

Here is the snappy 1 KW transmitter for NBC's FM station W2XWG. The antenna is atop the 1,250-foot Empire State Building, which gives it superior coverage.

NBC New York

FM Station

to go to

10,000 Watts

O. B. HANSON

Vice-President and Chief Engineer,
National Broadcasting Company.

THOSE of us who have made radio broadcasting our life's work may be pardoned, I am sure, for nursing a specialized grudge against those who so brutally shattered the peace of the world. For, first the threat of war, and then its full impact, have imposed severe limitations on the growth of radio's promising children.

One of these is *frequency modulation*, or FM broadcasting. The system is complete, its product of a quality beyond question. It should have its fair chance for a place in radio's expanding ranges of services to the American public. The national effort, however, demands intense concentration by the radio industry on every activity that will carry forward the battle for American freedom. Like other new radio developments, FM will undoubtedly fit usefully into that effort. Meantime we must divert energy and materials which might otherwise have gone into expanding FM's role in the field of broadcasting.

All the more laudable, therefore, that some broadcasters and some manufacturers have carried the cause of FM to the American listener as successfully as they have these last two years.

A tabulation before me as I write, lists more than twenty commercial FM stations already on the air, with nearly forty in process of completion. Another fifty applications await action by the Federal Communications Commission. Figures released by FM Broadcasters, Inc., indicate that about 240,000 receivers capable of receiving FM programs have been bought by the public.

Such figures are impressive in themselves, but even more so as an indication of the future of FM in radio broadcasting.

Advantages of FM. We have evidence, therefore, that FM has appeal for radio listeners. It has almost complete freedom from static. To critical ears it offers *higher fidelity*. Technically stated, the advantages of FM over AM transmissions (the latter in the standard broadcast band) may be stated as follows: (1) reduction of noise in reception, permitting a greater signal-to-noise ratio, (2) higher fidelity trans-

mission, i.e., a wider range of audio frequencies than is practicable on present channels in the standard broadcast band, (3) greater dynamic range in the program material being transmitted, and (4) less potential interference between stations having the same, or adjacent, carrier frequencies.

The last-named quality may be traced to the *limiter action* in the receiver, and the fact that in all UHF reception a directive antenna, of small physical dimensions, may be used to give one signal a distinct advantage over another, at locations where

The National Broadcasting Company conducted some of the earliest experiments in FM transmission. They were also one of the first in the industry to establish regular FM program service; W2XWG went on the air in April 1939 for the purpose of making extensive field tests. Regular FM programs have been broadcast since January 1940. NBC will erect an FM transmitter in Chicago.

stations on the same frequency would otherwise be received with approximately equal signal strength.

FM Channels Give 15,000 Cycle Fidelity. The higher fidelity characteristics of FM are attributable in part to the wider audio range which can be transmitted in the wider channels allocated for FM by the F.C.C. Forty channels have been set aside in the band extending from 42.1 megacycles to 49.9 megacycles. Each is 200 kilocycles wide. The channel in the standard broadcast band is but 10 kilocycles wide, ordinarily limiting the audio frequency range to 5,000 cycles. In the FM channels we find it possible to transmit a range of audio frequencies up to 15,000 cycles. This range permits the inclusion of all of the higher audible harmonics, or overtones, of music, which contribute to realism in the reproduced program.

These commendable characteristics of FM have sent many broadcasters searching for high buildings on which to perch their

UHF antenna arrays. Antenna height becomes an important factor in UHF transmission, since ground attenuation of the signal enters as a factor only when the optical horizon, as measured from the transmitting antenna, is reached. Beyond that horizon the UHF waves are governed by formulas for wave propagation on the surface of the ground. Here the UHF signal attenuates far more rapidly than it does within horizon limits. It is desirable, therefore, to push the horizons as far distant as possible. Hence the search for the highest possible antenna locations.

So much for the advantages of FM in ultra-high frequency broadcasting. Where does the broadcaster stand? The answer will be found in the list of actual and prospective commercial FM broadcasters.

Anticipating the future of UHF in radio broadcasting, the National Broadcasting Company selected the highest building in New York City for the installation of experimental transmitters with which to conduct propagation studies and developments in this field. Some of the first experiments in FM transmission were carried on at our station in the Empire State Building.

The National Broadcasting Company also was one of the first in the industry to establish an FM station. Its Station W2XWG went on the air in April, 1939, for the purpose of conducting extensive field tests of the comparative qualities of AM and FM. These findings have been the basis for numerous technical papers and talks.

A regular program service five days a week, eight hours or more a day, has been offered over the NBC station since January, 1940. Since it has been on the air, NBC has received numerous complimentary messages from discriminating listeners, who comment on the exceptionally high quality of the station's performance. Special programs and carefully selected material from NBC's daily schedules are heard over the station. In selecting program material from the network schedules, we have favored programs originating in the Radio City studios, since these afford us the opportunity of transmitting the wide range of audio frequencies that makes FM attractive to our listening audience.

THE STRANGE CASE OF SERVICEMAN WALDO MUDD

Our present transmitter, of RCA design, was installed under the direct supervision of NBC's radio facilities engineer, Raymond C. Guy. Operating on a frequency of 45.1 megacycles, it has an output of 1,000 watts. The principal innovation in its design is an FM modulator of the type developed by Murray G. Crosby, of the Radio Corporation of America. This modulator consists of several tubes, including an oscillator, a reactance tube, a crystal beating oscillator, a discriminator and a filter.

Power of FM Station to Be Increased. NBC holds a commercial construction permit under which the power of the FM station is shortly to be raised to the limits permitted by the F.C.C. in covering a service area of 8500 square miles with a minimum signal strength of 50 microvolts. The feat will not be difficult, inasmuch as the antenna location is the top of the Empire State Building tower, the highest and most advantageous site in the city (1250 ft.). The antenna array used, incidentally, is the video (picture) component of the familiar NBC television antenna, the transmission characteristics of which are substantially flat over 30 megacycles.

Transmitter equipment with a rating of 10,000 watts was ordered more than a year ago. The manufacturers have found themselves so deeply engaged in defense production, however, that delivery has been necessarily delayed. We hope to be on the air with increased power very shortly. NBC also holds a construction permit for a station at Chicago where an FM transmitter will be completed as soon as possible.

Future of FM Broadcasting. The fate of FM broadcasting will not rest with the broadcaster. The ultimate arbiter will be the American listener. For it is he who will judge for himself whether its superior service offsets the cost of a new FM receiver. The better his service from powerful AM stations in the standard broadcast band, the less likely he is to be impelled to rush to his nearest radio dealer to buy an FM set. Those who do not get comparatively noise-free reception from AM stations are likely soon to become FM enthusiasts.

Frequency modulation receivers designed to realize the full value of FM's high fidelity potentialities command a higher price than the best AM sets. If the listener is to enjoy the full benefits of FM transmissions in his home he must have a receiver incorporating a high-fidelity audio amplifier and loudspeaker system. Such a receiver cannot be manufactured to sell at a price comparable to those prevailing for the most popular AM models. There are, however, FM adapters on the market. These may be used in conjunction with the listener's AM receiver to yield the full value of FM's noise-free reception. Fidelity, however, is here limited to the characteristics of the AM receiver's audio amplifier and loudspeaker. It is worthy of note that many of this year's more expensive console models include an FM band. This will add to the new service's expanding audience.

A conservative estimate of FM's future would be that it will progress, not sensationally, but steadily. It also seems quite probable that when armies have ceased to march, when the dive-bomber's scream has been stilled, that FM will march briskly into an expanding future alongside that other infant prodigy of radio—television!

New I.R.E. President

Arthur F. Van Dyck, Manager of the Industry Service Section of the RCA Laboratories, has been elected President of the Institute of Radio Engineers it was announced today by that technical organization. The

Dear Miss Barefacts

I know that your column is entitled "Advice to the Loveless" and I am not loveless. As a matter of fact, I have more love than I know what to do with. That's why I am writing to you.

You see, Miss Barefacts, I am a radio service man. I make good money and I'm very happy. I mean I was happy until I met Arabella Blotts. She is one of my customers. In fact, she is my very best customer. That's the trouble.

Arabella has a very nice apartment with about eight radios in it. The first time she called me, I went over and fixed two of the radios in about half an hour. Then Arabella asked me to sit down and have a drink with her.

The correspondence course I took in radio servicing didn't say anything about what to do in a case like this. Besides, I don't drink anything but ginger ale. However, Arabella insisted, so I asked for ginger ale. It was very funny tasting ginger ale and I even felt funny after I drank it.

Then Arabella sat down beside me. She is a very big girl. Also, she is very determined. Every time I moved away from her, she shoved over closer to me. Finally, I was at the end of the davenport and couldn't move any farther. Also, I was at the end of my wits.

When I got back to my shop, I remembered she hadn't paid me for fixing the radio. Also, I was dizzy and didn't feel like working any more that day.

The next day, Arabella called and said both of the radios I had fixed were broken again and would I please come right over. Well, there wasn't anything to do but go over and fix them. So I did.



is the best customer I have. What shall I do?

Very truly yours,
WALDO MUDD,
Radio Service Man.

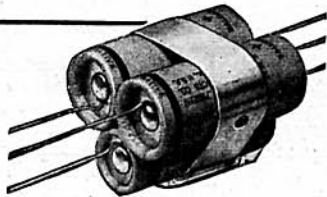
* * *

Dear Mr. Mudd

Don't worry. Your problem should be an easy one to solve. My first suggestion is that you marry Arabella Blotts. Evidently that would please her. Then you can repair her radios in your spare time and spend the rest of your time at work for which you will be paid. My second suggestion is that, in the future, you use Sprague Condensers and Koolohm Resistors for every replacement. Once you install them you can forget them—and so can your customer. Then, the next time you meet a girl like Arabella, she will have to be more original in finding an excuse to invite you back again.

Sincerely yours,
GERTRUDE BAREFACTS,
Editor, "Advice to the Loveless Column."

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Institute is the most important technical radio society in the world with 7000 members in 74 countries.

Van Dyck has been a well-known personality in radio from its earliest days. He has made many technical contributions to the art, the most recent being the RCA Alert Receiver, a device by which civilian defense workers are notified in times of emergency and called to a special radio to receive instructions for action. This development led to his appointment as Member of the Communications Liaison Committee of the Office of Civilian Defense. His interest in radio dates from his school days. He has some thirty patents to his credit, and a variety of interests that are as broad as an industry which comprises many diverse branches.

Arthur Van Dyck began his career in radio as a radio amateur. Later, he served as a ship operator for the United Wireless

Telegraph Company during college vacation periods. After receiving his Ph.B. at Yale, he joined the laboratory of Professor Reginald Fessenden, at Brant Rock, Mass., where he participated in many of the experiments of that pioneer which have since become technical classics. Afterwards he went to the Westinghouse Company at Pittsburgh, to serve as laboratorian, and later was instructor in Electrical Engineering in the Carnegie Institute of Technology.

During World War I Van Dyck was Expert Radio Aide in the U. S. Navy, which experience led to his appointment as Chief Factory Engineer of the Marconi Wireless Telegraph Company of America when peace-time radio was resumed. There followed a period of service with the General Electric Company, when he was in charge of development and design of radio receivers.