 kw	44.5 mc 5 kw	1035 Barnett Rd. March 29, 1940

PENNSYLVANIA

PHILADELPHIA.....	KYW-FM KYW	Westinghouse Radio Stations Inc. 1619 Walnut St.	Westinghouse Electric Co. Lee B. Wailes—Leslie Joy	100.3 mc (262) 20 kw	45.7 mc 10 kw	17th & Sansom Sts. October 5, 1942
PHILADELPHIA.....	WCAU-FM WCAU	WCAU Broadcasting Co. 1622 Chestnut St.	Dr. Leon Levy Norris West	102.7 mc (274) 20 kw	46.9 mc 10 kw	1616 Walnut St. December 1, 1941
PHILADELPHIA.....	WFIL-FM WFIL	WFIL Broadcasting Co. Widener Bldg.	Lit Bros. Dept. Store Roger W. Clipp	103.1 mc (276) 20 kw	45.3 mc 10 kw	Widener Bldg. Novcmber 10, 1941
PHILADELPHIA.....	WIBG-FM (CP) WIBG	Seaboard Radio Broadcasting Corp. 1425 Walnut St.	P. F. Harron-Joseph Lang E. D. Clery	97.1 mc (246) 20 kw	....	Ford Rd. & Edgley .....
PHILADELPHIA.....	WIP-FM WIP	Pennsylvania Broadcasting Co. 35 S. Ninth St.	Gimbel Bros. Inc. Benedict Gimbel, Jr.	97.5 mc (248) 18 kw	44.9 mc 3 kw	35 S. Ninth St. April 20, 1942
PHILADELPHIA.....	WPEN-FM WPEN	William Penn Broadcasting Co. 1528 Walnut St.	Philadelphia Bulletin G. Bennett Larson	99.5 mc (258) 20 kw	47.3 mc 3 kw	1528 Walnut St. June 6, 1942
PITTSBURGH.....	KDKA-FM KDKA	Westingbouse Radio Stations Inc. 310 Grant St.	Westinghouse Electric Co. J. E. Baudino	94.1 mc (231) 6.5 kw	47.5 mc 3 kw	Allison Park, Pa. April 11, 1942
PITTSBURGH.....	WMOT WWSW	WWSW Inc. 212 Wood St.	Pittsburgh Post-Gazette Frank R. Smith	94.5 mc (233) 20 kw	44.7 mc 3 kw	341 Rising Main St. August 1, 1941

TENNESSEE

NASHVILLE.....	WSM-FM WSM	National Life & Accident Insurance Co. 7th Ave. & Union St.	E. W. Craig Harry Stone	100.1 mc (261) 8.5 kw†	44.7 mc 20 kw	Nr. Franklin, Tenn. March 15, 1941

UTAH

SALT LAKE CITY....	KSL-FM (CP) KSL	Radio Service Corp. of Utah 10 S. Main St.	{ Mormon Churcb { Tribune & Telegram Earl I. Glade	100 1 mc (261) 8..5 kw	....	....

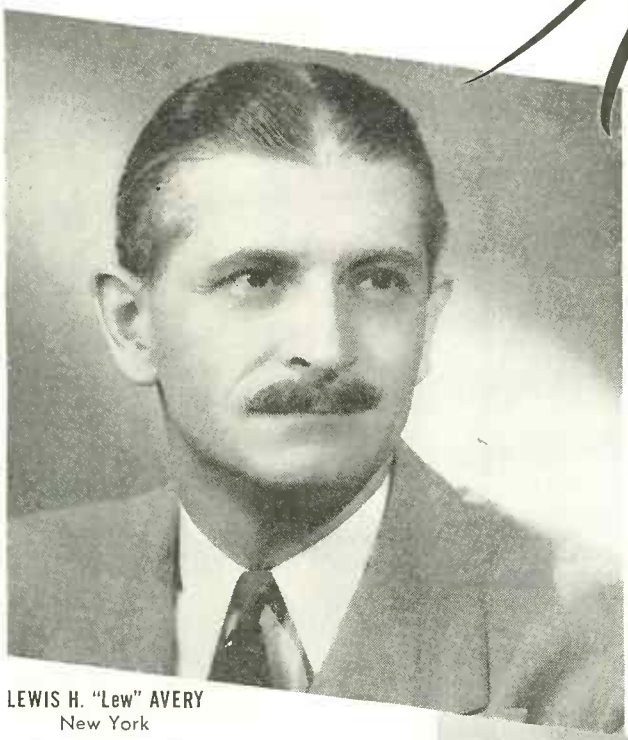
WISCONSIN

MILWAUKEE.....	WTMJ-FM WTMJ	The Journal Co. 333 W. State St.	Milwaukee Journal Walter J. Damm	92.3 mc (222) 20 kw†	44.5 mc 50 kw	Richfield, Wis. February 22, 1942

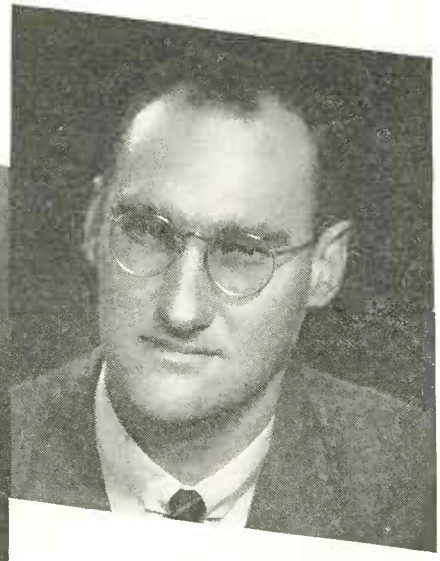
EXPONENTS OF *Aggressive Activity*

...the men
who have formed

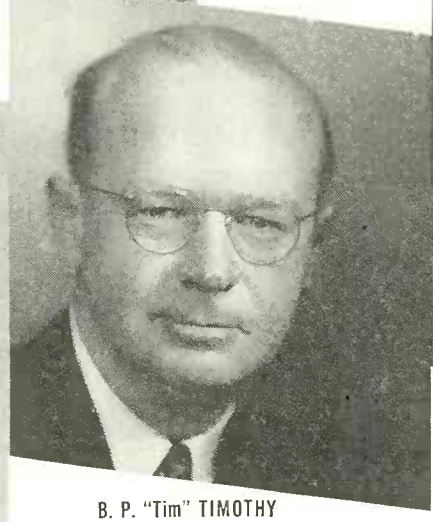
LEWIS H. *Avery* INC.



LEWIS H. "Lew" AVERY
New York



DAVID H. "Sandy" SANDEBERG
San Francisco



B. P. "Tim" TIMOTHY
Chicago

ARTHUR H. "Art" McCOY
New York

LEWIS H. *Avery* INC.

Radio Station Representatives

565 Fifth Ave.
New York 17, N. Y.
PLaza 3-2622

544 Market Street
San Francisco, Calif.
Douglas 5873

333 No. Michigan Ave.
Chicago 1, Ill.
ANDover 4710

FM

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ZENITH RADIO

30 Years of "Know-How"

THE GREATEST CONTRIBUTION TO RADIO SINCE BROADCASTING BEGAN

E CORNER - - IT'S HERE!

ZENITH

TRADE MARK REG.

O BAND FM

CORPORATION

in Radionics Exclusively

Modulations

FM Advertises FM

WHAT better way to sell FM than to advertise it via FM? That's exactly what Philco did at the Chicago Furniture Mart, Jan. 7-11. Buying time on WGNB, Philco broadcast a one-hour program each afternoon which was received on Philco FM receivers at the Mart to demonstrate its Advanced FM System to dealers.

GE Phasitron Magic

A NEW low-power FM transmitter, General Electric's latest development in the art of sound transmission, was unveiled to the industry last month and received more than its share of accolades from the trade press. Engineers were especially impressed with the magic of the new Phasitron tube, heart of the new transmitter.

Brainchild of Dr. Robert Adler, of Zenith Radio Corp., the tube makes possible a simplified circuit which necessitates fewer components, thus minimizing transmitter maintenance costs. According to GE, it also provides better frequency stability, has less distortion and a lower noise level.

March 1, 1946 has been scheduled as the delivery date for the first of these transmitters. Present plans do not call for licensing of any other manufacturers, though that may come later. Use of the new transmitter will not eliminate Armstrong royalties.

DR. ROBERT ADLER, of the Zenith Radio Corporation holding original Phasitron tube.

Two-Band Sets

THOUGH the FCC on January 24 voted down the proposal to include the 50 mc. band for longer-range FM coverage than 100 mc. affords, six manufacturers have indicated their intentions of putting out two-band receivers: Ansley, Freed, Galvin, Stromberg-Carlson, Templetone, Zenith.

The FCC ruling against widening the FM band came after two days of hearings in Washington (Jan., 18-19) on Zenith's petition for inclusion of the 44-50 mc. frequencies (TV Channel No. 1). Pros and cons of proposal, strenuously debated by engineers and manufacturers, centered around Zenith's Milwaukee-Deerfield, Ill., tests on both high and low portion of spectrum.

Bellwether Hearing

FAMOUS for the bean and the cod, Boston may, in a more special way, also become famous for FM. The first consolidated FM hearing will be held there March 11-22, with Commissioner Durr presiding. It will be the focus of the industry's eyes, for the tenor of the hearing will show the trend for the establishment of commercial, nation-wide FM broadcasting.

As of this writing, there are 9 applicants for Boston's 10 channels; one of which is already occupied by Westinghouse's WBZ-FM, and many more may file. They are:

CBS (WEEI).
Matheson Radio Co., Inc. (WHDH).
Northern Corp. (WMEX).
Yankee Network (WNAC).
Unity Broadcasting Co. of Mass.
Templeton Radio Manufacturing Corp.
Mass. Broadcasting Corp. (WCOP)
Harvey Radio Laboratories Inc.
Raytheon Manufacturing Co.

Unity Broadcasting Co. of Mass., is the first labor union applicant to come up. Unity is an outcrop of the well-heeled International Ladies Garment Workers Union (Dave Dubinsky), is backed by the national organization whose locals in New York, Philadelphia and Chattanooga also seek outlets.

And, finally, the industry will have its eye on Commissioner Durr, whose sentiments with respect to broadcasters, labor unions, newcomers, and FM are not unknown.

End of Philadelphia Plan

FOUR months after V-J Day, or on December 15, 1945, Philadelphia's famed FM broadcasting plan was brought to a close. Beginning early last month, each of Philadelphia's five pioneer FM stations—KYW-FM (Westinghouse), WCAU-FM (Levy Brothers), WFIL-FM (Lit Brothers), WIP-FM (Gimbels), WPEN-FM (Philadelphia Bulletin)—went on its own.

Growing out of wartime shortage of personnel and material, each station maintained a full schedule on an appointed day of the week, remaining silent the other days. Sundays and Wednesdays were filled by rotation, with a coordinator planning the schedule and overseeing the swapping of tubes and other equipment.

This cooperative plan worked well and assured the 20,000 FM set owners in the Quaker City full FM program schedules each day during the war.

ACTION OF Philco's new FM simulated by its inventor, William Brodley (left).

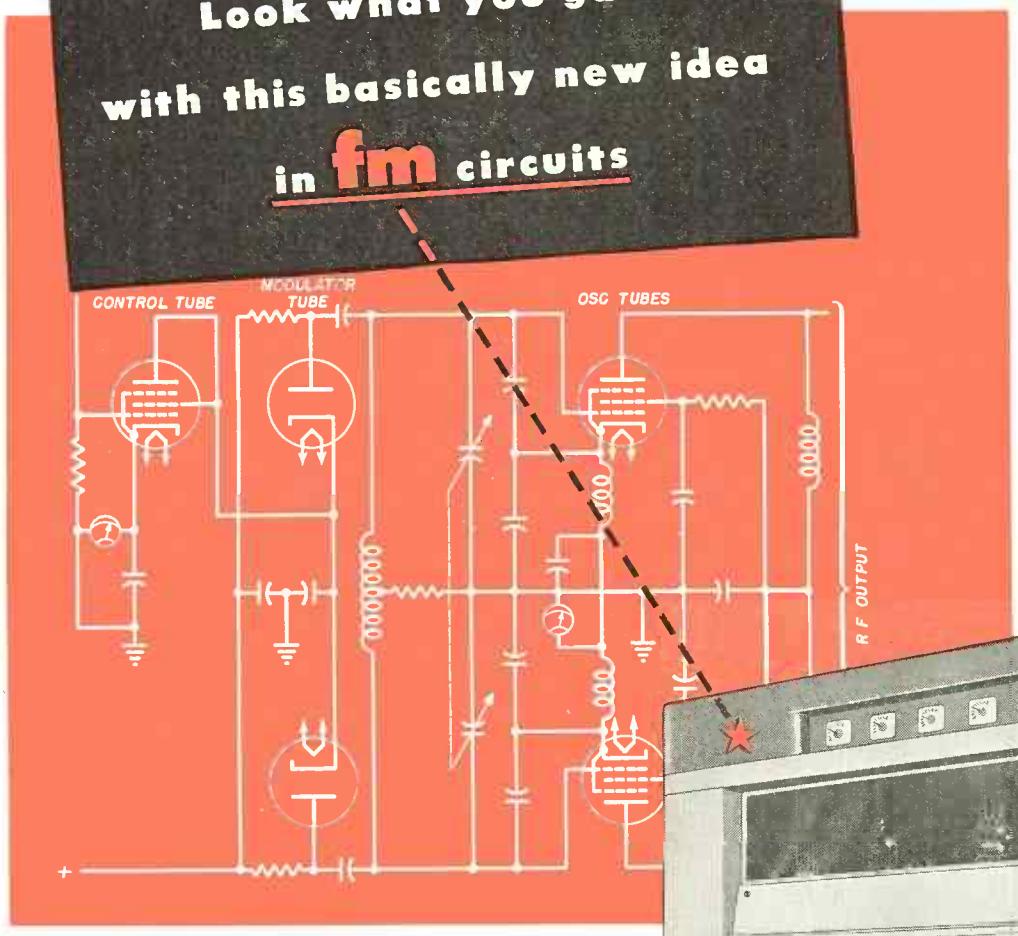
Philco Receiver Circuit

PHILCO CORP. sees great things ahead for its new FM receiver circuit which it claims "represents the first major postwar advance in the radio art which is available to the public." Heart of the new circuit is a seven-element vacuum tube.

The new circuit, which Philco calls the Advanced FM System, ignores the AM characteristics of a signal entirely and accepts only the FM component. Limiter tubes and discriminator, used in conventional FM circuits, lose their importance by this method, Philco says.

Gain in fidelity is also stressed. Response to FM signals is highly linear and uniform, Philco claims, and the entire audible range is faithfully reproduced. Promising applications are foreseen in broadcasting, television, communications and industrial electronics.

Look what you gain with this basically new idea in fm circuits



These new ideas in FM circuits designed by Westinghouse bring you important advantages never before available in FM transmitters.

Modulation, for example, is a simple, straightforward diode type . . . noncritical, non-microphonic, no-trick tubes (see drawing above). The effective resistance of the tubes is a function of plate current in the modulator-control tube.

Thus, the master oscillator tank circuit is frequency-modulated due to *resistance variation* in response to audio signals applied to modulator-control input circuit. And the frequency-modulated master oscillator operates at only 1/9th the F.C.C. assigned center-frequency.

There are other important benefits in the new Westinghouse design. Frequency is held without using critically-tuned elements or moving parts and nowhere does frequency stability depend upon a tuned circuit.

These new improvements are born of intensive wartime radar experience and actual operation of five FM stations . . . a background unmatched by any other transmitter manufacturer. Ask your nearest Westinghouse office today to give you all the facts, and look at Westinghouse before you buy! Westinghouse Electric Corporation, P. O. Box 868, Pittsbugh 30, Pa. J-08158

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Electronics at Work

UNITED PRESS RADIO NEWS

Foremost because it offers most—

24 hours a day, from coast to coast, at high speed, over wires carrying radio news only, United Press brings broadcasters in every one of the 48 states—

26 news roundups a day, punctuating a steady flow of datelined dispatches . . .

14 regional reports a day. These flow into stations for a total of four and a half hours, cover every big broadcast period of the day, from six in the morning until eleven at night. They go into both the roundups and datelined news . . .

24 special features. Seventeen of them are daily, including four on sports . . .

3000 words a day of spot sports bulletins—enough to make two 15-minute newscasts in addition to the four features.

United Press has more radio news clients than all other services combined. Because it offers more than any other service.

An FM Credo

CBS's Paul Kesten and NBC's Niles Trammell went unequivocally on record as forecasting an important future for FM during last autumn's hearings before the FCC. Just before the year ended, ABC's Mark Woods also made his company's position clear—it too believes firmly in FM. Occasion for the Woods statement may or may not have been the outspoken criticism by some of the independent FM broadcasters that entrenched AM interests, particularly the networks, have no desire to see FM succeed, have even seized upon the Petrillo duplication ban as an excuse for shutting down their FM's.

Mark Woods' statement is also clear cut, unequivocal. Coming as it does from a company not now in FM but applicant for four FM stations to parallel its four owned-and-operated AM stations, three of them 50,000 watters, it is particularly cogent. Said Mr. Woods:

1. We believe that eventually FM will be the principal medium of broadcasting, particularly in urban areas. AM, because of its sky wave characteristics, will always be needed to provide rural service.

2. We believe that, with few exceptions, every station operating on a regional or local channel can not only improve its service in the area which it now serves, but can extend its service area materially, especially at night.

3. We believe that FM should eventually replace all local and regional stations in urban areas so that these local and regional channels can be available to provide rural service at higher power; so that these rural areas now with grossly inadequate service should eventually have a wide selection of program services comparable to those now available in the cities.

4. Just how long it will take to establish FM on a commercial basis depends upon the pattern that will be laid down by the FCC. The development of that pattern is now a matter of study by the FCC. The forthcoming clear channel hearings should be most helpful in aiding the FCC in the development of that pattern because the clear channel problem and the FM problem are interrelated.

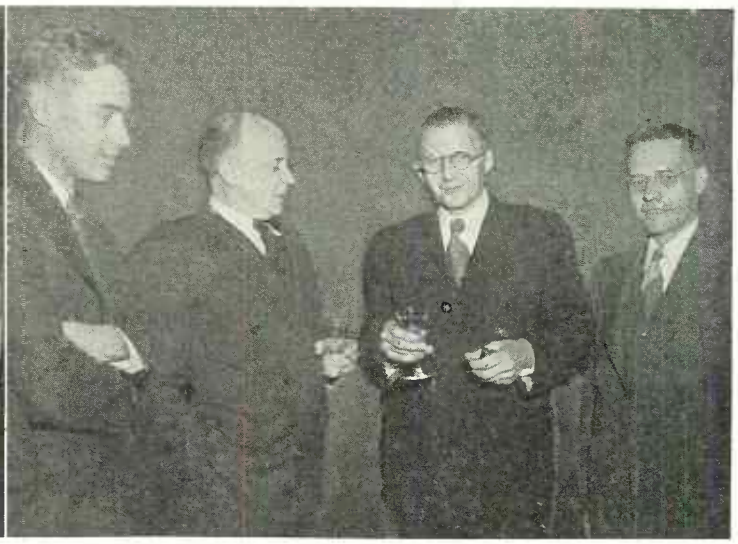
5. We urge every local and regional affiliate to apply for FM and to become active in its development.

6. We believe that only through the establishment of FM can there be an equalization of facilities between the networks and provision for additional program services.

7. We do not believe that the radio industry should draw back from FM because of Mr. Petrillo's recent edict. That edict is but one phase of an overall problem which involves the broadcasting industry as a whole. The whole problem must be met and solved by the entire industry.

Pictorial

Introducing its plans for FM equipment to Washington consulting engineers at recent capital party, Federal Telephone & Radio Corp. passes the drinks to (L to R): Robert Lewis, Federal; Glenn Gillett; Henry B. Riblet, associated with Gillett; M. M. Lasensky, Wincharger Corp.



Cy Braum, FCC; Norman E. Wunderlich, Federal Telephone & Radio; John Willoughby, FCC; Glenn E. Neilsen, FCC.

Dr. Frank Kear, Kear & Kennedy; Garo W. Ray, Stratford, Conn.; Dixie McKey, McKey & Shaw; Lester Carr, Weldon & Carr; Paul A. deMars, Raymond M. Wilmotte, Inc.

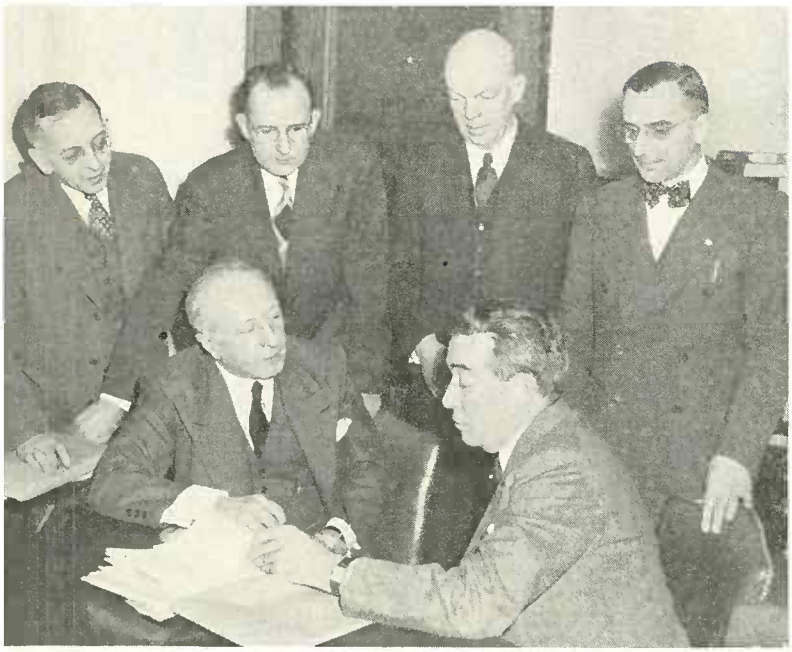
Washington Party

Joseph A. Chambers, Chambers & Garrison, and Lt. Col. E. C. Page, Mutual Broadcasting's director of engineering.

Glenn Boundy, of the Fort Industry Co. stations; Capt. Millard M. Garrison, Chambers & Garrison; Paul Loyet, WHO-WOC, Des Moines-Davenport; and George C. Davis.

First Stratovision Antenna developed by Westinghouse and Glenn L. Martin Co. draws curious look from Betty Nolan.

Tower and turnstile of WFIL-FM rises over statue of William Penn, one of Philadelphia's most famous historic landmarks atop City Hall.



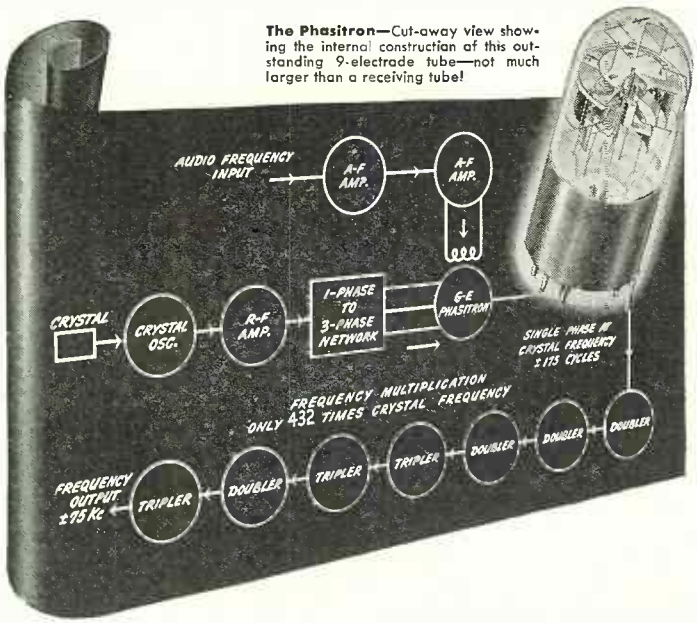
Comdr. E. F. McDonald, Jr., Zenith president (seated R) is surrounded by 50-mc proponents at FCC hearing January 19 on proposed widening of FM band. Seated also is Irving Herriott, Zenith counsel. Standing (L to R): J. E. Brown, Zenith v.p.; G. E. Gustafson, Zenith chief engineer; Dr. Edwin H. Armstrong, FM's sire; Paul A. deMars.

Protagonists of both sides of 50-mc issue meet outside FCC hearing room. Making a point opposed is Edward A. Allen, Jr., FCC Technical Information Division (R). C. W. Carnahan, Zenith research engineer (L), made Milwaukee-Deerfield tests. Listener-in is Stromberg-Carlson's W. F. Cotter.

FM BROADCAST TRANSMITTERS . . .

use this revolutionary

NEW CIRCUIT



The Phasitron—Cut-away view showing the internal construction of this outstanding 9-electrode tube—not much larger than a receiving tube!

- **Direct crystal control**
- **One crystal**
- **Modulation independent of frequency control**
- **Less distortion**
- **Lower noise level**
- **Greater frequency stability**
- **Fewer tubes**
- **Fewer circuits and controls**

Block Diogrom of the New G-E FM Modulotor Circuit—A fundamentally new modulotion and frequency-control circuit, the G-E FM modulotor provides new simplicity, eosy tuning, and o minimum of mointenonce. Control center of the circuit is the Phositron—o 9-electrode tube pioneered by Zenith, developed ond built by General Electric. The Phositron in effect produces a "rototing electron wheel" within the tube itself. An externol coil around the tube acts to momentorily occelerote ond retord this "wheel" mogneticolly ot on oudio-frequency rote. The action produces wide-swing frequency modulotion without need for frequency conversion ond intricote frequency multiplier chains.

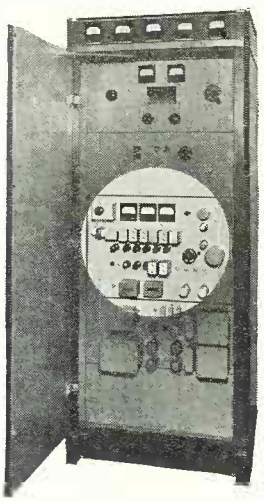
GENERAL ELECTRIC FM transmitters open a new era in broadcasting with a modulator and frequency-control circuit as sweeping in importance as the introduction of crystal control.

Operating under principles of frequency modulation and frequency control completely different than those employed in conventional FM broadcast transmitters, this *simplified, all-electronic* circuit makes possible direct frequency control independent of modulation—with a frequency multiplication of only 432! Here is a dependable and straightforward system that uses no frequency conversion, permits extremely wide modulation phase shifts at low frequencies and improves transmitter signal-to-noise ratio. Simplicity with one crystal, fewer tubes, fewer circuits, and fewer components insures greater dependability, makes every G-E transmitter easier to tune and to maintain.

Heart of the G-E FM modulator circuit is the G-E Phasitron—a combined electronic tube achievement of the Zenith Radio Corporation and General Electric Company. This tube is capable of producing directly wide-swing frequency modulation without need for intricate frequency multiplier chains and frequency conversion. With the Phasitron, reactance-tube and crystal-reference circuits are eliminated.

For complete facts about the new modulator circuit and for full technical specifications on General Electric's complete line of FM broadcast transmitters call your G-E broadcast sales engineer, or write to: *Electronics Department, General Electric Company, Schenectady 5, New York.*

For earliest possible delivery of your broadcast equipment, place your order now.



New 250-watt G-E FM Broadcast Transmitter BT-1-A—Carrier Frequency Ronge, 88 to 108 Mc. More thon meets every F.C.C. Specificotion. The Section in the Circle is the New *All-Electronic* Modulotor system thot uses only 12 tubes! Ask your G-E broadcost soles engineer for complete doto.

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SEE G-E FOR ALL THREE! **FM • TELEVISION • AM**

By GEORGE M. HAKIM

IT started out as a dream and ended up a full-fledged obsession.

The dreamer was one Leonard Asch and his dream was about high-fidelity, static-less radio in the days when FM was still wetting its over-sized diapers. Approximately five years later that dream bore fruit, and on July 17, 1941 America had its first independent commercial FM station—WBCA Schenectady.

Throughout the four harrowing war years that followed, Mr. Asch, president of the Capitol Broadcasting Co., which operates WBCA, nurtured his radio baby and guided it wisely through the early years of its growth. Today, WBCA's reputation as a leading independent FM station (among the 50-odd which pioneered FM in America) is unchallenged and its contribution as a leader in the development of the new industry a subject of much acclaim.

Actively interested in the radio field from the manufacturing and broadcasting viewpoint, Leonard L. Asch, as director of sales promotion methods in the Merchandise Department of General Electric, was concerned with two vital factors—a better technical radio service to consumers, and the obsolescence of existing equipment to provide a greater market.

Inadequacies of AM

The inadequacies of radio broadcasting and receiving service were: A lack of full tonal range, static, interference and fading. In the broadcasting transmitter field, transmitter sales were fast reaching a saturation point because of the dearth of frequencies. And, in the receiver field, a saturation point was at hand, necessitating the invention of "gadgets" such as electric eye, push buttons, etc., to force obsolescence and possible sales to the consumer.

With this picture of the radio field and the belief that FM would become basic for all future developments in the industry, such as facsimile and television, Asch, in the middle 1930's started planning the Capitol Broadcasting Co.

From a dollars and cents standpoint, one of the most remarkable things about WBCA is that, without an AM affiliation, it started in the black and has been there periodically ever since it commenced operations. A remarkable, almost unique, achievement, to be sure—but not half as remarkable as the men who were responsible for it. The deeper you probe into the short history of WBCA, the more convinced you become that the story of the station is the story of two men—Leonard L. Asch and Harold E. Blodgett.

Rate Yardstick Needed

Just how Asch and Blodgett made the $35,000 station a going concern from the day of its debut is noteworthy. Some yardstick was needed—something more than the pat "radio homes per dollar" formula used by standard broadcasters. In 1941, FM, from the point of view of set production and customer acceptance, had not yet hit its stride. Obviously the standard radio formula did not apply.

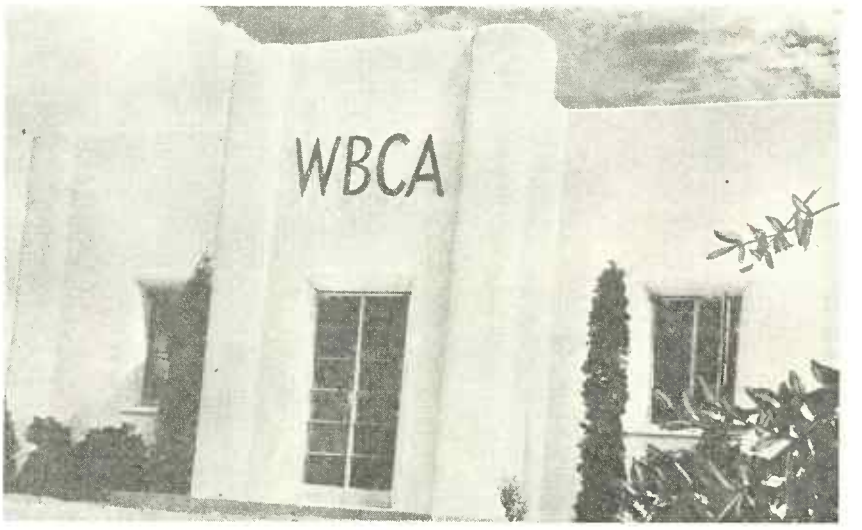
Asch finally hit on a solution. Rates were based on the cost of a direct mail campaign per listener home. The fact that before Pearl Harbor more and more people were being sold on FM, plus the promised rate for the contract period, enabled the station to sell the local advertiser on the medium. In a period of four years, 167 local concerns, encompassing 51 different lines of business, have bought time on the station at the $50 per hour evening base rate schedule. Seventy-four per cent are repeats. But national advertisers have been slow in accepting FM.

Even before Asch and his handful of FM pioneers set out to sell time on their infant station, they devoted most of their time and energies to building up a listening audience. Just how they did it might well be established as a pattern for all prospective FM station operators to study and follow.

Wholesaling FM Sets

Before the station went on the air, it was difficult to get wholesalers in the area to handle FM receivers. To lick this problem, the Capital Broadcasting Co., with the cooperation of its General Electric neighbors and suppliers of equipment, took over the wholesaling and merchandising of FM sets. Dealers were sold an elaborate window display unit. Dipoles were installed on dealers' roofs so that they could demonstrate the receivers to their customers. An FM salesmen's institute was set up to train the men who would sell the sets in the fundamentals of FM. Graduates of the course

(Continued on page 46)



WBCA's TRANSMITTER BUILDING on top of Mt. Pinnacle in the Helderberg Mountains, 12 airline miles from the Capitol Broadcasting Company's Schenectady studios.

Basic FM Channels Available to Your Community

• Allocation Plan for FM Broadcasting Stations Announced by FCC, Dec. 19, 1945. Includes All Metropolitan and Rural Channels Assignable in the United States in the 88.1 to 107.9 Megacycle Band. Does Not Include Community Channels. Asterisk (*) Indicates that the Area is Eligible for Community Channel.

ALABAMA

City	Channel No.
Anniston (includes Gadsden)	280
Bessemer	See Birmingham
Birmingham (includes Bessemer)	226, 228, 230, 232, 234
Decatur	261
Dothan	267, 269
Gadsden	See Anniston
Huntsville	249
Mobile	231, 250, 271, 273
Montgomery	268, 260, 263
Muscle Shoals	244, 246
Opelika (see also Columbus, Ga.)	277
Selma	221, 223
Sylacauga (see also Talladega)	275
Talladega (see also Sylacauga)	273
Tuscaloosa	254, 266

ARIZONA

Globe	221, 223
Lowell	229, 231
Phoenix	245, 247, 249, 261, 263
Prescott	225, 227
Safford	233, 235
Tucson	237, 239, 241, 243
Yuma	238, 240

ARKANSAS

Blythesville (see also Jonesboro)	249, 261
El Dorado	277, 279
Fort Smith	267, 269
Helena	241, 243
Hot Springs and Hot Springs N. P.	271, 273, 275
Jonesboro (see also Blythesville)	268, 270
Little Rock	267, 269, 261, 263, 265
Pine Bluff	221
Siloam Springs	245, 247

CALIFORNIA

Bakersfield	264, 266, 268
Chico	226, 228
El Centro	232, 234
Eureka	230, 232
Fresno	270, 272, 274, 276, 278
Los Angeles (Metropolitan District)	223, 225, 227, 229, 231, 233, 235, 237, 239, 241, 243, 245, 247, 249, 251, 253, 255, 267, 259, 261
Marysville	222, 224
Merced	230, 232
Modesto	257
Monterey	261
Palm Springs	269, 271
Redding	232, 234, 236
Riverside	273, 276
Sacramento	271, 273, 275, 277, 279
Salinas	280
San Bernardino	277, 279
San Diego	222, 224, 226, 228, 230
San Francisco-Oakland (Metropolitan District)	221, 223, 225, 227, 229, 231, 233, 235, 237, 239, 241, 243, 245, 247, 249, 251, 253, 265
San Jose	263, 266
San Luis Obispo	222, 224
Santa Barbara	274, 276, 278
Santa Maria	234, 236
Santa Rosa	258, 260
Stockton	267, 269
Visalia	238, 240
Tulare	242, 244
Watsonville	259

Key to Channel Numbering System

Channel No.	Frequency (Mc.)	Channel No.	Frequency (Mc.)
201	88.1	251	98.1
202	88.3	252	98.3
203	88.5	253	98.5
204	88.7	254	98.7
205	88.9	255	98.9
206	89.1	256	99.1
207	89.3	257	99.3
208	89.5	258	99.5
209	89.7	259	99.7
210	89.9	260	99.9
211	90.1	261	100.1
212	90.3	262	100.3
213	90.5	263	100.5
214	90.7	264	100.7
215	90.9	265	100.9
216	91.1	266	101.1
217	91.3	267	101.3
218	91.5	268	101.5
219	91.7	269	101.7
220	91.9	270	101.9
221	92.1	271	102.1
222	92.3	272	102.3
223	92.5	273	102.5
224	92.7	274	102.7
225	92.9	275	102.9
226	93.1	276	103.1
227	93.3	277	103.3
228	93.5	278	103.5
229	93.7	279	103.7
230	93.9	280	103.9
231	94.1	281	104.1
232	94.3	282	104.3
233	94.5	283	104.5
234	94.7	284	104.7
235	94.9	285	104.9
236	95.1	286	105.1
237	95.3	287	105.3
238	95.5	288	105.5
239	95.7	289	105.7
240	95.9	290	105.9
241	96.1	291	106.1
242	96.3	292	106.3
243	96.5	293	106.5
244	96.7	294	106.7
245	96.9	295	106.9
246	97.1	296	107.1
247	97.3	297	107.3
248	97.5	298	107.5
249	97.7	299	107.7
250	97.9	300	107.9

COLORADO

City	Channel No.
Alamosa	222, 224
Colorado Springs	266, 267, 269, 271
Denver	245, 247, 249, 261, 263, 255, 257, 269, 261, 263
Durango	226, 228
Grand Junction	230, 232
Greeley	276, 278
La Junta	233, 235
Pueblo	273, 276, 277, 279
Sterling	272, 274

CONNECTICUT

Bridgeport (includes Danbury)	265, 267, 269
Danbury	See Bridgeport
Hartford (includes Meriden)	226, 228, 230, 232, 234, 236
Meriden	See Hartford
New Haven	263, 271, 275, 277, 279
New London	250, 252
Stamford	*
Waterbury	222, 224, 261, 273

DELAWARE

Wilmington (includes Bridgeton, N. J.)	264, 266, 268

DISTRICT OF COLUMBIA

City	Channel No.
Washington	221, 223, 225, 227, 229, 231, 233, 263, 265, 267, 269, 271

FLORIDA

Daytona Beach	233, 235
Fort Myers	233, 235
Fort Lauderdale	229, 231
Gainesville	267, 269
Jacksonville	240, 242, 244, 246, 248
Key West	225, 227
Lakeland	237, 239
Miami-Miami Beach	238, 240, 242, 244, 246, 248
Ocala	250, 252
Orlando	258, 260, 262
Palm Beach	250, 262
Panama City	276, 278
Pensacola	225, 227, 229
St. Augustine	226, 228
St. Petersburg	221, 223, 225
Sarasota	241, 243
Tallahassee	271, 273
Tampa	227, 229, 231
West Palm Beach	254, 266

GEORGIA

Albany	226, 228, 230
Athens	261, 263
Atlanta	261, 253, 255, 257, 259
Augusta	233, 236, 237
Brunswick	221, 223
Cedartown (includes Dalton)	269, 271
Columbus (see also Opelika, Ala.)	242, 244, 246
Cordele	254, 256
Dalton	See Cedartown and Rome
Dublin	266, 268
Gainesville	276
Griffin	222, 224
La Grange	238, 240
Macon	270, 272, 274, 279
Moultrie	262, 264
Rome	266, 267
Savannah	253, 255, 267, 269
Thomasville	249, 251
Toccoa	249
Valdosta	236, 238
Waycross	232, 234
West Point	248

IDAHO

Boise	271, 273, 275
Idaho Falls	268, 270
Lewiston	257, 259
Nampa	267, 269
Pocatello	277, 279
Twin Falls	239, 241, 243
Wallace	268, 270

ILLINOIS

Aurora (includes Joliet)	276, 277
Bloomington	230, 232
Cairo	243
Carbondale	263
Carthage	259, 261
Champaign	See Urbana
Chicago	221, 223, 225, 227, 229, 231, 233, 235, 241, 245, 247, 249, 253, 265, 257, 259, 261
Decatur	254, 256
East St. Louis	See St. Louis, Mo.

Metropolitan - Rural Allocations Explained:

• FCC Statement Says They Provide Tentative Pattern Subject to Variations. Leave Room for Many Community Stations That Can Be Provided Where Needed.

IN CONNECTION with the FM applications now being acted upon by the Commission, a tentative allocation pattern has been developed for the United States and is used as a basis of allocation for Metropolitan (and Rural) FM channels. The plan attached hereto does not include Community stations, as it has not been considered practical to establish a basic allocation pattern for stations of this type.

In this proposed allocation, the number of channels indicated for each city (or area) normally exceeds the number of existing AM stations by from 50 to 100 per cent. Pending applications for FM stations were also considered, particularly for cities where no AM stations now exist. The allocation plan uses as a basis an effective radiated power of 20 kilowatts and antenna height of 500 feet above average terrain, and the separation of co-channel stations varies from that required by ground wave interference (principally in the Eastern United States) to the separation required for freedom from tropospheric interference one per cent of the time or less (principally in western areas). It is, of course, probable that many of the service areas which are being determined for these cities may exceed or be less than that provided by this power and antenna height, and accordingly interference may be more or less than that now considered. In general the separation of stations increases toward the western part of the United States where the expected demand for channels will be less, and where added protection for weak signals will be provided. Since in many cases it is likely that the service areas established will be smaller than that provided by 20 kilowatts effective radiated power and 500 foot antenna heights, the number of metropolitan channels available for assignments may be increased. It is also probable that many existing standard broadcast stations may be assigned Community channels, increasing the number of unused metropolitan channels in an area. Ten community channels may provide as many as five such assignments in some cities, depending upon the demand for such facilities in the area. It will be noted that only a few channels have been designated for a number of small cities, particularly in the West, since it appears that this would supply the probable demand. In such cases, of course, more channels are available for assignment and will be provided where required.

In several instances there appears a lack of sufficient channels to meet the probable need for assignments. When the demand grows in these areas, it is usually possible to reallocate channels from adjacent areas where the demand is less and where service may already be sufficient. As a result, a lack of channel listing for a particular locality does not necessarily mean that a channel cannot be made available there, should the need develop.

This plan is published as a guide regarding the manner in which the Commission expects to allocate FM channels throughout the country. The Commission wishes to emphasize that this allocation pattern is tentative only, that the channels listed for particular cities (and their areas) will not be followed in a hard and fast manner and that departures will be made from the plan wherever it is found desirable or necessary to do so.

ILLINOIS—Continued

City	Channel No.
Elgin	See Chicago
Evanston	See Chicago
Freeport	271
Galesburg	234, 236
Harrisburg	255, 257
Herrin	259, 261
Jacksonville	278, 280
Joliet	See Aurora
Kankakee	243
Mt. Vernon	265
Peoria	222, 224, 226, 228
Quincy	249, 251
Rockford	273
Rock Island (see also Davenport, Iowa)	264
Springfield	267, 269,276
Tuscola	250, 252
Urbana (includes Champaign)	258, 260, 262
Waukegan	251

INDIANA

City	Channel No.
Anderson	See Indianapolis
Columbus	237
Connersville	273
Elkhart	276, 278
Evansville (includes Henderson and Owensboro, Ky.)	222, 224, 226, 228, 230, 232, 234
Fort Wayne	235, 238, 240
Hammond	263, 265
Indianapolis (includes Anderson)	223, 225, 227, 229, 231, 233, 235
Kokomo	268, 270
Lafayette	272, 274
Marion	254
Muncie	277, 279
Richmond	275

INDIANA—Continued

City	Channel No.
Shelbyville	221
South Bend	257, 269
Terre Haute	242, 244
Vincennes	271, 273
West Lafayette	246

IOWA

City	Channel No.
Ames	237
Boone	233, 235
Burlington	257
Cedar Rapids	241, 243
Clinton	279
Davenport (see also Rock Island, Ill.)	266, 268
Decorah	225, 227
Des Moines	253, 265. 257, 269, 272
Dubuque	256, 258, 260
Fort Dodge	253, 255
Iowa City	245, 247
Marshalltown	230, 239
Mason City	257, 259
Ottumwa	274, 277
Shenandoah	238, 240, 242
Sioux City	274, 276, 278
Spencer	241, 243
Waterloo	249, 251

KANSAS

City	Channel No.
Atchison	264, 255
Coffeyville	276, 278
Dodge City	221, 223
Emporia	269, 271
Garden City	225, 227
Great Bend	258, 260
Hutchinson	237, 239
Kansas City	See Kansas City, Mo.
Lawrence	277, 279
Manhattan	222, 224
Pittsburg	238, 240

KANSAS—Continued

City	Channel No.
Salina	253, 255
Topeka	273, 275
Wichita	241, 243, 246, 249, 251

KENTUCKY

City	Channel No.
Asbland	See Huntington, W. Va.
Bowling Green	242, 244
Harlan	240, 248
Henderson	See Evansville, Ind.
Hopkinsville	250, 252
Lexington	272, 274
Louisville	258, 260, 262, 254, 255, 258, 270
Owensboro	See Evansville, Ind.
Paducah	245, 247
Winchester	276, 278

LOUISIANA

City	Channel No.
Alexandria	251, 263, 265
Baton Rouge	241, 243, 245
Lafayette	247, 249
Lake Charles	277, 279
Monroe	254, 256, 258
New Orleans	224, 226, 228, 233, 235, 237, 239
Shreveport	244, 245, 248, 250, 252

MAINE

City	Channel No.
Augusta	226, 228, 230
Bangor	232, 234, 235, 238
Lewiston	222, 224
Portland	251, 263, 255
Presque Isle	240, 242

MARYLAND

City	Channel No.
Baltimore	253, 255, 257, 259, 261, 273, 275, 277, 279
Cumberland	256, 262
Frederick	251

MARYLAND—Continued

City	Channel No.
Hagerstown	*
Olney	*
Salisbury	*

MASSACHUSETTS

City	Channel No.
Boston (includes Waltham)	221, 223, 225, 227, 229, 231, 233, 235, 264, 266
Fall River (includes New Bedford)	243, 245, 247
Fitchburg	*
Greenfield	*
Haverhill	241
Holyoke (includes Springfield)	238, 240, 242, 244, 246, 248
Lawrence	239
Lowell	237
New Bedford	See Fall River
North Adams	268
Pittsfield	280
Salem	*
Springfield	See Holyoke
Waltham	See Boston
West Yarmouth	*
Worcester	260, 262, 274, 276

MICHIGAN

City	Channel No.
Ann Arbor	277, 279
Battle Creek (includes Kalamazoo)	271, 273
Bay City (includes Saginaw)	248, 250, 252
Benton Harbor	280
Cadillac	222
Calumet	242, 244
Dearborn	*
Detroit (includes Pontiac, Royal Oak and Wyandotte)	221, 223, 225, 227, 229, 231, 233, 235, 237, 239, 241, 243, 246, 247
East Lansing (includes Lansing)	258, 260, 262
Escanaba	221, 223
Flint (includes Lapeer)	264, 266, 268, 270
Grand Rapids	224, 226, 228, 230, 232, 234
Ironwood	276, 278
Jackson	*
Kalamazoo	See Battle Creek
Lansing	See East Lansing
Lapeer	See Flint
Ludington	277, 279
Marquette	225, 227
Muskegon	254, 256
Pontiac	See Detroit
Port Huron	272, 274
Royal Oak	See Detroit
Saginaw	See Bay City
Sault Ste. Marie	233, 235
Traverse City	237, 239
Wyandotte	See Detroit

MINNESOTA

City	Channel No.
Albert Lea	261
Duluth (includes Superior, Wis.)	222, 224, 226
Fergus Falls	221, 223
Hibbing	232, 234
Mankato	222, 224
Minneapolis (includes St. Paul)	244, 246, 248, 250, 265, 267, 269, 271, 273, 275, 277, 279
Moorhead (see also Fargo, N. D.)	257, 259
Northfield	238, 240
Rochester	234, 236
St. Cloud	252, 254
St. Paul	See Minneapolis
Virginia	228, 230
Willmar	227, 229
Winona	229, 231

MISSISSIPPI

City	Channel No.
Clarksdale	245, 247
Columbus	237, 239
Corinth	264, 266
Greenville	236, 238
Greenwood	253, 255

MISSISSIPPI—Continued

City	Channel No.
Gulfport	253, 255
Hattiesburg	257, 259
Jackson	262, 264, 266, 268, 270
Laurel	242, 244
McComb	276, 278
Macon	272, 274
Meridian	246, 248
Natchez	272, 274
Tupelo	277, 279
Vicksburg	225, 227

MISSOURI

City	Channel No.
Cape Girardeau (see Cairo, Ill.)	239, 241, 243
Clayton	See St. Louis
Columbia	244, 246
Hannibal	240, 242
Jefferson City	264, 266
Joplin	272, 274
Kansas City (includes Kansas City, Kan.)	248, 250, 252, 254, 256, 258, 260, 262
Poplar Bluff	276, 278
St. Joseph	234, 236
St. Louis (includes Clayton)	221, 223, 225, 227, 229, 231, 233, 235, 237
Sedalia	268, 270
Springfield	224, 226, 228, 230, 232

MONTANA

City	Channel No.
Billings	239, 241
Bozeman	243, 245
Butte	248, 250
Great Falls	256, 258
Helena	252, 254
Kalispell	260, 262
Miles City	235, 237
Missoula	264, 266
Sidney	230, 232

NEBRASKA

City	Channel No.
Fremont (see also Omaha)	280
Grand Island	263, 265
Hastings	233, 235
Kearney	226, 228
Lincoln	245, 247, 249, 251
Norfolk	254, 256
North Platte	222, 224
Omaha (see also Fremont)	221, 223, 225, 227, 229, 231, 271
Scottsbluff	234, 236

NEVADA

City	Channel No.
Boulder City	255, 257
Las Vegas	259, 261, 263
Reno	259, 261, 263

NEW HAMPSHIRE

City	Channel No.
Claremont	271
Keene	*
Laconia	269
Manchester	269, 279
Mount Washington	251, 253, 255, 257
Portsmouth	249

NEW JERSEY

City	Channel No.
Alpine	See New York
Asbury Park	*
Atlantic City	*
Bridgeton	See Wilmington, Del.
Camden	See Philadelphia
Ewing Township	See Trenton
Jersey City	See New York
Newark	See New York
New Brunswick	*
Paterson	See New York
Trenton (includes Ewing Township)	270, 272, 278
Zarephath	*

NEW MEXICO

City	Channel No.
Albuquerque	245, 247, 249, 251
Carlsbad	221, 223
Clovis	237, 239
Gallup	238, 240
Hobbs	246, 248
Las Vegas	254, 256
Roswell	233, 235
Santa Fe	258, 260
Tucumcari	276, 278

NEW YORK

City	Channel No.
Albany (includes Schenectady and Troy)	221, 223, 225, 227, 229, 231, 233, 235, 259, 264, 266, 272
Auburn	See Syracuse
Batavia	241, 243
Binghamton	242, 244
Brooklyn	See New York
Buffalo (includes Niagara Falls)	221, 223, 225, 227, 229, 231, 233, 235, 237, 239
Coram	See New York or possibly Connecticut channels
Corning (see also Elmira)	236
Dunkirk	277, 279
Elmira (see also Corning)	238
Freeport	*
Gloversville	245
Hornell	260
Ithaca	258, 267
Jamaica	*

NEW YORK—Continued

City	Channel No.
Jamestown	268, 270
Kingston	*
Massena	226, 228
Middletown	*
Mt. Vernon	See New York
Newburgh	*
New York (includes numerous adjacent cities)	221, 223, 225, 227, 229, 231, 233, 235, 237, 239, 241, 243, 245, 247, 249, 251, 253, 255, 257, 259
Niagara Falls	See Buffalo
Ogdensburg	260, 262
Olean	272, 274
Oswego	270
Plattsburg	222, 224
Poughkeepsie	*
Rochester	245, 247, 249, 251, 253, 255
Saranac Lake	237, 239
Schenectady	See Albany
Syracuse (includes Auburn)	222, 224, 226, 228, 230, 232, 234
Troy	See Albany
Utica	250, 252, 254
Watertown	256, 265
West New Brighton	See New York
White Plains	See New York
Woodside	See New York

NORTH CAROLINA

City	Channel No.
Asheville	232, 234, 236
Burlington	267
Charlotte (see also Gastonia)	264, 266, 273, 275
Concord (see also Salisbury)	262
Durham	257
Elizabeth City	236, 238
Fayetteville	263
Gastonia (see also Charlotte)	270
Goldsboro	259
Greensboro (see also High Point and Winston-Salem)	251, 253, 255
Greenville	241, 243
Henderson	265
Hickory	258
High Point (see also Greensboro and Winston-Salem)	249, 278
Kinston (see also New Bern)	225, 227
New Bern (see also Kinston)	229
Jacksonville	252, 254
Raleigh	235, 237, 239
Roanoke Rapids (see also Rocky Mount)	272, 274
Rocky Mount (see also Roanoke Rapids)	277, 279
Salisbury	260
Washington	269
Wilmington	221, 223
Wilson	261
Winston-Salem (see also Greensboro and High Point)	241, 243, 245, 247

NORTH DAKOTA

City	Channel No.
Bismarck (includes Mandan)	222, 224, 226, 228
Devil's Lake	231, 233
Fargo (see also Moorhead, Minn.)	261, 263
Grand Forks	236, 238, 240, 242
Jamestown	245, 247
Mandan	See Bismarck
Minot	249, 251
Valley City	268, 270

OHIO

City	Channel No.
Akron (includes Tallmadge)	236, 238, 240
Alliance (includes Canton)	242, 244, 246
Ashland	284, 266
Ashtabula	See Erie, Pa.
Athens	275
Canton	See Alliance
Cincinnati (includes Hamilton)	239, 241, 243, 245, 247, 249, 251, 253, 255
Cleveland (includes Lorain)	222, 224, 226, 228, 230, 232, 234
Columbus	221, 223, 225, 227, 229, 231, 233, 235
Dayton (includes Springfield)	257, 259, 261, 263, 265
Dover	*
East Liverpool	*
Findlay	269
Fostoria	*
Freemont	See Toledo
Hamilton	See Cincinnati
Lima	*

(Continued on page 40)

OHIO—Continued

City	Channel No.
Lorain	See Cleveland
Mansfield	276, 278
Marion	272, 274
Newark (includes Zanesville)	268, 270
Portsmouth	See Huntington, W. Va.
Springfield	See Dayton
Steubenville	See Wheeling, W. Va.
Tallmadge	See Akron
Toledo (includes Freemont)	249, 251, 253, 255
Warren	269, 271, also Sharon, Pa.
Wooster	248, 250
Youngstown	See Sharon, Pa.
Zanesville	See Newark

OKLAHOMA

Ada	271, 273
Ardmore	246
Bartlesville	223
Elk City	238, 240
Enid	268, 270
Lawton	275, 277
Muskogee	221, 225
Norman	See Oklahoma City
Oklahoma City (includes Ponca City and Norman)	253, 255, 257, 259, 261, 263, 265
Okmulgee	250, 280
Ponca City	See Oklahoma City or Tulsa
Shawnee	242, 244
Tulsa	227, 229, 231, 233, 235

OREGON

Albany	253, 255
Astoria	269, 280
Baker	254, 256
Bend	222, 224
Coos Bay	268, 265
Corvallis (see also Albany)	257
The Dalles	249, 251
Eugene	259, 261
Grants Pass	272, 274
Klamath Falls	238, 240, 242
La Grande	226, 228
Medford	276, 278
Pendleton	230, 232
Portland (see also Vancouver, Wash.)	221, 223, 225, 227, 229, 231, 233, 235, 237, 239, 241, 243
Roseburg	267, 269
Salem	245, 247

PENNSYLVANIA

Allentown (includes Bethlehem and Easton)	234, 236, 238, 240
Altoona	264, 266
Beaver Falls	See Pittsburgh
Bethlehem	See Allentown
Bradford	246, See also Jamestown and Olean, New York
Butler	See Pittsburgh
Clearfield	See DuBois
DuBois (includes Clearfield)	248, 250
Easton	See Allentown
Erie (includes Ashtabula, Ohio)	259, 261, 263, 265
Glenside	See Philadelphia
Greensburg	237, 239
Grove City	*
Harrisburg	245, 247, 249, 270, 272, 278
Hazleton	*
Indiana	*
Johnstown	258, 260
Lancaster	222, 224
Lewistown	274, 276
Meadville	See Sharon
New Castle	See Sharon
New Kensington	See Pittsburgh
Philadelphia (includes Glenside, Pa., and Camden, N. J.)	242, 244, 246, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 274, 276
Pittsburgh (includes New Kensington, Beaver Falls and Butler, Pa.)	221, 223, 225, 227, 229, 231, 233, 235
Pottsville	*
Reading	226, 228, 230, 232
Scranton (includes Wilkes-Barre)	261, 263, 265, 269, 271, 273, 275, 277, 279
Sharon (includes Warren and Youngstown, Ohio, and Meadville and New Castle)	253, 255, 257, 273, 275
State College	252, 254
Sunbury	257, 259
Uniontown	241, 243
Washington	277, 279
Wilkes-Barre	See Scranton
Williamsport	221, 223
York	235, 237, 239, 241, 243

RHODE ISLAND

City	Channel No.
Pawtucket	See Providence
Providence	254, 256, 258, 270, 272, 278

SOUTH CAROLINA

Anderson	278, 280
Charleston	222, 224, 226
Columbia (see also Sumter)	250, 252, 254, 256
Conway	231
Florence	268
Greenville (see also Spartanburg)	225, 227, 229
Greenwood	240, 242
Rock Hill	238
Spartanburg (see also Greenville)	221, 223
Sumter (see also Columbia)	277, 279

SOUTH DAKOTA

Aberdeen	253, 255
Pierre	277, 279
Rapid City	221, 223, 225, 227
Sioux Falls	262, 264, 266, 268
Vermillion	258, 260
Watertown	237, 239
Yankton	270, 272

TENNESSEE

Bristol (includes Johnson City and Kingsport)	269, 271, 277, 279
Chattanooga (includes Cleveland)	233, 235, 237, 239, 241, 243
Clarksville	254, 256
Cleveland	See Chattanooga
Cookeville	263
Jackson	234, 236
Johnson City	See Bristol
Kingsport	See Bristol
Knoxville	222, 224, 226, 228, 230
Memphis	222, 224, 226, 228, 230, 232
Nashville	221, 223, 225, 227, 229, 261

TEXAS

Abilene	245, 247
Amarillo	267, 269, 271
Austin	238, 246, 248
Beaumont	271, 273, 275
Big Spring	242, 244
Brady	227, 229
Brownsville (includes Harlingen and McAllen and Weslaco)	221, 223, 225, 233, 237, 239
Brownwood	258, 260
College Station	233, 236
Corpus Christi	241, 243, 245, 247, 249
Corsicana	254, 256
Dallas	226, 228, 230, 232, 235, 237
El Paso	225, 227
Fort Worth	239, 241, 243, 262, 279
Galveston	267, 269
Harlingen	See Brownsville
Houston	251, 253, 255, 257, 259, 262
Huntsville	229, 231
Kilgore (includes Longview and Tyler)	272, 274, 276, 278
Laredo	227, 229
Longview	See Kilgore
Lubbock	226, 228
Lufkin	221, 225
Midland	273, 275
McAllen	See Brownsville
Palestine	264, 266
Pampa	232, 234
Paris	258, 260
Pecos	277, 279
Plainview	262, 264
Port Arthur	223, 227
San Angelo	231, 233
San Antonio	261, 263, 265, 268, 270, 272, 274, 276
Sherman	268, 270
Sweetwater	253, 255
Temple	250, 252
Texarkana	223, 226, 242
Tyler (see also Kilgore)	280
Vernon	222, 224
Victoria	278, 280
Waco	222, 224
Waxahachie	See Dallas and Fort Worth
Weslaco	See Brownsville
Wichita Falls	249, 251

UTAH

Cedar City	221, 223
Logan	273, 275
Ogden	265, 267
Price	277, 279
Provo	269, 271
Salt Lake City	245, 247, 249, 251, 253, 255, 257, 259, 261, 263

VERMONT

City	Channel No.
Burlington	230, 232
Rutland	243
St. Albans	234, 241
Waterbury	246, 248

VIRGINIA

Alexandria	See Washington, D. C.
Charlottesville (includes Staunton)	276, 278
Covington	236, 238
Danville	221, 223
Fredericksburg	See Washington, D. C.
Harrisonburg	232, 234
Lynchburg	268, 270
Martinsville	231, 233
Newport News (see also Norfolk, Suffolk and Portsmouth)	222, 224
Norfolk (see also Newport News, Portsmouth and Suffolk)	226, 228
Petersburg	258, 260
Portsmouth (see also Newport News, Norfolk and Suffolk)	230, 232
Richmond	242, 244, 246, 248, 250, 252, 254, 256
Roanoke	225, 227, 229
Staunton	See Charlottesville
Suffolk	See Newport News, Norfolk and Portsmouth
Winchester	*

WASHINGTON

Aberdeen	264, 266
Bellingham	276, 278
Centralia	260, 262
Everett	272, 274
Longview	273, 275
Olympia	256, 258
Port Angeles	268, 270
Pullman	238, 240
Pasco	242, 244
Seattle	222, 224, 226, 228, 230, 232, 234, 236, 238, 240, 242, 244
Spokane	221, 223, 225, 227, 229, 231
Tacoma	246, 248, 250, 252, 254
Vancouver	271, see also Portland, Ore.
Walla Walla	234, 236
Wenatchee	267, 269
Yakima	265, 277, 279

WEST VIRGINIA

Beckley	264, 266
Bluefield (includes Welch)	250, 252, 254
Charleston	222, 224, 226, 228, 230
Clarksburg (includes Fairmont and Morgantown)	245, 247, 249, 251, 253
Fairmont	See Clarksburg
Huntington (includes Ashland, Ky.)	258, 260, 262
Logan	232, 234
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ELECTRONIC INDUSTRIES

views TELECOMMUNICATIONS for 1946

No form of electronic applications has advanced more rapidly from war technology than telecommunications. Newly-revealed trends point to a wide use of frequencies in parts of the radio spectrum where a few years ago it was impossible even to generate radio waves.

For example, what do you know about pulse modulation, frequency shift transmission, or beam transmission at s.h.f.? All three have been developed from radar. All three represent new telecommunication methods which unquestionably are destined to revolutionize our concepts of communications. All of industry will benefit from these new methods, through radio (AM and FM), television, railroad, aviation and marine communications, and even citizens' radio.

These advances have recently been presented in ELECTRONIC INDUSTRIES. Editorially, ELECTRONIC INDUSTRIES is built around the need of charting these technics and presenting them for all industries' use.

As the technical magazine of telecommunications, ELECTRONIC INDUSTRIES in the past year has published the following articles, full indication of its editorial service to its 18,293 circulation.

Pulse Position Modulation Technic—Dec.
Pulse-Time Modulation—Feb.
PT Modulation for Multiple Transmission—Nov.
Reviewing Some Basic Modulation Processes—May
Measuring Klystron Amplifier Features—Feb.
Transitron Oscillator for High Stability—Dec.
Measuring Emission Characteristics with Pulse Technic—Nov.
Tropospheric Study of FM Transmission—Dec.
Analysis of Transmission Line Networks—June
Ratio Discriminator Is Insensitive to AM—Nov.
Latest Type AAF Blind Landing Equipment—Jan.
Operational Elements of a Radar System—May
Technic of Antenna Gain Measurements—Oct.
Ground Wave Range Calculator for FM—Nov.
Interference Effects in FM Without Limiting—May
Engineering Double Superhet Receivers—Mar.
High Quality Sound Recording on Magnetic Wire—Dec.
Television Optics—Aug.
VHF Network for Television Relay—June
Silicon Crystals for UHF Detection Circuits—Nov.

Engineering decisions are made by engineers—men who make engineering decisions read ELECTRONIC INDUSTRIES.

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TRANSMITTER-ANTENNA COSTS

THERE'S a 25 to 35 million dollar market in equipment for new FM stations, according to best informed industry circles. Figures are based on the more than 725 applications on file with the Federal Communications Commission at the end of 1945. These indicated that applicants were planning to spend $39,097,325, but the estimates were based on pre-war prices and many included real estate costs.

In a survey of transmitter and antenna costs recently completed by FM JOURNAL, nine manufacturers were able to stipulate prices, with two others (Collins Radio Co., and Harvey Radio Laboratories, Inc.) indicating that figures could be expected early in '46. The transmitter prices currently quoted by these companies are as follows:

FEDERAL TELEPHONE & RADIO CORP.: 250 w, $5,500; 1 kw, $9,100; 3 kw, $12,500; 10 kw, $23,200; 50 kw, $70,000. (Delivery of 250 w. 1 kw and 3 kw by March; 10 kw by June; 50 kw by July.)

GENERAL ELECTRIC CO.: 250 w, $3,950; 1 kw, $7,800; 3 kw, $11,950. (Delivery by March.)

GATES MANUFACTURING CO.: 250 w, $3,500; 1 kw, $6,000; 3 kw, $8,000; 10 kw, $17,000. (All prices are tentative.)

FRED M. LINK: 250 w, $3,500; 1 kw, $8,500; 3 kw, $11,500; 10 kw, $16,500. (Delivery of 250 w and 1 kw by February; 3 kw by March; 10 kw by June.)

RCA: 250 w, $4,500; 1 kw, $9,200; 3 kw, $12,300; 10 kw, $22,000 (estimated).

REL: 250 w, $5,550; 1 kw, $10,500; 3 kw, $12,500; 10 kw, $23,000. (Delivery of 250 w and 1 kw by March; 3 kw by April; 10 kw by June.)

TEMCO: 250 w, $4,250; 1 kw, $8,250; 3 kw, $12,150; 10 kw, $21,250. (Delivery of 250 w and 1 kw by February; 3 kw and 10 kw by March.)

WESTERN ELECTRIC: 1 kw, $1,000; 3 kw, $12,080; 10 kw, $20,500; 50 kw, $70,000.

WESTINGHOUSE: 1 kw, $9,500; 3 kw, $14,000; 10 kw, $24,000; 50 kw, $70,000. (1 kw, 3 kw and 10 kw immediately available.)

Plus Armstrong Royalties

Foregoing prices include 2 sets of crystals and operating tubes.

Purchasers of Federal, GE, REL, Western Electric, Gates, and Link transmitters must also stand the cost of one-time royalties to FM inventor E. H. Armstrong, for the use of his phase-shift modulator. These figures are as follows: 250 w, $300; 1 kw, $500; 3 kw, $917; 10 kw, $2,000; 50 kw, $5,000.

OUR own survey of equipment manufocturers, ond the FCC's, indicote costs of FM transmission equipment ore well within the reach of both smoll entrepreneurs ond lorge. New FM station applicants, prepored to invest obout $40,000,000, will spend $25,000,000-$35,000,000 on their technicol equipment.

Four manufacturers were also able to divulge their prices on antenna arrays for the new 88-108 mc band.

FEDERAL: 1-bay, $1,700; 2-bay, $2,000; 4-bay, $3,000; 6-bay, $3,500; 8-bay, $4,200. (Delivery by February.)

GE: 1-bay, $500; 2-bay, $950; 4-bay, $1,850 (low power), $2,250 (high power); 6-bay, $3,500; 8-bay, $4,750. (Delivery of 1- and 2-bay by June.)

RCA: 2-bay, $1,500; 4-bay, $2,850; 6-bay, $4,250.

REL: 1-bay, $1,700; 2-bay, $2,000; 4-bay, $3,000; 6-bay, $3,500; 8-bay, $4,200. (Delivery by February.)

FCC-Senate Figures

Figures prepared by the FCC Accounting, Statistical & Tariff Dept., at the behest of the Senate Small Business Committee, and released in November of last year, estimated that the median cost of specified equipment for. let us say, a 3-kw station amounts to only $17,858. The range of costs for a station of this power runs from a low of $12,420 to a high of $24,427. (But FCC statistics are generally on the loose side, more often than not do not jibe with trade figures. and so should not be accepted as completely accurate.)

FCC used replies from leading manufacturers as the basis for its study. Selected items covered transmitters (including royalty), antennas, control consoles, remote pick-up equipment, turntables, monitors. They did not include supporting structures for antennas, furniture, real estate, construction, etc.

Adjoining are the FCC tables, covering low, median and high estimates for 250 w, 1 kw, 3 kw, 10 kw, and 50 kw FM stations. The last table, comparing FCC findings with General Electric figures published in 1944, does not include costs for antenna towers nor control consoles.

Table I—250-Watt Station

Equipment	Low Estimate	Median Estimate	High Estimate
Transmitters	$3,800	$4,500	$5,940
Antennas*	950	1,700	3,250
Control Consoles .	830	1,800	3,000
Remote Pick-up ..	75	208	800
Turntables	165	450	650
Monitors	600	850	860
Total	$6,420	$9,508	$14,500

* Estimates for 2-bay antennas only. Estimates for one-bay antennas: Low, $500; Median, $1,500; High, $2,000.

Table II—1 Kw Station

Equipment	Low Estimate	Median Estimate	High Estimate
Transmitters	$6,500	$9,200	$10,500
Antennas*	1,850	2,250	4,200
Control Consoles .	830	1,800	3,000
Remote Pick-up ..	75	208	800
Turntables	165	450	650
Monitors	600	850	860
Total	$10,020	$14,758	$20,010

* Estimate for 4-bay antennas only. Estimate for 2-bay: Low, $950; Median, $1,700; High, $3,250. Estimate for 6-bay: Low, $3,500; Median, $3,700; High, $4,200.

Table III—3 Kw Station

Equipment	Low Estimate	Median Estimate	High Estimate
Transmitters	$8,900	$12,300	$14,917
Antennas*	1,850	2,250	4,200
Control Consoles .	830	1,800	3,000
Remote Pick-up ..	75	208	800
Turntables	165	450	650
Monitors	600	850	860
Total	$12,420	$17,858	$24,427

* Estimate for 4-bay antennas only. Estimate for 2-bay: Low, $950; Median, $1,700; High, $3,250. Estimate for 6-bay: Low, $3,500; Median, $3,750; High, $4,200.

Table IV—10 Kw Station

Equipment	Low Estimate	Median Estimate	High Estimate
Transmitters	$18,500	$21,750	$25,056
Antennas*	1,850	2,250	4,200
Control Consoles .	830	1,800	3,000
Remote Pick-up ..	75	208	800
Turntables	165	450	650
Monitors	600	850	860
Total	$22,020	$27,308	$34,566

*Estimate for 4-bay antennas only. Estimate for 2-bay: Low, $950; Median, $1,700; High, $3,250. Estimate for 6-bay: Low, $3,500; Median, $3,750; High, $4,200.

Table V—50 Kw Station

Equipment	Low Estimate	Median Estimate	High Estimate
Transmitters	$70,000	$75,000	$75,600
Antennas*	1,850	2,250	4,200
Control Consoles .	830	1,800	3,000
Remote Pick-up ..	75	208	800
Turntables	165	450	650
Monitors	600	850	860
Total	$73,520	$80,558	$85,110

*Estimate for 4-bay antennas only. Estimate for 2-bay: Low, $950; Median, $1,700; High, $3,250. Estimate for 6-bay: Low, $3,500; Median, $3,750; High, $4,200.

Table VI—Station Costs by Power

Power	FCC Survey—Nov. 1945 Low Estimate for Selected Items	FCC Survey—Nov. 1945 Median Estimate for Selected Items
250 w	$ 5,580	$ 8,000
1 kw	8,290	12,700
3 kw	11,580	16,350
10 kw	21,180	25,800
50 kw	72,680	79,050

Power	General Electric—1944 Average Estimate for Selected Items	General Electric—1944 Average Estimate for All Items
250 w	.....	.....
1 kw	$ 20,000	$ 42,000
3 kw	26,250.	33,250
10 kw	30,000	74,285
50 kw	102,000	136,530

margin for perfection

FROM THE DEEP TONE of sound throbbing at fifty cycles a second to the keen brilliance of sound at more than ten thousand cycle vibrations—FM broadcasting is a vehicle to transmit the whole range of human hearing.

Perfect complement to the exacting standards of FM is the NBC THESAURUS radio recorded library service. NBC THESAURUS offers a system of reproduction free from traceable distortion—reproduction harmonically balanced—reproduction of unique clarity. That is the RCA-NBC Orthacoustic recording system.

In content, NBC THESAURUS is designed in accordance with specific program requirements of 1000 station operators. In performance, NBC THESAURUS provides balanced, full-cycle, undistorted sound reproduction. For FM broadcasting, NBC THESAURUS offers the inherent advantages of its lateral-cut system—**the margin for perfection.**

NBC

A Service of Radio Corporation of America

NBC RADIO-RECORDING DIVISION

AMERICA'S NUMBER 1 SOURCE OF RECORDED PROGRAMS

RCA Bldg., Radio City, New York • Chicago • Washington • Hollywood • San Francisco

$600 MILLION MARKET

(*Continued from page 19*)

FM according to family income appears to be about as follows: 75.6% of the executive and professional radio families with annual incomes of over $5,000; 67.8% of highly skilled and white-collar workers with incomes between $3,000 and $5,000; 63.4% of the skilled and semi-skilled labor and average farmer radio-families with annual incomes between $1,000 and $3,000; 53.3% of the unskilled and tenant farmer radio-families with annual incomes of less than $1,000.

The number of non-FM owners who want an FM set also varies according to geographical areas. In the Northeast section of the country, 57.4% say they want FM; in the North Central, 65.7%; in the South, 87.6%; in the West, 54.3%. These figures may also reflect the relatively poor conditions for AM reception in contrast with possible FM reception in certain areas. In the South static is more troublesome and in the North Central section many receivers are located far from transmitters and are therefore subject to more fading and less selectivity.

Although slightly less than one-fifth of those who said they want an FM set were unable to state how much more they expected to pay for it, the other four-fifths expressed their ideas as follows: 36.4% estimated the extra cost of FM at less than $30; 23.5% between $50 and $75; 15.1% at over $100; 14.8% between $30 and $50; 8.2% between $75 and $100; and an even 2% estimated the extra cost of FM at zero.

High Fidelity Is Attraction

The average is somewhere in the neighborhood of $60 per set or a possible total increase of $600,000,000 in the market value of 10,000,000 sets.

One of the outstanding reasons why the non-FM owners are willing to pay more for the FM sets they say they will buy, is FM's high fidelity feature. 71.8% think high fidelity is an advantage; only 2.4% say it is a disadvantage, while the remaining 25.8% simply say it is unimportant. When we asked them if they would pay $100 to $150 more for a set with true high fidelity, 56.2% said yes.

However, when we studied the position of set controls after FM owners had adjusted them, we observed that only 18.6% actually took advantage of FM's high fidelity feature. 70.9% did not and 10.5% apparently did not know how to adjust their receivers for high fidelity. But whether he will take advantage of FM's high fidelity feature or not, the average non-FM owner who wants to buy an FM set also considers high fidelity one of the outstanding features.

One might assume that many who want FM reception would look to the use of a converter to use with their existing AM sets. This does not appear to be true. People who want FM want new sets. They want AM-FM combinations similar to the 93.1% of FM sets now in use.

This is the conclusion we reached after putting the question of converters directly to the non-FM owner. We described a converter as a device to receive FM signals through the use of amplifiers and speakers in existing AM sets and said the cost would be in the neighborhood of $50. Only 10.6% of those interviewed said they wanted converters; 55.4% said they don't want them; 34.0% didn't know whether or not they wanted a converter.

Outside Antenna

Fully three-quarters of the FM owners we called on used an outside antenna. However, not all of these are special FM antennas. Further investigation showed that 45.3% of FM owners use special FM antennas—only 16.7% using them in large cities and 72.7% using them in country areas. Using ordinary antennas in connection with FM sets were 28.5% of the owners in large cities and 20.5% in country areas. Using inside antennas with FM were 42.9% of the owners in large cities and only 4.5% in country areas.

More available roof space outside of city areas, combined with increased distances from FM transmitters, naturally increases the need for special antennas to receive FM and other high frequency signals.

When we asked non-FM owners whether they considered the extra cost of an antenna for FM important, only 18.3% said they would not buy an FM set if the antenna costs $15 to $20 extra. 33.7% said they would not buy if the antenna costs $30 to $50 extra. On the other hand, the majority said they would buy FM sets anyway or considered the extra antenna cost unimportant.

In addition to discussing the antenna requirements for FM sets, we "revealed" other possible FM "faults" to prospective FM set buyers. We told them they might find FM sensitive to man-made static such as automobile ignition; we told them FM receivers sometimes do not stay tuned to stations; that some sets produce loud inter-station noises; that FM programs are quite different from standard broadcasts. And we reminded them

that many FM sets do not have push-button tuning.

Then we asked them how these considerations would affect their opinion of FM. 60.4% said they would buy an FM set even though it might pick up ignition noise; 68.9% said they would buy even though some sets may not stay tuned to programs; 74.1% said they would buy even though there were loud inter-station noises; 80.9% said they would buy despite the difference between FM programs and standard broadcasts; 90.9% said they would buy whether FM sets had push-button tuning or not.

So after we threatened them with the worst, 60.6% still said they would buy; 25.5% didn't know right now; but only 13.9% said they won't buy.

There is little doubt that FM has created a vast new kind of radio market, one that may expand more rapidly and more spectacularly than the initial growth of the radio business soon after World War I. FM should be a great boon to both the set manufacturer and the broadcaster. Twenty-five years ago nobody knew just where radio was heading or what the public would demand. Today we know the pulse of public demand. We know the trend of the radio listener's wants and we know what he will pay for what he says he wants.

CAESAR ADDRESSES HIS LEGIONS

[From the New York Times]

CHICAGO—James C. Petrillo, president of the American Federation of Musicians, asserted here today that he was trying to prevent the "importation" of foreign musicians by his ruling that radio stations in this country must ban programs originating abroad, except in Canada.

In an address at the annual party of Local 10, blind musicians, of which he also is president, and Local 208, colored musicians, Mr. Petrillo asserted:

"There's the tariff. The manufacturers lobby to keep cheap material out of the country. There's the immigration law. The Government, everybody, protects themselves against labor. Why the hell should we be exempt?

"You know what happened to Swiss watches. They stopped some from coming into this country. We're trying to see that foreign musicians, in person or by air, don't get our jobs."

"For a long time the conductors came from London, all the stars from Europe," he said, adding:

"They'd stay here several months, make a lot of dough, and then go home. I said, huh, you boys get into the union. There was a hell of a holler from the long-haired boys about that. Well, what about it?

"Then all the Heifetzes, the artists who play in front of the orchestra, didn't belong to the union. They said they didn't need a musician's card. We said, all right, if you don't need a card, go play by yourselves. They're all in now."

PROFILE OF A STATION

(*Continued from page 35*)

were furnished free of charge to the dealers.

Local theater displays were arranged and contests held in conjunction with the local motion picture houses to promote store traffic. Full-page cooperative ads were run in the local newspapers. The papers, wise in the ways of radio by reason of GE's many local demonstrations of its magic over the years, in turn did their share by opening their editorial columns to a wide variety of news and information about FM in general and WBCA in particular.

Building an Audience

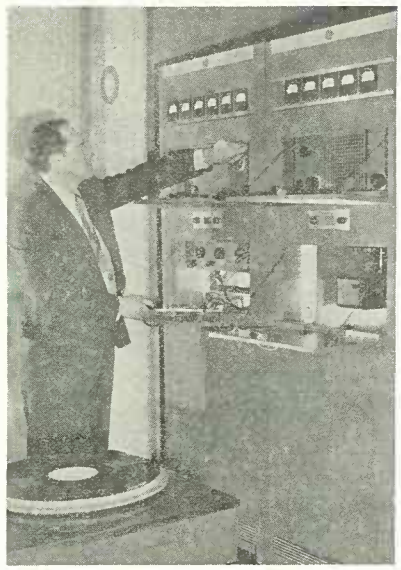
Within a period of three months, approximately 600 FM homes were added to WBCA's audience potential. By the time the station went on the air, more than 2,000 FM sets were sold to home owners in the area serviced by WBCA and about 15,000 at the freeze.

When Asch and Blodgett were ready to translate their idea for an FM station into action, Asch left his post with GE and together with Blodgett joined forces in 1939 with James E. Cushing, one of Schenectady's leading business men. They formed the Capitol Broadcasting Co., and filed an application for an FM station. The FCC granted a construction permit October 31, 1940.

At the outset, the Capitol Broadcasting Co., was confronted with the problem of transmitting programs from its studios in mid-town Schenectady to its transmitter on Pinnacle Point in the Helderberg Mountains, approximately 12 airline miles away.

The proposal to use leased telephone wire was unanimously vetoed since the quotation of $15,634.50 as installation cost, with a monthly rental of $118.50, was not only prohibitive but the full swing could not be guaranteed. With quotation in hand, Asch went to Washington, and with the backing of the FMBI, he asked for and received authorization to use a relay transmitter for a studio-transmitter link—a system never before tried for FM.

Since none of the relay equipment was available at the time, it was decided that temporary studios would be installed at the mountain-top transmitter in order to begin operations immediately. Meanwhile GE experimented with relay equipment and found that a radio relay system above 300 megacycles was practical for FM. For one year, through all sorts of weather, technicians, announcers and



WBCA's CHIEF engineer, Dwelle S. Hoag, checks the station's 1 kw FM transmitter.

talent trudged up and down the mountain.

WBCA was on the air!

Mountain Transmitter

The winters are long and rugged in the Helderberg Mountains. On many occasions, the county snowplow had to be called out to lead the way up the mountain. Happily, plans for the mountain transmitter, which is 1,600 feet above sea level, called for an apartment with an electric kitchen which the engineers call home during most of February and March. They are often snowed in for more than a week at a time.

Located in the center of the Albany-Schenectady-Troy triangle, WBCA's 1 kw. transmitter covers an area of 6,589 square miles, with a population of over a million. Among this total population are more than 15,000 homes with FM receivers.

WBCA, from the outset, began rebroadcasting programs originating at Yankee's WGTR in Paxton, Mass., 110 miles away, and Major Armstrong's Alpine station in New Jersey, 127 miles away. No relays were used and the then prevalent theory that the FM signal could travel perhaps a maximum of 30 miles was conclusively disproved.

Promotionwise, Asch's ideas knew no bounds. The people in the area served by the station were fed a steady diet of FM information in the form of talks before various local groups, newspaper publicity and direct mail. A list of FM set owners was compiled and a flow of station mail encouraged by the offer of "Pioneer Listening Certificates."

Glenn Miller and his orchestra were playing in Schenectady at Proctor's Theatre. To sell the high fidelity feature of FM to the 3,200 people in the audience, Asch installed a high-priced GE receiver on the theatre stage, several feet to the right of the orchestra. The receiver was offered to anyone in the audience who could distinguish between the music played by the band and that coming over the receiver. When the receiver music was being heard, members of the band faked the notes on their instruments. Several attempts were made by various individuals in the audience to call it right three times running. Not one succeeded.

Majored 'Live' Shows

WBCA is not a "white tie and tails" station. As a Mutual Network affiliate, the station has been on the air 16 hours a day for the last 4½ years. Currently, 29 live shows, totaling approximately 20 hours, originate from the station's studios each week. Prior to the recent Petrillo edict, which put the clamp on Mutual's live FM transmissions, only 1½% of WBCA's programs were transcriptions.

During the war, FM station WBCA consistently outsold all AM stations in the area in bond drives and in solicited blood donations. On one half-hour program, the station set itself a $25,000 war bond quota and received more than $283,000 in bond purchase orders!

The building on Schenectady's busy State Street, which currently houses WBCA's studio and antenna, will be torn down next May. Plans have already been made for the erection of a new building housing larger and more modern studios and offices. WBCA will broadcast from a temporary location from May to November, 1946 when the building should be completed.

Unofficially, the new building will be Schenectady's first full-fledged monument to FM—an industry which has outgrown its once over-sized diapers and which is ready to step into its first pair of long pants.

Award to WNYE

THE citation read "for exceptional merit in the utilization of a radio series." It came from the School Broadcast Conference of the Chicago Radio Council and was awarded, for the second consecutive year, to the New York Board of Education's FM station WNYE, operated by the city along with its AM station WNYC. The award was given to the station for the series *Know Your City,* a quiz program for elementary schools dealing with local geography and history, produced in collaboration with the City History Club.

Dedicatory

This is a journal for the FM Industry. The only one, in fact, 100% for it. It starts life with this issue. It starts life generously endowed with all the good things that make an industry magazine click . . . with recognized broadcasting experts behind it; with men who know how to infuse meaning, strength and beauty into a trade journal staffing it; and with the financial wherewithal to publish it. It starts, too, with a sense of deep obligation to a bright new field, and a keen zest for watching it grow. Its job: to bring ideas and inspiration to its industry, to give it cohesion, to interpret trends, to report happenings, and to help guide FM toward a useful and profitable existence.

The Journal of FREQUENCY MODULATION

Unique Antenna Resembles Rocket

RESEMBLING A ROCKET astride a launching site and towering approximately 700 feet above sea level, New York City's most recent addition to its skyline (atop 10 East 40th St.) is actually a new type of antenna designed and made expressly for FM broadcasting. It is presently undergoing stringent tests for FM Station WGHF, owned-operated by Capt. William G. H. Finch. The results have been so successful that Finch Telecommunications, Inc., of Passaic, N. J., manufacturers of facsimile apparatus and other electronic equipment, has acquired manufacturing rights and is putting the new antenna into production with promises of delivery within a few weeks after receipt of orders.

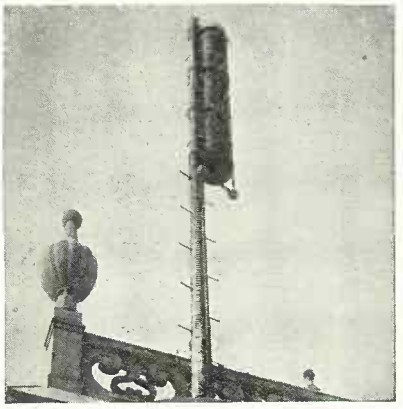
The inventor, Dr. Andrew Alford. of Harvard University, claims his "rocket antenna" improves on dipole or donut types. He says it nearly equals the power gain of four stacks or two circular antennas. This high output is attained by utilizing certain simple radiation factors which the war has brought to the fore.

In its operation, this new single unit antenna reacts as a wave guide, with one end shorted and the other energized. Numerous standing waves result when excited and emit a power potential which compares favorably to a stock of an infinite number of loops all fed in phase. A radiated effect of one wave-length is thereby gained.

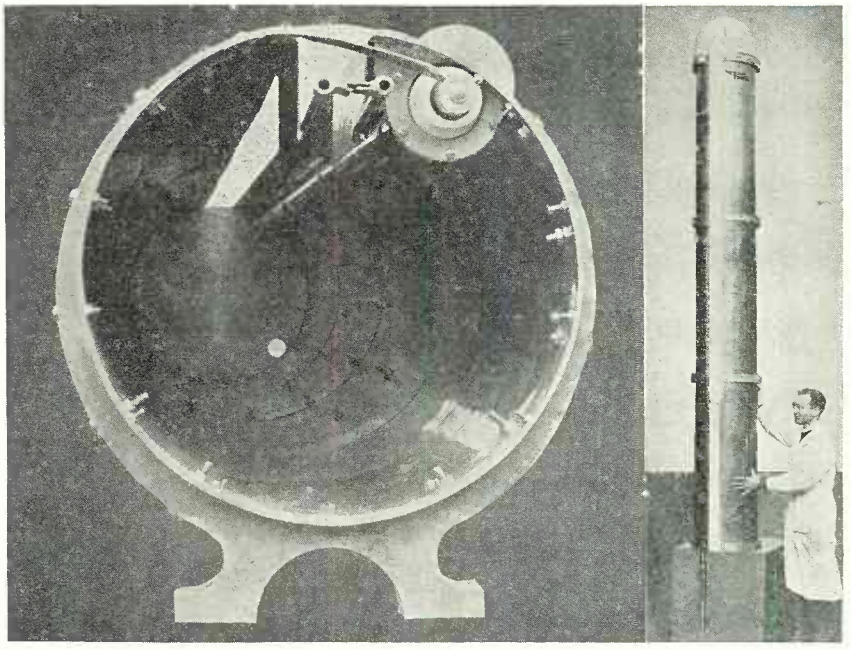
In designing an antenna which would perform its primary job efficiently, Dr. Alford has developed a rugged and simply constructed antenna. It is dressed up in a metallic robe with a fiber glass slot and dome to ward off the effects of the most destructive weather, thus reducing the task of maintenance.

The antenna meets all the necessary building construction and FCC requirements, being capable of radiating highly polarized waves which cover the entire service area. Although the present unit is designed for 3 to 10 kw., the inventor believes that rocket antennas can be made available for greater power.

In keeping with FM's new place in the spectrum, Dr. Alford's new antenna was developed to meet the technical standards of transmission necessary for the latest high frequency allocations, as specified by the FCC. The "rocket," according to its inventor, is also capable of serving as a radiator for facsimile, a field in which Capt. Finch has long been active.



NEW ANTENNA, now employed by FM station WGHF, graces New York's skyline.



INTERIOR VIEW of WGHF's racket antenna (left). The inventar, Dr. Andrew Alford, af Harvard University, stands beside his unique radiatar (right).

CLOTHING THE SKELETON

(Continued from page 7)

Syracuse. The Copley Press, with only a single AM station to date, wants outlets for its various newspapers in California and Illinois. Hearst seeks five—in New York, Baltimore, Milwaukee, Pittsburgh and San Francisco. McClatchy wants five in California. The Steinmans have applied for six—five in Pennsylvania, one in Wilmington, Del.

The Chicago Tribune, with a pioneer AM and FM in Chicago, has formed a subsidiary seeking additional FM outlets in Milwaukee, Peoria, Fort Wayne and Grand Rapids, and its related newspapers—the big New York Daily News and Washington Times-Herald—ask for outlets in those cities.

These are just a few of the bigger ones. We might mention, too, the applications of Frank Gannett's papers, Guy Gannett's in Maine, the Brush-Moore chain—and others ranging down to multiple publishers of very small town newspapers. And such big individual publishers as the Los Angeles Times.

There are other groups, too, besides newspapers, networks and old-line AM broadcasters.

Labar and Liberals

There's the liberal-labor union-cooperative segment of the nation, who see in FM's open field a chance to get on the air with their particular messages or who hope to make a go of just plain commercial operation.

Among them are the two big clothing worker unions—David Dubinsky's International Ladies Garment Workers Union, (as Unity Broadcasting Corp.), seeking outlets in New York, Boston, Philadelphia and Chattanooga; Sidney Hillman's Amalgamated Clothing Workers of America, seeking FMs in New York, Chicago, Philadelphia, Rochester. Then there's CIO's mighty United Automobile Workers Union, seeking outlets in Detroit, Flint, Chicago, Los Angeles, Cleveland and Newark.

Joe Curran's National Maritime Union wants a voice in New York. Chicago Federation of Labor's WCFL wants an FM also, as does Debs Memorial Fund's WEVD in New York, Socialist mouthpiece.

In New York also there is the newly formed Peoples Radio Foundation, comprising local labor unions, fra-

ternal organizations and the like whose "names" include Howard Fast and Langston Hughes, the writers; Rockwell Kent, the artist; Corliss Lamont, left-wing scion of the noted banking family; Rev. Adam Clayton Powell, Negro Congressman and husband of singer Hazel Scott; and others.

In Ohio, the Ohio Council of Farm Cooperatives seeks an FM outlet in Columbus with additional transmitters in the towns of Lebanon, Dunkirk, Dalton and Lancaster.

Politicos are in there pitching, too. Elmer Benson, Farmer-Labor Governor of Minnesota, former U. S. Senator, now a bigwig in the PAC, wants FM stations in Minneapolis, Duluth and Rochester. James Noe, ex-lieutenant governor of Louisiana and owner of several AM stations, seeks FMs in New Orleans, Monroe, Shreveport, Alexandria and Lake Charles.

Ex-Gov. Francis P. Murphy of New Hampshire wants to supplement his AM station in Manchester with an FM. Ed Rivers, former governor of Georgia, wants the same for his AM at Valdosta.

Nor are just plain business men lacking among the applicants. Telair Corp. of Ohio is an example. Composed largely of past and present Firestone officials, it seeks stations in Akron, Detroit, Chicago and Cleveland. There are motion picture interests like Howard Hughes, the producer and aircraft manufacturer, who would establish FMs in Los Angeles and San Francisco, and Balaban & Katz (Paramount) which is deeply in television and wants a Chicago FM also.

These are the diversity of interests represented among those who would crash the broadcasting field via the new FM art. Add them to the existing AM broadcasters, whose outside interests are fairly well known where they are not in radio as a business exclusively, and you have the flesh and blood of America's future broadcasting.

Streamlining for FM

To help speed up the processing of the close to 800 FM applications, the FCC Law and Engineering departments are now reorganized into individual sections for this purpose, and also to help handle the great numbers of AM and TV applications.

Head of the FM section of the Broadcast Branch, Law Department, is Sam Miller, who continues under Vernon L. Wilkinson, assistant general counsel in charge of the Broadcast Branch. Acting Chief of FM Division, Broadcast Branch, Engineering Department, is Cyril M. Braum, who also continues under John A. Willoughby, assistant chief engineer and head of Broadcast Branch.

Things to Come . . .

By EDWIN H. ARMSTRONG

I HAVE BEEN ASKED to make some predictions about the future of FM broadcasting. In the early days of its history this was not a difficult thing to do, because its course could be laid along the line of proven technical facts. Now it is no longer possible to do this for the vagaries of unproven theory have taken the place of experienced engineering judgment.

A little over ten years ago I made some predictions in the symposium of the future of the radio art which is carried out annually by the *New York Times*.

Those who were active in broadcasting at that time will recall that the question then being asked was "Will we ever have FM broadcasting?"

The predictions follow:

(From a Symposium in *New York Times* of January 5, 1936, headed "Radio Leaders Tell What They Foresee for 1936"): . . . "By Major E. H. Armstrong, Professor, Electrical Engineering, Columbia University—

"The New Year will undoubtedly witness the installation of frequency modulation transmitters operating in accordance with the principles that I recently described before the Institute of Radio Engineers. The problems in connection with this system which have their origin in the forces of nature have been completely solved, and it will be possible to furnish a staticless, high fidelity broadcasting service over greater distances than that now considered the normal service range of the present high-power station, namely, seventy-five miles.

"The sole difficulties which remain to be overcome and that may retard but not prevent the introduction of this service are those intangible forces so frequently set in motion by men, and the origin of which lies in vested interests, habits, custom and legislation."

All of these predictions have come to pass. Now the question is no longer asked "Will we have FM broadcasting?" We will. The question now is "What kind of FM broadcasting will we have?"

Will it be the best that the system can be engineered for by the men who developed it, limited in its ability to give service only by the forces of nature, or will it be a system restricted in its operation by those forces so frequently set in motion by men.

That is the issue. . . .

PLANNING AND BUILDING

(*Continued from page 14*)

governing the coverage of an FM station. Antenna elevation may be accomplished by supporting it on a building or tower or by a combination of natural elevation and supporting structure. In all except flat country it is necessary to weigh carefully the relative cost of construction and operation from several possible locations, employing combinations of tower heights and natural elevations. High natural elevations permit operation of FM stations in each class with less power than that indicated by the FCC formula. The relations between height of antenna and power for Community, Metropolitan and Rural class stations to provide the same coverage for each class of station is shown below:

Height of Antenna Above Surrounding Terrain	Effective Radiated Power	
	Community Class Station	Metropolitan and Rural Class Station
250 feet	250 watts	———
300 feet	180 watts	———
350 feet	130 watts	———
400 feet	100 watts	———
450 feet	80 watts	———
500 feet	50 watts	20 kilowatts
600 feet	33 watts	13 kilowatts
700 feet	20 watts	8.5 kilowatts
800 feet	15 watts	5.8 kilowatts
900 feet	10 watts	4 kilowatts
1,000 feet	8 watts	3 kilowatts
1,500 feet	———	1 kilowatt
2,000 feet	———	500 watts
5,000 feet	———	60 watts

It is evident that transmitter cost and operating expenses can be substantially reduced if high transmitter sites are available on natural elevations, provided the cost of development of the site is not too great.

The next most important factor which determines the coverage of an FM station is the effective radiated power. By the use of an array of radiators the effective power radiated may exceed by several fold the power output of the transmitter. A typical array suitable for FM is the "Turnstile." This consists of layers or bays of radiators supported on a steel mast. Below is a table of the power gain versus the number of turnstile bays.

Number of Bays	Power Gain
1	.5
2	1.3
4	2.7
6	4.2
8	5.8
10	6.5
12	8.0

It is evident that an effective radiated power of 20 kilowatts can be obtained by the following combinations with allowances for antenna coupling and transmission line losses:

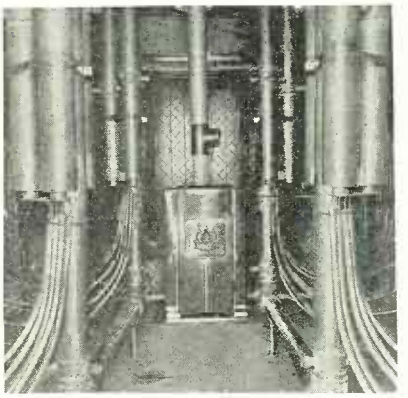
Transmitter Power	Number of Bays
20 kilowatts	2
10 kilowatts	4
3 kilowatts	12

The most economical combination can be determined only from a detailed study of first cost and operating expenses for the possible practical combinations. The wide range of possibilities is illustrated by the following table, which shows possible combinations of antenna height, antenna power gain, and transmitter power having substantially the same coverage over reasonably flat terrain.

Antenna Height	Antenna Power Gain	Transmitter Power
500 feet	1	20 kilowatts
500 feet	2	10 kilowatts
500 feet	4	5 kilowatts
500 feet	7	3 kilowatts
1,000 feet	1	3 kilowatts
1,000 feet	2	1.5 kilowatts
1,000 feet	4	750 watts
1,000 feet	7	430 watts
2,000 feet	1	500 watts
2,000 feet	2	250 watts
2,000 feet	4	125 watts
2,000 feet	7	71 watts
5,000 feet	1	60 watts
5,000 feet	4	15 watts

The above example holds for reasonably flat terrain but in hilly or mountainous country it is almost essential to select the highest practical transmitter site if more than spotty coverage beyond a relatively short distance is to be attained.

Yankee Network's pioneer FM station, WGTR in Paxton, Mass., is an example. Designed to serve the hilly and mountainous New England terrain, it combines the highest available transmitter location, centrally located with respect to the population to be served and high effective radiated power. A 50 kilowatt transmitter and a 10-bay turnstile antenna resulted in



COUPLING CIRCUIT for high power, high gain FM antenna of WGTR at Paxton.

an effective radiated power of about 300 kilowatts from a height of 1,600 feet.

Operating expenses will run from a minimum of about $2,500 per month up, exclusive of the cost of talent and network program service charges. The operating costs of Community class stations should be near the minimum stated. Metropolitan and Rural class stations will, however, cost considerably more, and it is estimated that $5,000 to $6,000 per month represents a fair average, exclusive of talent and network program service charges.

Many Local Variables

The above estimates are useful as a guide only, each individual case being subject to many local modifying factors, affecting the cost of both the establishment and the cost of operating FM stations. The principal variables are the nature of the terrain over the area to be served, the cost of power, cost of land, and the extent to which buildings, studios, and acoustic treatment and property are furnished beyond the bare necessity to comply with FCC rules and standards.

When the Yankee Network pioneered FM at Paxton and Mt. Washington, the cost of establishing these facilities was about one quarter of a million dollars each. Pioneering is always expensive, but much of the cost was due to expenses in connection with the development of the transmitter sites and expensive construction necessary because of the extraordinary weather conditions encountered on these northern mountain tops. In varying degrees similar factors will often be encountered in the establishment of many future FM stations.

Having determined the facilities required, application is filed with the FCC for a construction permit. Upon authorization, construction may be undertaken, upon completion of which application may be made for a license. If all rules, regulations and standards have been fulfilled, a license to operate is issued by the FCC.

Since the filing of applications involves many legal and technical details, engineering advice and legal counsel are usually found desirable, if not necessary, by the applicants.

By the time the FM broadcast station license has been issued by the FCC and the new FM station is on the air, the owner will realize that he has embarked on a venture in business that is legally, technically and operationally complex. The foregoing has merely presented a few of the facts of life on the planning and building of an FM broadcast station.

OPINION

'Almost the Whole Future'

I believe that FM is not merely one aspect of the future of audio broadcasting—but that it contains in itself almost the whole future of audio broadcasting. . . . Except in certain rural areas, FM was technically destined to replace AM transmission, as surely and inevitably as the tungsten lamp was destined to replace the old carbon filament . . . the mere fact of FM—the simple fact of its existence—while it becomes merely an invitation without a deadline for the newcomer—becomes almost an overnight mandate for the present AM broadcaster.—*Paul W. Kesten, CBS vice chairman, testifying before the FCC.*

2,000 by 1947

Today we are on the verge of an FM development in broadcasting so enormous that it may soon rival and thereafter surpass our present broadcasting system. On October 8, 1945, when the wartime freeze on new stations was lifted, there were already 669 applications for new FM broadcast stations on file with the Federal Communications Commission [the number now exceeds 750]. Conservative estimates suggest that the number will approach 2,000 by 1947 as compared with only about 950 standard broadcast stations now in operation.—*Paul A. Walker, FCC Commissioner, before Oklahoma City Chamber of Commerce.*

More National Networks

Actually, the transition from AM to FM in radio broadcasting will have little effect on an agency's operations. AM and FM are both radio, however you slice them, and production, writing, talent, and commercial problems will be essentially the same as ever. There will probably be more FM than AM stations, however, and perhaps more than four national networks. So competition for high rating programs will be tough, and the successful agency must maintain an accordingly elevated standard of showmanship.—*John Southwell, Young & Rubicam, Inc., in an article in Advertising & Selling.*

Petrillo 'Back to Normal'

Thus once more Mr. Petrillo decides what music the American people can and cannot hear. . . . Mr. Petrillo's irresponsible private dictatorship, we may assume, is perfectly satisfactory to Congress, to the Administration and to the Supreme Court. Not only have they done nothing to curb his power, but among them they have in fact conferred these powers upon him. Mr. Petrillo has the power to ruin any radio station by boycotting it. He can order his musicians not to work for it. He derives a large part of his power from the Wagner Act, which forces the broadcasting network to negotiate with him alone no matter how fantastic his demands or how anti-social his course. —*New York Times, commenting editorially on Petrillo's new ban on musical programs from foreign countries.*

Tubes for Larger Capacities

In addition to the time consumed during the studies and hearings in arriving at a decision, the new spectrum allocation required considerable development work, and, as a consequence, transmitters in the small capacities are expected to be available during the latter half of 1946. There are many problems involved, particularly the development of tubes for the larger capacities in the new spectrum areas.—*R. C. Cosgrove, President of RMA, before the Radio Executives Club of N. Y.*

What Price Laissez-Faire?

We likewise anticipate that Congress will do nothing to curb Mr. Petrillo's power to interfere at will with freedom of communications, and nothing to curb the arrogance which permits him to subordinate the tastes and cultural interests of other American citizens to the economic interests of the American Federation of Musicians. . . . The next step, doubtless, would be for Mr. Petrillo to prohibit all nonmusical programs, whether they originate in this country or not, on the ground that they deprive American musicians of a livelihood to which they are entitled. There are a large number of such programs, and it is impossible to believe that it will be very long before Mr. Petrillo will discover that they are taking a good deal of bread and butter away from his boys.—*Washington Post.*

FM as Mr. Wills Sees It

If they make available locally outstanding news and entertainment features from all over the world, and if they provide those special services for children, for rural listeners who are so peculiarly dependent on radio, and for other minority listeners, FM and television can become even more significant a feature of our daily life than standard broadcasting is at present.—*FCC Commissioner William H. Wills.*

Drawn for FM JOURNAL by Walter Frehm

"You won't hear any musicians saying anything against me."—J. Caesar Petrillo

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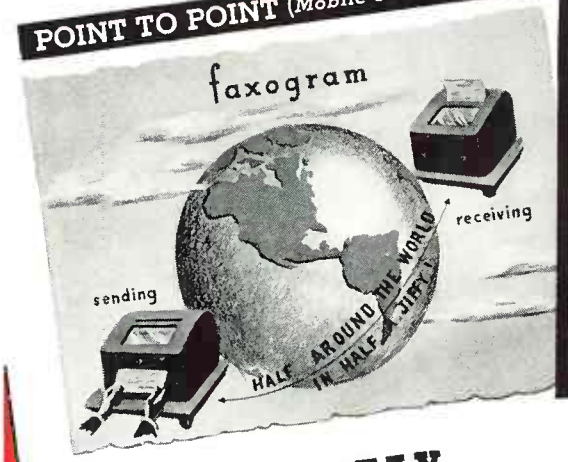

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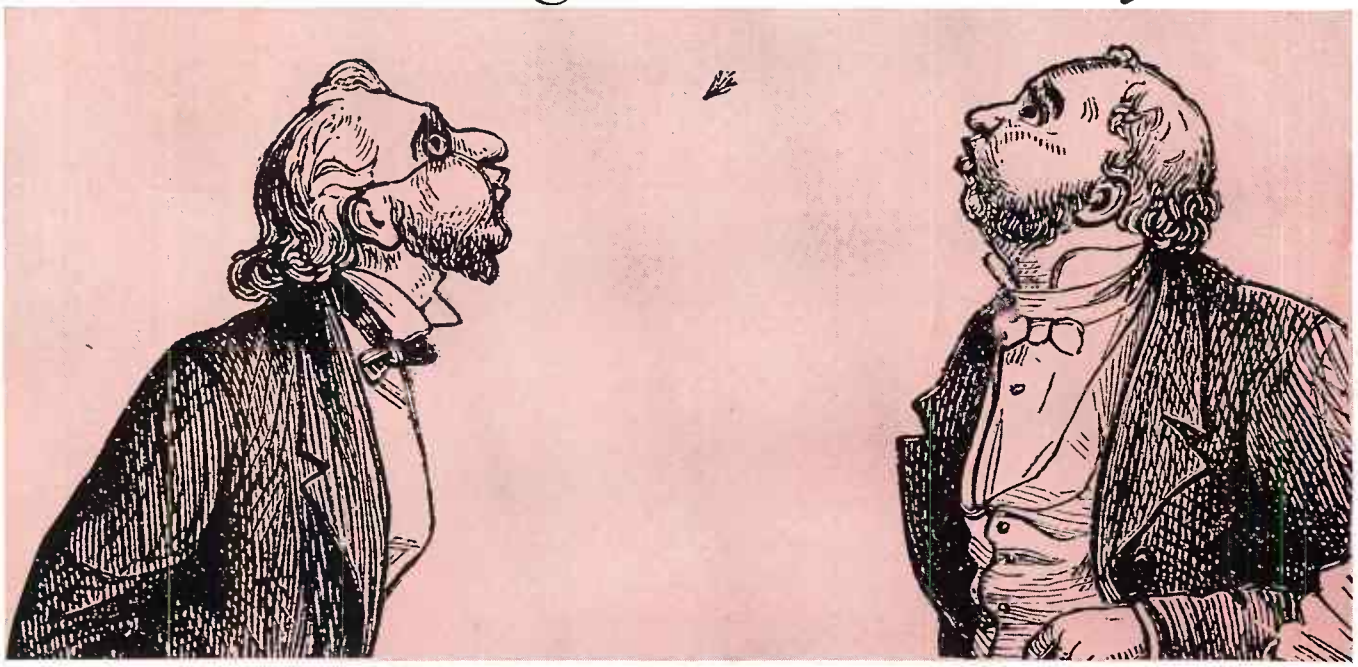

being some questions—with answers—that people have asked about WOR's frequency modulation station in New York

Q. When did the FCC grant WOR permission to open an FM transmitter?

A. In December, 1939. The call letters were W2XOR. On February 26, 1940, W2XOR went on the air from Carteret, N. J. It was powered by a 1000-watt REL transmitter and operated on 43.4 megacycles.

Q. When did the next advance, if any, take place in WOR's FM plans?

A. Technical experimentation was (and is) constantly being conducted by WOR's engineers, but anticipating the swift governmental and industrial progress about to take place in FM broadcasting, WOR moved W2XOR from Carteret in August, 1940, to an ideally equipped transmitting site on the 42nd floor of a New York skyscraper at 444 Madison Avenue. Here W2XOR began operating on the first Western Electric Prototype transmitter ever to be used in the United States.

Q. Did the megacycles remain the same?

A. No. A month later, September, 1940, they changed from 43.4 to 43.5. Eight months later the call letters became W71NY. In November, 1943, they were changed to WOR-FM.

Q. When did the last major call letter and megacycle change occur?

A. In December, 1943, WOR-FM became WBAM. At the moment, WBAM is powered by 10,000 watts and operates on 47.1 megacycles.

NOTE: *Apropos its technical experimentation, WBAM made other meritorious contributions to the advancing industry of FM. Typical: In January, 1942, the renowned research firm of Paul W. Stewart & Associates, Inc. was hired to conduct what probably was, and still is, the most intensive study ever made of FM listeners by family composition, sex, age, program preferences, etc. The findings were issued gratis to the industry, both in the U. S. and Canada, as a book entitled, "A Study of FM Listening."*

WOR'S FM STATION

wbam

AT 444 MADISON AVENUE, IN NEW YORK