Broadcasting Music

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ERNEST LAPRADE
Director of Music Research
NATIONAL BROADCASTING COMPANY

RINEHART & COMPANY, INC.
NEW YORK TORONTO

OPENING ANNOUNCEMENT: Ladies and gentlemen, we bring you at this time another book on radio broadcasting, presented as a public service by the author, the publisher, and cooperative booksellers.

Much has been written on the subject of broadcasting. Its history, organization, and social implications have been copiously documented, and there are numerous textbooks on the techniques of radio engineering, radio writing, and radio production. However – and this is perhaps the chief justification of the present addition to radio literature – the broadcasting of music has hitherto received scant attention in print. In view of the fact that music constitutes more than half of the program material broadcast, its neglect is rather hard to understand.

The purpose of this book is to depict for the student – and for the music-loving listener, if he should be interested – the entire process of broadcasting music, from the planning of programs to their production in the studio. The requisite organization, equipment, and techniques are described; underlying principles are

analyzed; and, in order to give perspective to the picture, the historical and technical background is sketched in. Vocational requirements and opportunities are considered, and, finally, there is an inquiry into the possible future trends of music broadcasting.

As music and broadcasting both are highly technical arts, any discussion of them must inevitably involve technical considerations. As far as possible, technical matters are treated here in non-technical terms, and where technical phraseology is unavoidable it is explained in ordinary language.

The writer gratefully acknowledges his indebtedness to the many persons who, consciously or unconsciously, have helped in the preparation of this volume. To the radio engineers who during the past eighteen years have labored patiently to instruct a dull pupil in the elementary mysteries of their craft; to the NBC executives and specialists who have checked the accuracy of the text; to I. Keith Tyler, of The Ohio State University, and Burton Paulu, manager of the University of Minnesota radio station, KUOM, both of whom have offered constructive criticism and valuable suggestions; and to others who have contributed in various ways to the accomplishment of the task he expresses cordial appreciation. Thanks are due particularly to the following members of the NBC organization:

Whitney M. Baston, Thomas H. Belviso, Samuel Chotzinoff, Joseph D'Agostino,

Edwin L. Dunham, Charles Grey, O. B. Hanson, William S. Hedges, Charles G. Hicks, Mildred Joy, Samuel Kaufman, Henry Ladner, John H. MacDonald, Thomas McCray, Richard McDonagh, C. L. Menser, Leonard Meyers, Robert Morris, George M. Nixon, Ernest de la Ossa, John F. Royal, Edmund Souhami, Frances Sprague, F. A. Wankel, and George Wheeler.

Acknowledgment is also made to the National Broadcasting Company, for permission to reproduce several NBC continuities, and to the National Broadcasting Company, the American Broadcasting Company, the Mutual Broadcasting System, and Station WQXR, for photographs used as illustrations; to the American Telephone and Telegraph Company, for permission to quote a portion of The Birth and Babyhood of the Telephone and for furnishing a reproduction of the cartoon from Mr. Punch's Almanack which appeared in The Telephone Almanac for 1940; to Orrin E. Dunlap, Jr., for copies of old newspaper clippings; to the RCA Victor Division, for permission to reproduce photographs and response patterns of RCA microphones; and to Samuel Ross, first program director of Station WEAF (now WNBC), for details of that station's early history.

E. LaP.

New York
February, 1947.

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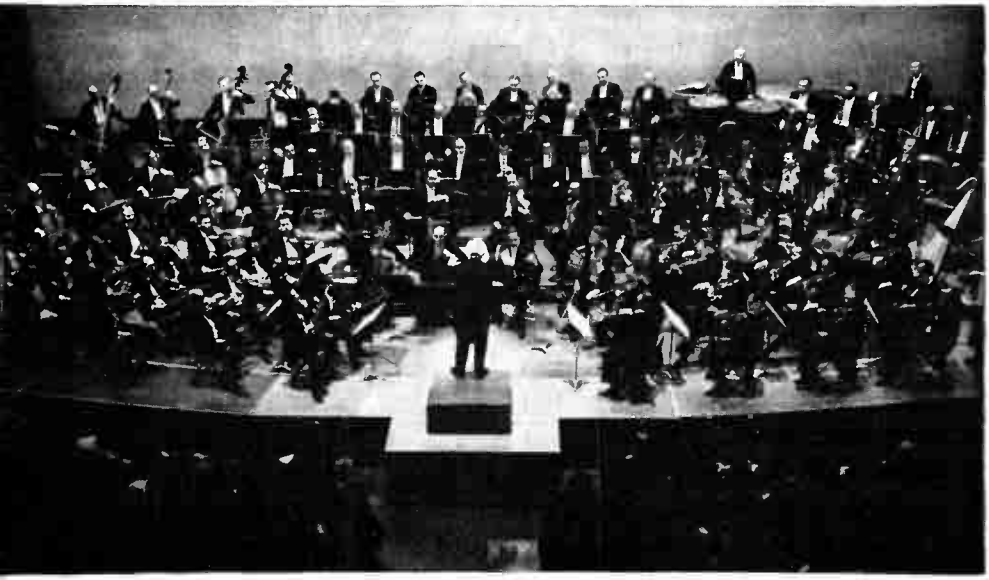


The NBC Symphony Orchestra, Arturo Toscanini conducting.

BROADCASTING MUSIC

1

The Beginnings of Music Broadcasting

IN 1945 the radio broadcasting industry celebrated its twenty-fifth anniversary. That is to say, it commemorated, with special radio programs and other appropriate observances, the broadcast by Station KDKA in Pittsburgh of the national election returns on November 2, 1920, the date now generally regarded as marking the inauguration of radio broadcasting as a regular service to the public.

There are other claimants, however, to the honor of having launched broadcasting on its fabulously successful career. WWJ, in Detroit, is one; another is a station that, according to Clarkson,[1] was established by Lee de Forest at San Francisco in March, 1920, for the purpose of broadcasting concerts by the San Francisco Symphony Orchestra. A third was Station WGI, formerly located at Medford Hillside, Mass. The writer is indebted to Edwin L. Dunham, an employee of WGI in the early 1920's and now assistant production manager of the National Broadcasting Company, for the opportunity to examine an office manual published in 1924 by the American Radio and Research Corporation, operator of Station WGI. This booklet outlines the history of the company from its incorporation on June 5, 1915, and states that

[1] R. P. Clarkson, *The Hysterical Background of Radio* (New York: J. H. Sears & Co., Inc., 1927).

it began transmitting radiophonic broadcasts, including both speech and music, in the latter part of 1915.

It may seem strange that there should be any question as to when and by whom radio broadcasting was initiated. One might suppose that an inspection of the records of pioneer stations would settle the matter, once and for all; but it does not. Apparently, broadcasters in the early days were too engrossed in their immediate problems to worry about posterity's interest in their activities. Moreover, the legal responsibilities that have subsequently imposed on radio stations the necessity of keeping complete and accurate records of their transmissions were not at once recognized. For these and perhaps other reasons the incompleteness of early station logs is the despair of historians.

In any case, the controversy as to whether broadcasting began in 1920 or in 1915 need not detain us, for there is ample evidence to show that it actually began some years before the latter date. For example, New York newspapers of January 14, 1910, reported a broadcast that occurred the previous evening and that is of peculiar interest from the musical as well as the historical point of view. It was engineered by the pioneer radio inventor, Lee de Forest, and originated on the stage of the Metropolitan Opera House in New York. The program consisted of the traditional double bill, *Cavalleria Rusticana* and *Pagliacci,* and its special musical significance derives from the fact that the role of Canio in *Pagliacci* was sung by none other than Enrico Caruso. This, apparently, was Caruso's first appearance before the microphone. That it was also his last is indicated by the fact that no further broadcasts took place at the Metropolitan until 1931, by which time the famous tenor had long since taken his final curtain call.

Orrin E. Dunlap, Jr., formerly radio editor of *The New York Times* and now an executive of the Radio Corporation

of America, has furnished the writer with photostatic copies of a number of press comments on this first broadcast from the Metropolitan. Some of them describe the preparations for the experiment, others its actual accomplishment. From the *New York Globe* of January 8, 1910, we learn that

> Grand Opera by wireless telephone from the Metropolitan Opera House will be ready within a few days. Already there is opera by the regular telephone, and during the performance of "Walküre" this afternoon telephones about town were connected with the opera house and some of the singing of Mme. Homer was heard miles away from the opera house.

The New York Times of January 9, 1910, gives further details.

> Opera is to be heard by wireless telephony, if present plans of Lee de Forest and the Metropolitan Opera Company are carried out, on Wednesday evening, when Mme. Fremstadt is to sing *Tosca* at the Metropolitan. . . . Any wireless receiver, properly attached and connected to a single upright wire and a telephone ear piece, will catch the ether pulsations.
>
> In company with Kelly Turner, the inventor of the Dictograph, an instrument which picks up the smallest sounds made many feet from the transmitter, Mr. de Forest has for a long time [been] at work perfecting arrangements for the present plan.

Presumably the arrangements met with some delay, for the promised broadcast took place not on Wednesday but on the following evening, Thursday, January 13, 1910. The results, when it finally came off, seem to have varied considerably at different reception points. According to the *New York Evening Sun* of January 14

> The experimental receiver at the front of the house [i.e., in the foyer of the Metropolitan] certainly delivered the voices like any talking machine. The more distant trials were marred by at-

mospheric and electrical conditions, but late returns said that some notes of Destinn and Caruso were picked up as far off as Newark, N. J.

The *New York Press* of the same date stated that the voices of Destinn and Caruso were heard at points as far distant as Bridgeport, Conn. While admitting that "A few interruptions by a wireless operator who evidently did not like music spoiled one or two scenes of the 'Rusticana,' " it declared that the music was heard "on many steamers in and out of the harbor" and that it was appreciated especially "on board the Royal Mail Packet Avon, when two hundred and sixty guests . . . heard Caruso's voice reproduced. . . . A remarkable thing about the tests was the strength of Caruso's voice, as compared with other voices. Not a note of Caruso was lost."

That broadcast from the Metropolitan was not the first musical program transmitted by de Forest. In the summer of 1908 he had visited Paris, installed his equipment in the Eiffel Tower, and broadcast a program of recorded music that was heard as far afield as Marseilles. But even that was not the world première of musical broadcasting. The honor of being the first to accomplish radiophonic sound transmission apparently belongs to Reginald A. Fessenden, another pioneer radio inventor, who on Christmas Eve, and again on New Year's Eve, in 1906 broadcast from his experimental station at Brant Rock, on the Massachusetts coast, programs of music, both vocal and instrumental, as well as spoken words. Details of these broadcasts are given by Archer [2] and by the inventor's wife,[3] who quotes him as stating that the musical part of the Christmas Eve program consisted of a

[2] Gleason L. Archer, *History of Radio to 1926* (New York: The American Historical Society, Inc., 1938).

[3] Helen M. Fessenden, *Fessenden, Builder of Tomorrows* (New York: Coward-McCann, Inc., 1940).

phonograph recording of Handel's *Largo* followed by a violin solo and song performed by Fessenden himself. The soloist modestly explained that he undertook these artistic responsibilities only because he could persuade nobody else to assume them—which suggests that at Brant Rock on December 24, 1906, occurred the first cases of "mike" fright in history.

Wireless telegraph operators on naval and merchant ships using Fessenden's equipment had been alerted for the Brant Rock tests and asked to report on them. Their replies indicated that the first broadcast was heard as far south as Norfolk, Va., and that the second carried to the West Indies.

In view of the claims of de Forest and Fessenden it would appear that what the radio industry celebrated in 1945 was not so much the anniversary of the birth of broadcasting as its discovery and adoption by the public. On the latter score there is little reason to challenge the priority of KDKA. Regardless of when broadcasting began, its social importance could not begin to develop until there were listeners; and there is no question that KDKA's dramatization of its social significance, through the 1920 election returns, was the thing that caught the fancy of the public and turned it, almost overnight, into an eager and ever growing host of radio fans.

Returning to the early history of broadcasting, we find that even Fessenden was not the first to transmit music by electrical means. He was, it seems evident, the first to broadcast music by radio telephony, but before there was radio broadcasting there was radio communication, thanks to Marconi, Hertz, and others, and before that there was the telephone. It is common knowledge that Alexander Graham Bell invented the telephone for purposes of point-to-point communication, but it may be less generally known that Bell also invented wire broadcasting, and that he used it with telling effect in his earliest public demonstrations of the

telephone. (The complete story was told by Thomas A. Watson, Bell's laboratory assistant, in an address delivered at the third annual convention of the Telephone Pioneers of America, at Chicago in 1913, and subsequently published by the American Telephone and Telegraph Company.[4])

These demonstrations were incorporated in a series of lectures which Bell delivered in various eastern cities during the spring and early summer of 1877, and the climax of each demonstration was a telephonically transmitted musical program in which Watson figured as the star performer. His account of these events runs, in part, as follows:

> Professor Bell would have one telephone by his side on the stage, where he was speaking, and three or four others of the big box variety we used at that time would be suspended about the hall, all connected by means of a hired telegraph wire with the place where I was stationed, from five to twenty-five miles away. Bell would give the audience, first, the commonplace parts of the show and then would come the thrillers of the evening—my shouts and songs. I would shout such sentences as "How do you do?" "Good evening," "What do you think of the telephone?" which they could all hear, although the words issued from the mouthpieces rather badly marred by the defective talking powers of the telephones of that date. Then I would sing "Hold the Fort," "Pull for the Shore," "Yankee Doodle," and as a delicate allusion to the Professor's nationality, "Auld Lang Syne." My sole sentimental song was "Do Not Trust Him, Gentle Lady." After every song I would listen at my telephone for further directions from the lecturer, and always felt the artist's joy when I heard in it the long applause that followed each of my efforts. I was encored to the limit of my repertoire and sometimes had to sing it through twice.

Thus it appears that the 1870's saw the birth not only of the telephone but also of the concept of music broadcasting

[4] Thomas A. Watson, *The Birth and Babyhood of the Telephone* (New York: American Telephone and Telegraph Co., 1937).

and of the telephonic method of program transmission that today supplies music to hotels and restaurants in certain cities.

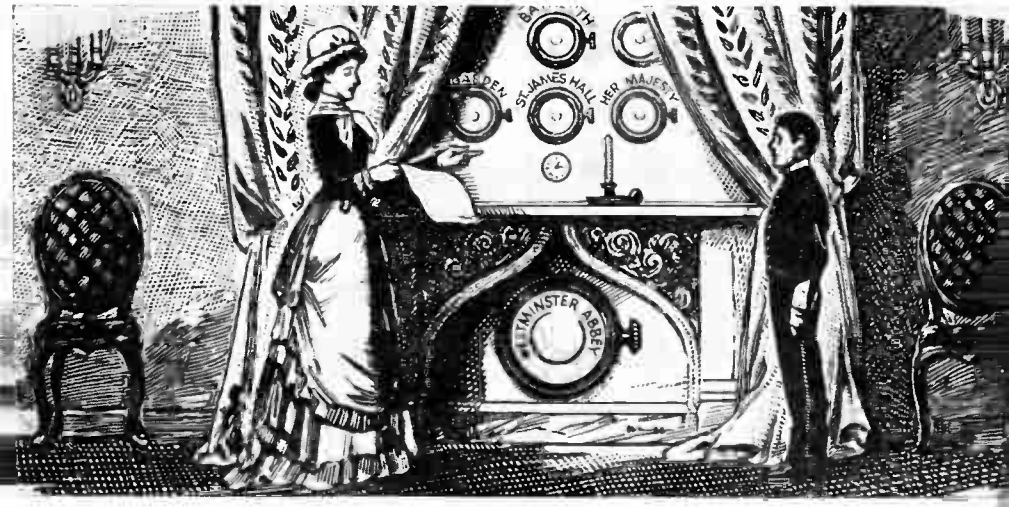
The full import of Bell's achievement may have escaped some of his contemporaries but not that canny observer of human affairs, Mr. Punch, for a cartoon published in *Mr. Punch's Almanack* for 1878 shows that he fully appreciated the effect that the invention was destined to have on drawing room entertainment (see page 10).

From 1877 to 1920 the progress of broadcasting was mainly along technical lines. Musically it lagged, and what few listeners there were had to content themselves with the artistic offerings of inventor-*virtuosos,* supplemented now and then by phonograph records. Not until the autumn of 1920 did musical broadcasts begin to assume intrinsic value, and for some time thereafter improvement was slow and spotty. There were several reasons for this. Radio equipment was incapable of anything approaching faithful reproduction of music, and conditions in the ether were hardly conducive to good reception. Lacking adequate regulation, transmitters sprang up like mushrooms, scrambled for wave lengths, and filled the air with the squeals and howls of interference. Listeners, interested primarily in the gadget aspect of radio, sat up all night manipulating cats' whiskers. They cared little what they heard, so long as they could identify the station that transmitted it.

Another difficulty was that musicians at first were inclined to look askance at a development that seemed to many of them to threaten their security. Only a few venturesome spirits were willing to lend their talents to a dubious project offering little or no remuneration—broadcasting being at that time without visible means of support. The sixty-four dollar question of the day was "Who is to pay for broadcasting?" For the first year or two a temporary answer was

supplied by manufacturers of radio equipment, who operated stations to promote the sale of their products, and by other commercial organizations for experimental or publicity purposes; but it was obvious that this was a makeshift arrangement which could not continue indefinitely. What broadcasting needed was a means of supporting itself. That means was found, rather unexpectedly, in 1922, when the first commercial sponsor appeared on the scene and advertising became the angel of the radio show business.

With its future thus assured, broadcasting began to pay more attention to the quality of its programs and music began to advance towards its destined place on the air. More talent was attracted to the microphone, studio presentations improved, "name" bands appeared in the program schedules, and pickups from concert halls and opera houses became more frequent; and as the musical side of broadcasting grew in importance broadcasters had to develop techniques, policies, and staffs to deal with it. In 1946 there were more than 900 standard wave stations in operation in the United States, not to mention a considerable number of short-wave and FM stations. The musical programs they transmit are multitudinous and varied. How they are planned and produced—what it takes in the way of organization, methods, and skills to put them on the air—will be the subject of discussion in the pages that follow.

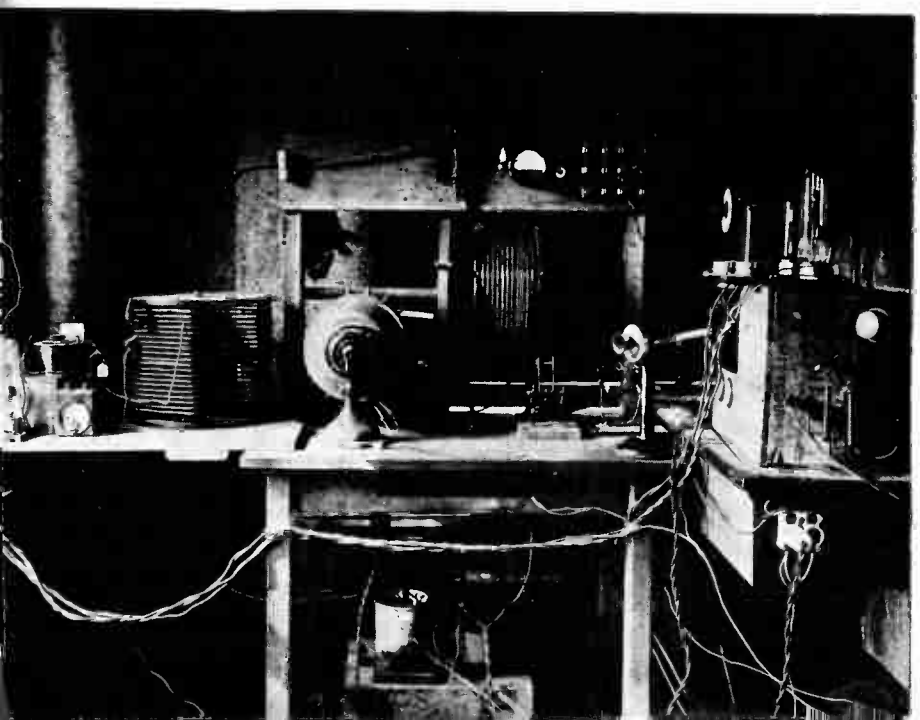


Musical Mistress of House ("on hospitable thoughts intent"): Now recollect, Robert, at a quarter to nine turn on 'Voi che sapete' from Covent Garden: at ten let in the stringed quartette from St. James' Hall; and at eleven turn the last quartette from 'Rigoletto' full on. But mind you close one tap before opening the other!

(From *Mr. Punch's Almanack* for 1878)

One of the first broadcasting stations. Established during World War I in the garage of Dr. Frank Conrad at Wilkinsburg, Pennsylvania, it was licensed in April, 1920, as Station 8XK. The interest it aroused led to the inauguration later the same year of Station KDKA, in Pittsburgh.

Transmitting equipment of Station 8XK.



2

The Transmission of Sound

To THE FANS of 1920, radiophonic sound transmission was the eighth wonder of the world. Some of them, having dabbled in wireless telegraphy, knew more or less how it worked, but they were thrilled by it, nonetheless, and viewed it as a scientific marvel of the first magnitude. Others, being sheer laymen, regarded it as nothing short of a miracle. To them it was miraculous that sounds produced at a point miles away could leap instantaneously and silently through space, penetrate the walls of houses, and emerge—in something recognizably like their original shape—from a telephone receiver attached to a crystal and a cat's whisker. They didn't know how it happened; nor, apparently, did they care to. The fact that the miracle occurred at all, and that they could control its occurrence after a fashion—when their receivers behaved properly—was sufficient. Quite naturally, the novelty of the thing wore off in time and the miracle became a commonplace, with the result that the transmission of sound by radio, while no longer a marvel, still remains a mystery to the average radio listener.

Musicians who perform for broadcasting perhaps have no greater interest than their audience in the process whereby the music they make is transmitted and reproduced, though they might well be curious about it. On the other hand, those who act or aspire to act in other capacities connected with the broadcasting of music—production, for example—

will find that an understanding of it is essential to the efficient performance of their duties. The following discussion of the subject is couched as far as possible in nontechnical terms, and no attempt is made to explain electrical phenomena as such. Students who wish to pursue that aspect of the matter will find it amply dealt with in textbooks and popular treatises on radio engineering, some of which are listed in the Bibliography, page 226.

THE NATURE OF SOUND

Prerequisite to a consideration of electrical sound transmission is an understanding of sound itself—what it is, how it is caused, and how it behaves.

Sound may be defined in various ways. It may, for example, be considered as an auditory sensation in the ear, or as a reaction produced in the brain by stimulation of the auditory nerve. Thus regarded, sound exists only when it is heard. A tuning fork vibrating in a room full of people would, unless the people were all deaf, produce sound; but the same tuning fork vibrating in a soundproof box would produce no sound. For the present purpose a more objective approach is preferable; therefore, sound is defined here as *a series of vibrations of the air capable of producing a response in the normal human ear.*

Sound is generated in the following manner: Any solid body in a state of vibration creates disturbances in the surrounding air by alternately compressing and rarefying it, and these disturbances travel outward from the source in waves that gradually diminish in amplitude until their energy is dissipated. Sound waves are often compared to the water waves generated by dropping a pebble into a quiet pool. There are important differences, however. Water waves consist of alternate crests and troughs that travel outward on a

single plane, expanding as concentric *circles.* Sound waves consist of areas of increased and diminished atmospheric pressure that travel outward in all directions, expanding as concentric *spheres.*

One complete wave of compression and rarefaction is called a *cycle,* and the number of cycles occurring in a given period of time is referred to as *frequency.* Thus a series of pressure waves generated at the rate of 100 per second is said to have a frequency of 100 cycles ("per second" being understood).

Whether or not a series of vibrations constitutes sound as defined above depends on its frequency. Aural sensitivity varies greatly among individuals and gradually declines with advancing age, but the normal human ear during its period of maximum efficiency—that is, up to about thirty years of age—responds to vibrations ranging from about 16 cycles to about 17,000 cycles. Therefore, sound may be more specifically defined as *a series of vibrations of the air at any frequency from 16 cycles to 17,000 cycles.*

Sounds differ to the ear in three respects:

1. ***Pitch.*** A sound may be "high" or "low." The pitch of any sound is determined by the frequency of its vibrations—that is, the greater the number of vibrations per second, the higher the pitch.

2. ***Loudness.*** The loudness of a sound depends on several factors. One factor is *intensity,* which is determined by the amplitude of the vibrations. In other words, the more extensive the motions of the generating body, the greater the compression and rarefaction of the surrounding air and hence the louder the sound. Other factors are the distance of the listener from the source of sound, the reflecting or absorptive properties of the walls or of objects in the room, and the pitch of the sound, very low and very high pitches sounding less loud than medium pitches of equal intensity.

3. ***Quality.*** A sound may be either musical or nonmusical. If musical, it may have any one of a great variety of *timbres,* or tone colors. The quality of a sound is determined by the regularity or irregularity of its vibrations and their simplicity or complexity. A tuning fork vibrates regularly; therefore it produces a musical sound, or *tone.* It also vibrates at a single frequency; therefore it produces a simple, or *pure,* tone. Most musical sounds, however, are composite, consisting of a combination of frequencies called *harmonics,* between which there is an *orderly* numerical relationship. For example, the lowest note (A) on the piano has a frequency at standard pitch [1] of 27.5 cycles. The second harmonic of this pitch has double its frequency—55 cycles—and sounds one octave higher; the third harmonic has three times its frequency—82.5 cycles —and sounds a twelfth higher; the fourth harmonic has four times its frequency—110 cycles—and sounds two octaves higher; and so on.

The lowest harmonic of a composite tone is called the *fundamental;* the upper harmonics are called *overtones.* Normally, the fundamental is the strongest of the harmonics and therefore determines the pitch of the tone, but there are exceptional cases, such as certain tones produced by wind instruments, in which the fundamental is weaker than the upper harmonics, or is even missing altogether. The number and relative prominence of the overtones determine the timbre of the tone.

Vibrations that are irregular in frequency or that are haphazard combinations of frequencies too complex for the ear to analyze produce nonmusical sound.

The piano keyboard commands a scale of fundamental pitches ranging in frequency from 27.5 to 4186 cycles. The

[1] The pitch adopted by the United States Bureau of Standards and commonly referred to as "A440" because the A above middle C—the A to which orchestral instruments are tuned—has a frequency of 440 cycles.

combined ranges of the orchestral instruments is approximately the same, and the range of large pipe organs is slightly wider. All musical instruments, however, produce harmonics, many of which are considerably higher than the highest fundamental pitches available on any conventional instrument. For example, the fourth harmonic of the highest C on the piano (4186 cycles) has a frequency of 16,744 cycles. Theoretically, therefore, the frequency range of music is limited only by the capacity of the human ear; but it is doubtful whether the extremely high harmonics are actually audible under normal conditions, since they occur only as complements of lower frequencies of much greater intensity and are subject to rapid attenuation in passing through air. For practical purposes of sound transmission and reproduction the frequency range of music may be said to extend from about 30 to about 15,000 cycles.

Wave Length of Sound. The length of waves—i.e., the distance between points of equal height in water waves or between points of equal pressure in sound waves—varies according to frequency, lower frequencies producing longer waves and higher frequencies shorter waves.

Velocity of Sound. The speed at which sound travels through air depends on the temperature of the air. At 32 degrees F. the velocity of sound is about 1090 feet per second, and it increases at the rate of about 1 foot per second for each degree of rise in temperature. At temperatures such as usually prevail where music is performed the velocity of sound is about 1130 feet per second.

Since frequency may be defined as the number of waves passing a given point in one second, the length of a wave may be determined by dividing its velocity by its frequency. Thus the wave length of the lowest A on the piano (27.5 cycles) is about 41 feet, and that of the highest C (4186 cycles) is about 3 inches.

ELECTROMAGNETIC WAVES

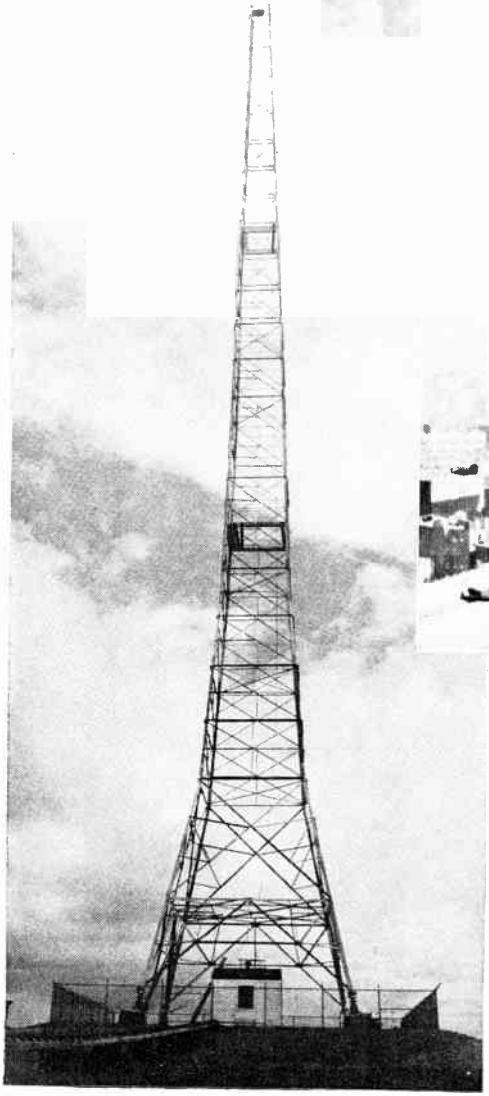
Sound waves, as we have noted, are disturbances in the air caused by physical motion, or vibration, and are analogous in certain respects to water waves. Electromagnetic, or radio, waves are caused by electrical vibration, or oscillation, and consist of varying electric and magnetic fields. They travel outward in all directions, as do sound waves—but much faster and much farther. Their velocity in free space is the same as that of light (about 186,000 miles per second), and some of them have been known to travel from the earth to the moon and back, a distance of nearly half a million miles.[2]

The electromagnetic waves at present assigned for various forms of radio transmission vary in frequency from 10 kilocycles (10,000 cycles) to 30,000 megacycles (30 billion cycles), and in length from 30,000 meters to 1 centimeter. In the United States these waves, which are sometimes referred to collectively as the radio spectrum, are divided into "bands" and assigned by the Federal Communications Commission to different types of radio service. Standard wave broadcasting stations—i.e., those that can be tuned in by the ordinary home radio receiver—are distributed throughout the band extending from 550 to 1600 kilocycles, each station being allotted a *channel* 10 kilocycles wide. The bands below the standard band are used mainly for communications, those above it for communications, international short-wave broadcasting, television, frequency modulation broadcasting, facsimile transmission, radar, and experimental purposes.

RADIOPHONIC SOUND TRANSMISSION

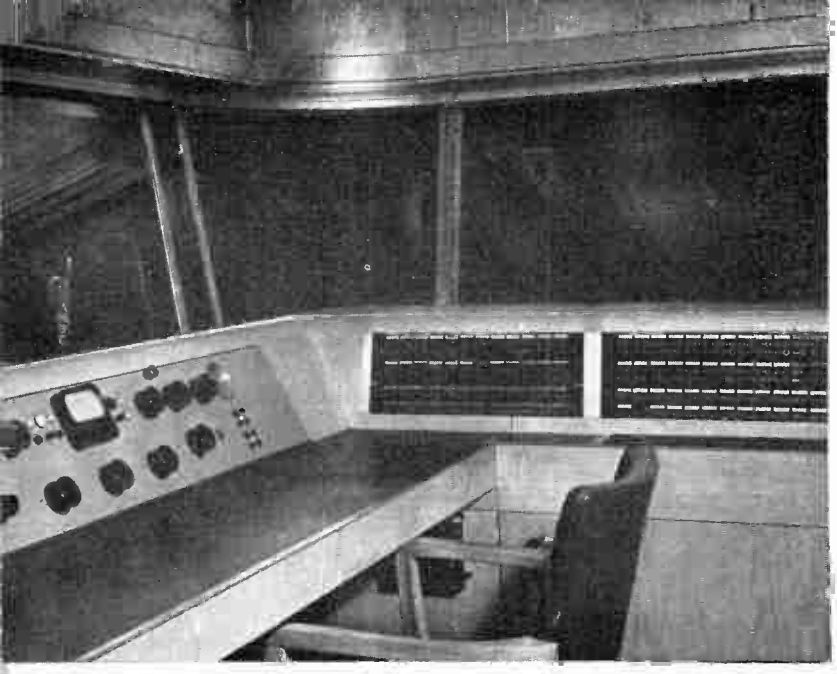
The transmission of sound by radio requires that the sound

[2] Radar contact with the moon on January 10, 1946, was announced by the U.S. Army Signal Corps on January 24, 1946. (See *The New York Times*, January 25, 1946, p. 1.)



Transmitting antenna of Station WEAF (now WNBC), 1940.

Transmitting antenna of Station WEAF, 1922.



Above: Studio control panel.

Below: Nerve center of a radio network. Master control desk of the National Broadcasting Company, Radio City, New York

vibrations be converted into electrical vibrations and back again into sound vibrations. This is accomplished by two sets of equipment, one for transmission and the other for reception.

The principal parts of the transmission equipment are

1. A microphone
2. A power supply
3. Wire lines
4. Amplifiers
5. Controls
6. A transmitter, including modulator and antenna

Receiving equipment includes the following:

1. A receiving antenna
2. A wire circuit
3. A selector
4. A demodulator
5. Amplifiers
6. A loudspeaker (or headphones)

This equipment operates in the following manner:

When a sound is produced in front of the microphone the waves impinging upon its diaphragm (or ribbon [3]) cause the latter to move to and fro at exactly the same frequency as that of the sound wave, and the motion of the diaphragm causes the current in the microphone circuit to alternate at the same frequency. For example, a pure tone of the frequency of 1000 cycles will generate in the microphone circuit an alternating current of 1000 cycles, and this current will correspond to the sound waves in amplitude as well as in frequency. Alternating current of frequencies equal to those of sound is known as *audio-frequency* current.

The audio-frequency current generated in the microphone

[3] See "Microphone Characteristics," Chapter 12, pp. 153 ff.

circuit is very weak. In order to increase its strength it is conducted by wire lines through a series of vacuum-tube *amplifiers,* after which it passes on to a *control panel* where its volume may be adjusted by the studio engineer. From there it goes by wire lines to the transmitter, which sends out a continuous high-frequency wave known as the *carrier.*

Modulation. Carrier frequencies are far higher than the frequencies of sound, those of standard wave broadcasting stations ranging upward from 550,000 cycles. They are made to convey audio frequencies by a process called *modulation,* which means the variation of some characteristic of the carrier, the variations corresponding in frequency to the alternations of audio-frequency current received from the microphone.

Several methods of modulation are known, the one most generally used at the present time being referred to as *amplitude modulation* because the audio-frequency impulses are

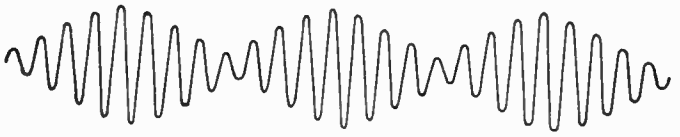


FIG. 1.—Amplitude-modulated carrier

transformed into changes in the amplitude of the carrier, the frequency of which remains constant. In *frequency modulation* the amplitude of the carrier remains constant while its frequency is modulated. A third method, called *pulse-time*

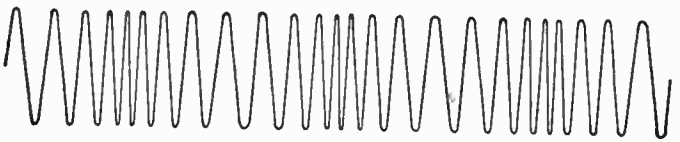


FIG. 2.—Frequency modulated carrier

modulation, was developed for military use during the Second World War and information concerning it was published in September, 1945.[4] In this form of transmission the carrier wave is not continuous, as in amplitude or frequency modulation, but consists of a series of pulses of very high frequency which are modulated by the audio frequencies of the program. Because of the large number of pulses produced per second—more than a million—it is possible to transmit a number of different programs simultaneously on a single carrier. This is accomplished by means of a cathode-ray tube with a rotating electron beam which, moving at a speed of 30,000 revolutions per second, picks up minute parts of the several programs one after the other and sends them to the transmitter. At the receiving station a similar tube receives the succession of pulses in the same order in which they were sent, sorts them out, reassembles them into individual signals, and distributes them to their respective receivers.

The principle of modulation, confusing though it may seem to the layman, is actually quite simple. It consists, in effect, of producing in the high-frequency carrier wave some kind of periodic changes that the receiver can translate back into audio-frequency current, as the following homely analogy may serve to illustrate.

Readers with fairly long memories may recall certain boyhood experiments with a sound-producing device known as a "ticktack." Designed especially for prankish occasions such as Halloween, it consisted of a rubber washer about an inch in diameter (extracted from an old-fashioned pop bottle), a screw, and a piece of string—the longer the better. The screw was inserted into the hole in the middle of the washer and one end of the string was tied to its threads. By wetting the washer the ticktack could be made to adhere by vacuum to

[4] See *The New York Times,* September 28, 1945, p. 23.

a window pane, with the head of the screw touching the glass. If the string were then pulled the elasticity of the washer would permit the head of the screw to be drawn away from the pane. When the tension on the string was released the screw head returned suddenly to its original position, striking the pane with a sharp tap. Ingenious operators found that the efficiency of the machine could be greatly increased by tying knots in the string at intervals of about half an inch, pinching the string between the thumbnail and the forefinger, and moving the hand quickly away from the window. This produced a series of minute jerks which were transmitted along the string to the screw and translated at the window into a rousing tattoo, the effect of which on the householder was sufficiently stimulating to make the length of string previously referred to a matter of considerable importance.

Drawing the fingers along a string without knots would have caused vibrations, but they would not have been of the proper frequency to set the screw in motion. Similarly, the high-frequency alternations of a carrier current produce electromagnetic vibrations in the ether, but they are not of an order that will actuate a loudspeaker. Therefore, "knots" in the form of modulations of amplitude, frequency, or some other characteristic must be tied in the "string" of the carrier.

Returning now to the evolution of the sound wave as it travels from the studio to the home of the radio listener, we may do well to recapitulate the transformations it has undergone thus far.

The original 1000-cycle tone has been converted by the microphone into 1000-cycle alternating current, and this has been amplified, regulated at the control panel, and sent on its way to the transmitter. Arriving there, still in the form of audio-frequency current, it is fed into the transmitting system in such a way that it causes modulations of the radio-

frequency current flowing in the *transmitting antenna,* and this current generates electromagnetic waves having the same frequency and the same modulations.

Reception. When the electromagnetic waves, radiating in all directions from the transmitting antenna, are intercepted by the *receiving antenna* of a radio set they cause a minute current of similar frequency and similar modulations to flow in the receiving antenna. As the antenna is affected by any waves that come its way, the receiver must be equipped with a *selector* that tunes the circuit to the frequency of the desired carrier. The selected current is then amplified and *demodulated*—that is, the modulations are reconverted into audio-frequency current. This current excites the diaphragm of a loudspeaker or telephone receiver, the vibrations of the diaphragm generate sound waves in the air, and the listener hears a tone of the same frequency as that produced in the studio.

Fidelity. How faithfully does the loudspeaker reproduce the sounds produced before the microphone? It would be pleasant to report that the reproduction is an absolute facsimile of the original, exactly similar in every respect to what the listener would hear if he were standing beside the microphone. The fact is, however, that the reproduction afforded by ordinary broadcasting methods and equipment is only a more or less acceptable substitute for the original, as an ordinary photograph is a substitute—flat and two-dimensional but nevertheless a recognizable likeness of the subject. Broadcast reproduction is most acceptable when every part of the transmitting and receiving equipment is of the highest efficiency, when acoustical conditions in the studio are good, when the production of the program is skillfully handled, and when atmospheric conditions are propitious. It is least acceptable when the transmitting system is inferior, the studio acoustically unsatisfactory, the production technique faulty, the at-

mospheric conditions unfavorable, and the receiver unduly limited in frequency response.

To transmit and reproduce music with complete fidelity—that is, without loss or distortion of any kind—is not feasible by present methods. To do so would require transmitting and receiving equipment entirely free of noise or distortion, proof against static or other kinds of interference, having a frequency range equal to that of the human ear, and capable of conveying the spatial relationships between sounds, or auditory perspective.

Transmission systems of adequate frequency range are available, but those that operate in the standard broadcast band are unable to use their full capacity because of insufficient elbow room. As we have noted, the channels allotted to standard-wave transmitters are only 10 kilocycles wide, which limits them, for practical purposes, to an audio-frequency range of 5000 cycles. This is because the modulation of a carrier wave creates what are known as "side bands," one side band having a frequency that is the *sum* of the carrier frequency plus the modulating frequency, the other having a frequency that is the *difference* between the carrier and the modulating frequency. Thus, if a carrier frequency of 600 kilocycles were modulated by audio-frequency current of 6000 cycles there would be one side band of 606 kilocycles and another of 594 kilocycles. This represents a total range of 12 kilocycles, which is 2 kilocycles wider than the channel allocated to the station. If a station exceeds the limits of its channel its side bands overlap those of stations in adjacent channels. The result is *interference,* particularly in receivers with a wide frequency range, which is one of the reasons that standard-wave receivers are rarely designed for the reception of frequencies higher than 5000 cycles.

Frequency modulated transmitters, operating in a higher part of the spectrum where wider channels are available, can

and do transmit a wider range of audio frequencies; but receivers capable of reproducing the full range are expensive and not very plentiful. In any case, if all other requirements were met, broadcast sound reproduction would still fall short of true fidelity by reason of its *monaural* characteristic.

Man hears *binaurally*—that is, with two ears which are so constructed by nature and so placed, on opposite sides of his head, that they tend to respond unequally to most sounds. For example, a sound originating to the right of a person with normal hearing causes a stronger reaction in his right ear than in his left. His two ears thus serve as a sort of range and direction finder that enables him to locate the point of origin of a sound by what might be described as aural triangulation. If he sits in a concert hall or broadcasting studio where an orchestra is playing he can determine by ear the approximate position on the stage of any instrument or group of instruments that he hears. Moreover, their sound has a three-dimensional, *stereophonic* quality analogous to the optical effect of solidity achieved by *stereoscopic* photography. When he listens to the monaural reproduction of music through a conventional radio or phonograph loudspeaker, however, he receives only a two-dimensional representation of the original and is unable to determine the relative positions of the various sources of sound, because all of the sounds originate, so far as he is concerned, at the same point in space: that occupied by the loudspeaker.

It is possible to transmit and reproduce sound stereophonically. To do so requires a dual or multiple system comprising two or more microphones, each with its separate lines, amplifiers, and controls, and each feeding a separate loudspeaker at the receiving end. To *broadcast* stereophonically would require, in addition, two or more transmitters operating on different frequencies—or else some form of multiplex transmission, such as that afforded by pulse-time modulation,

which would permit the sending of more than one signal on a single carrier.

Stereophonic broadcasting has not yet been attempted, but stereophonic transmission by wire lines has been successfully accomplished, not only in the laboratory but publicly as well. The first public demonstration was conducted by the Bell Telephone Laboratories on April 12, 1933, when a performance by the Philadelphia Orchestra was transmitted by multiple wire lines from the ballroom of the Philadephia Academy of Music to the auditorium in the same building, where it was reproduced by a battery of loudspeakers.[5] The experiment was repeated on April 27, this time over long-distance lines terminating in Constitution Hall in Washington.[6] On both occasions the orchestra's conductor, Leopold Stokowski, relinquished his baton to an assistant and operated the controls of the reproducing equipment.

[5] See *The New York Times*, April 13, 1933.

[6] See *New Vistas in Radio*, by Leopold Stokowski (Atlantic Monthly, January, 1935.)

3

The Network Music Division

IN THE early days of broadcasting, radio stations got along with a minimum of musical personnel. Phonograph recordings furnished most of the music called for by the intermittent schedules of those times, and when "live" talent was used it generally consisted of singers or instrumental soloists who built their own programs, supplied their own music materials, and provided their own accompanists. Announcers were usually selected from the ranks of trained singers, partly because their speaking voices were of superior quality and partly to provide a backlog of artistic talent that could be used in the frequent emergencies caused by the failure of volunteer attractions to keep their appointments. Among the subsequently famous announcers who began their radio careers in that dual capacity were Milton Cross and the late Graham McNamee. There were also announcers who doubled as pianists. These, together with similarly gifted hostesses, not only played accompaniments as required but also gave recitals at intervals throughout the day, sometimes under a variety of pseudonyms.

When, at length, the succession of vocal and piano recitals began to pall, progressive stations took steps to provide a richer and more varied musical fare. By adding a violin and cello to the staff they created the Studio Trio, so justly noted in its day for interpretations of *Salut d'Amour, At the Brook,* and similar masterpieces. In time the trio grew into a Studio

Ensemble consisting of a string quintet and piano; then a few more instruments were added to form a Salon Orchestra, and this in turn evolved into a Concert Orchestra that sometimes numbered as many as twenty players. Finally, with the advent of network broadcasting, the trend towards bigger and better staff orchestras culminated in full symphonic aggregations such as the NBC and Columbia Symphony Orchestras.

The increasing number and scope of musical broadcasts naturally brought a corresponding increase in musical paper work and other administrative functions. Radio stations acquired music libraries which needed librarians to handle them, and as the libraries expanded the librarians multiplied. The daily broadcast schedule lengthened from a few hours to eighteen or more, which meant that more programs had to be planned, built, cleared, supplied, and supervised. This led to the institution of program builders, program contact clerks, copyright specialists, typists, filing clerks, and other administrative or clerical functionaries, together with executives and supervisors to direct the increasingly complex operations.

Such elaborate organizations are, of course, maintained only by the national network key stations, which originate most of the musical programs for their respective chains, and by a few major independent stations whose musical activities are on a large scale. Independent local stations, which rely partly or wholly on recorded music, and network affiliates, whose musical needs are largely supplied by programs that the networks feed them, are able to operate with much smaller musical staffs or with none at all. Their orchestras, if any, are usually small, their music libraries modest, and their clearance problems are limited to the programs that they themselves originate. The network headquarters, on the other hand, must clear all network musical programs, regardless

of their point of origin, and are called on to supply much of the music material used at other stations of the network.

However, while network and local-station musical activities differ in magnitude, they are essentially similar in kind. Wherever music is broadcast, programs must be planned and built, libraries must be maintained—though they consist solely of records and transcriptions—and paper work must be done; and wherever music is broadcast for profit the broadcaster's right to use each musical item must be established. Therefore, the following outline of the organization and functions of a network music division will be of interest to the student of music broadcasting, whether his activities, present or future, be in the network or the local-station field.

The companies operating radio networks are organized along conventional lines. They have the usual boards of directors and executive officers, and consist of various departments that are subdivided into divisions and sections. The music division usually is a part of the program department, which is responsible for the planning, preparation, and presentation of programs. As the music divisions of the several networks differ somewhat in organizational detail and in nomenclature, the following functional analysis is designed primarily to show the tasks performed, rather than the precise administrative setup of any particular network. If it is found to conform more closely to the practices of the National Broadcasting Company than to those of other networks, the fact may be attributed to the writer's long experience as a member of the NBC musical staff.

ORGANIZATION AND FUNCTIONS OF THE NETWORK MUSICAL STAFF

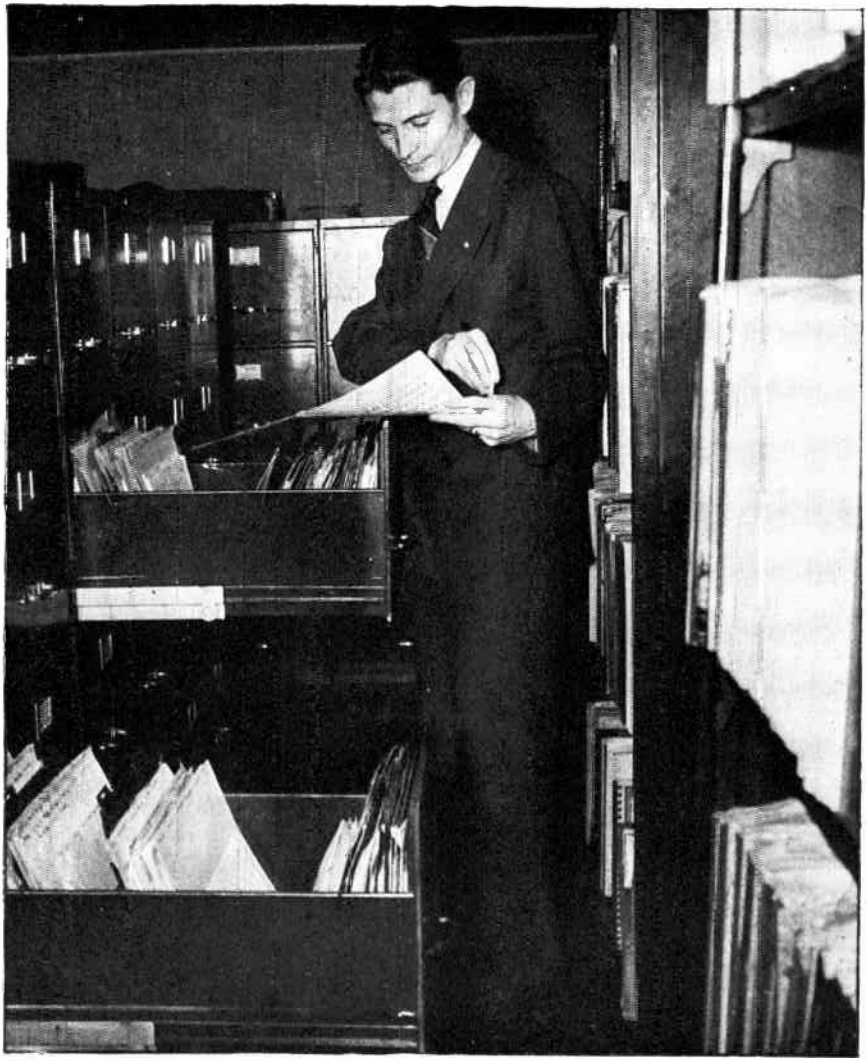
Executive Personnel. The executive head of the musical staff is known variously as Manager or Director of the Music Division, Musical Director, General Music Director, or by

some comparable title. He has charge of all personnel and activities of the division, develops musical program plans, acts as musical consultant to the management, and helps to formulate musical policies. He usually reports to the head of the program department.

Operational details are entrusted to section heads, whose number and titles differ according to the needs and preferences of the several networks. Their duties include supervision of the music library, music rights, composing, arranging, and copying; supervision of staff conductors and musicians; supervision of musical research; and assignment and supervision of all clerical work. These functions are distributed, according to the varying organization plans of the networks, among administrators bearing such titles as Manager or Director of the Music Library, Supervisor of Music, Manager or Director of Orchestra Personnel, Orchestra Contractor, Director of Musical Research, or other designations indicative of the duties performed, who report to the head of the music division.

Acting under the direction of the executive group is an operational staff of the requisite numerical strength and possessing the qualifications needed to accomplish the multifarious tasks involved in putting music on the air.

The Music Library. Besides serving as the repository of all music materials, including phonograph records and transcriptions, the music library is responsible for supplying the proper music to each program. It maintains accessible files of music of all kinds—symphonic, concert and dance orchestrations, band arrangements, operatic and choral works, chamber music, and vocal and instrumental solos. It also maintains card indexes listing the contents of the library alphabetically by title, by composer, and by such classifications as nationality, and mood or historical connotation. Another of its functions is the acquisition, by purchase, loan,



Music files in NBC Music Library.

A section of the record library of Station WQXR, New York. This library contains more than 14,000 recordings of serious and light concert music.

Below: Record catalogue of Station WQXR. Cards show the title, composer, performers, and playing time of each composition, and the date and time of its presentation by the station.

or rental, of any required music materials not already in its possession, and yet another is the shipment of music to other network stations for use on programs originated by them.

The library personnel comprises, in addition to the director, one or more assistant directors, who relieve the director of many routine duties; a music buyer, who is responsible for the acquisition of music materials and their shipment to other network stations; one or more cataloguing clerks, who catalogue all library acquisitions and type and file index cards; and a staff of music supply clerks, whose duty is to assemble the music required by the programs assigned to them, to make it available for use in the proper studio at the proper time, and to return it to the library after it has served its purpose.

Composing, Arranging, and Copying.[1] The specially qualified staff concerned with composing, arranging, and copying usually is attached to the music library. Staff composers devote their talents chiefly to the composition of incidental music for dramatic programs and to the creation of original "themes," or "signatures," used to identify various programs. Arrangers make orchestrations of music not originally scored for orchestra, reduce large orchestrations to fit the requirements of smaller groups, and make special arrangements of popular music. Copyists extract the parts from scores prepared by composers and arrangers, transpose accompaniments, and mark cues, cuts, and corrections in existing parts.

The Orchestra Section. All of the networks maintain large staffs of performing musicians at their New York headquarters, as well as somewhat smaller ones at the stations that they own and operate in other cities.[2] These staffs include symphonic and dance band men, chamber music players,

[1] These functions are discussed more fully in Chapters 8, 9, and 13.

[2] Each network owns and operates approximately a half dozen stations, the remainder of its chain being composed of independent stations affiliated with it by contract.

pianists, organists, and conductors. Together they constitute a pool from which can be drawn the necessary talent for a symphony orchestra, a concert orchestra, a military band, dance bands of different types, string ensembles, chamber music groups, and such other units as may be required. Their working hours and pay are fixed by agreement with the musicians' union, of which they are all members, and their activities are supervised by the orchestra contractor, who is also a member of the union. With the aid of one or more secretaries the contractor prepares weekly schedules listing the services to be performed by each musician during the seven-day period. He also selects new talent to fill vacancies on the staff and engages extra musicians when they are needed to augment the regular forces or to play instruments not ordinarily included in the orchestra.

Music Rights. Copyrighted music is protected by the copyright law [3] from various forms of infringement, including plagiarism and unauthorized performance for profit. Unpublished music, if not copyrighted, is similarly protected by the common law. Since any broadcast by a commercial radio station is deemed a performance for profit, broadcasters are careful to insure that no protected composition or arrangement is transmitted through their facilities without proper authorization from the proprietor of the copyright or common-law right, as the case may be, and they are equally careful to avoid the broadcasting of any music which plagiarizes a protected work. To safeguard their interests in this respect the networks include in their music divisions a music rights section, which is charged with the responsibility of clearing all music submitted for broadcasting over their chains or over the stations which they own and operate.

[3] Copies of the Copyright Law of the United States of America may be obtained from the Superintendent of Documents, Washington, D. C. Price: 15 cents.

Copyright clearance. The most important function of the music rights section is to make certain that the company has the right to perform and to broadcast any music that it proposes to use. This responsibility is delegated to a staff of copyright specialists, whose qualifications include familiarity with the provisions of the copyright law, with sources of copyright information (such as the lists of copyright entries published by the Library of Congress), and with published music of all kinds, including the catalogues of foreign publishers.

The task of the copyright specialist, difficult enough at best, would be well-nigh impracticable were it not for two circumstances: first, that much if not most of the music in current use is in the public domain, either because it was never copyrighted or because its copyright has expired; second, that a very large part of the existing copyrighted music is controlled by one or another of the agencies that have been organized in comparatively recent years for the purpose of licensing the use of protected music and collecting fees for its performance.

The chief licensing agencies in the United States are (1) American Society of Composers, Authors and Publishers (ASCAP); (2) Broadcast Music, Inc. (BMI); (3) SESAC, Inc.; (4) Associated Music Publishers, Inc. (AMP).

All these agencies control, and are prepared to grant for a consideration, the right to make nondramatic performances for profit of the works in their respective repertories. Some of them also perform other functions, and there are certain differences in their organization and operation, as will appear in the following brief descriptions.

ASCAP.[4] The American Society of Composers, Authors and Publishers was organized in 1914 by a group of com-

[4] For more detailed information see *The Story of ASCAP* (a pamphlet), published by the American Society of Composers, Authors and Publishers, 30 Rockefeller Plaza, New York, N. Y.

posers and authors, including Victor Herbert and John Philip Sousa, for the purpose of protecting the rights of its members with respect to the nondramatic performance of their works publicly for profit. It does not publish or sell music, its chief function being to license the use of music controlled by it and to distribute the proceeds among its composer, author, and publisher members. In 1945 it claimed a membership of more than 1675 composers and authors, and of more than 225 publishers. Its affiliation with 20 foreign agencies was said to increase to approximately 50,000 the number of composers and authors whose protected works were available to its licensees. Its repertory contains a very large quantity of music of all types, from the most popular to the most serious. ASCAP offers three forms of license: (1) a "blanket" license, which conveys the right to make nondramatic renditions as often as desired of any works in its catalogue or those of its foreign affiliates; (2) a "per-program" license, which permits similar use of such music on specified programs; (3) a "per-piece" license ("in some categories"), which grants the right to use a single work.

BMI. Broadcast Music, Inc., came into existence as the result of a controversy that began in 1939 between ASCAP and the broadcasters concerning the renewal of licensing agreements due to expire at the end of 1940. Foreseeing the probability that a satisfactory settlement would not be reached and that the ASCAP repertory would cease to be available to them, the broadcasters organized BMI as a source of protected music which they could continue to use after the expiration of their ASCAP licenses. Besides serving as a licensing agency BMI also published a considerable quantity of new music, including chiefly popular numbers and orchestral arrangements of standard works in the public domain. After the conclusion of new agreements between the broadcasters and ASCAP, in the autumn of 1941, BMI continued to exer-

cise and expand its functions as a licensing agency. It now (1947) acts as licensing agent for a large number of publishers in the United States and for several performance rights societies in Latin American countries. Its repertory embraces a wide variety of music, including many compositions by Latin American composers, both popular and serious. It offers blanket licenses and per-program licenses.

SESAC. Founded about 1930 as the Society of European Stage Authors and Composers and now known officially as SESAC, Inc., this organization acts as licensing agent for more than 100 American and foreign publishers. Its repertory, said to number approximately 50,000 protected works, includes western, cowboy, and hillbilly songs, religious music, college songs and marches, and serious works by American composers, including MacDowell. SESAC licenses are on a blanket basis.

AMP. Associated Music Publishers, Inc., acts not only as a licensing agent and publishing house but also as a rental library, supplying music materials on hire. Its repertory includes the catalogues of about 20 American and European publishers and is said to contain 18,000 copyrighted works. An outstanding feature of its list is the large proportion of symphonic works that it contains. AMP offers blanket licenses only.

The networks find it advantageous to hold blanket licenses from most if not all of these organizations. Individual stations that originate comparatively few programs containing copyrighted music may prefer to take out per-program licenses from those agencies which offer them. A station holding no license is obliged to negotiate with the licensing agency concerned, or with the copyright owner, for the right to perform any protected music it may want to use.

Programs submitted to the music rights section for clearance are scrutinized by the copyright specialists, who deter-

mine, first, whether any of the numbers are in the public domain. Those which are found to be entirely unprotected are approved without further ado, but copyrighted arrangements of public domain music are treated as protected works. All copyrighted numbers on the program are then checked to determine whether proper licenses for their use are in the possession of the company. If any item is found to require a license not already held, the music rights section endeavors to obtain it, meanwhile deferring approval of the program. In the event that a valid license for any work proves to be unobtainable the item is deleted and a substitution requested. Finally, when all necessary licenses are on file, the program is approved for broadcasting. Copies of the music sheet are then made by music division clerks and forwarded to the music library, to the production and script divisions, and to the various other offices concerned with the preparation and presentation of the broadcast.

Clearance of new music. When a new composition is submitted for clearance, music rights considers not only its status with respect to performance rights but also the possibility that its content may infringe some existing copyright. If the new work is controlled by some publisher or licensing agency that, under the terms of its license, indemnifies the broadcaster against infringement suits, music rights has nothing to worry about; otherwise it must be analyzed, measure by measure, to make sure that it contains nothing which plagiarizes, however briefly or inadvertently, any copyrighted work.

This is a task which demands a variety of qualifications: the ability to read music accurately, preferably without the aid of a musical instrument; familiarity with a wide range of existing music; knowledge of the melodic, harmonic, and rhythmic characteristics of music of different periods; and, above all, a good musical memory. In practice, the work of

"tune detecting" is likely to engage the attention at one time or another of any member of the division, those well versed in music of the popular type participating in the analysis of the lighter compositions and those experienced in the field of serious music scanning symphonic scores and other works of comparable nature.

The importance of tune detecting may be inferred from the following facts: that the statutory damages for a single infringement of copyright may be as much as five thousand dollars; and that, in network broadcasting, the transmission of a program by each station in the hookup is held to be a separate performance. The broadcast of a plagiaristic work by a network of one hundred stations could, therefore, incur a maximum liability of one-half million dollars.

Lyric clearance. In order to insure that their programs serve the public interest with respect to morals, ethics, and good taste, broadcasters have formulated certain policies governing program content. It is contrary to policy, for example, to broadcast misleading statements, profanity, suggestive dialogue, or any derisive reference to physical infirmities, such as blindness or stuttering, which might offend afflicted persons in the audience; and as these policies apply to words that are sung, no less than to spoken words, the text of every vocal composition must be approved by a lyric editor before it may be sung on the air.

Duplication clearance. It would obviously be possible in broadcasting to surfeit the audience with too-frequent repetitions of the same music. Even the most popular tunes grow stale when heard too often, and the greater their popularity the greater the danger that they will be played to death. As the dozen or more programs included in the broadcast schedule for a typical evening may be planned by as many program builders, all working independently, occasional duplications of program material are inevitable, particularly where cur-

rent popular music is concerned. In order to control such duplications the networks have set time limits (usually two hours) within which no composition may be presented more than once, and have provided machinery to aid in enforcement of the rule. This consists of some form of index that shows the title of each composition submitted for clearance, together with the name, date, and time of the program. Duplication clearance, which is granted on the basis of first come, first served, constitutes the first step in clearing a musical program, since it would be a waste of time to subject to the more complicated process of copyright clearance an item which might subsequently have to be deleted because of duplication.

Restrictions. From time to time, and for various reasons, musical works are restricted—that is, they are declared unavailable for broadcasting, either temporarily or permanently, by the broadcaster or by the copyright owner. Works in litigation, for instance, are restricted pending adjudication of the case. Songs with unacceptable lyrics may be restricted by the broadcaster, and theatrical or motion picture music published prior to the opening of the production for which it was written is sometimes restricted temporarily by the copyright owner. To keep track of such restrictions music rights maintains a card index of all restricted numbers, and a part of the process of music clearance consists in checking any doubtful composition against this index.

Music rights also keeps an alphabetical file of all special licenses, files of approved manuscripts and recent publications, and a file of registered signatures, the latter being for the purpose of preventing the use of the same music *as a signature* by more than one program.[5] The maintenance of

[5] Compositions used as signatures are not usually restricted except for that purpose. If they are published works they may generally be used as occasional items by other programs. Signature restrictions are, of course, effective only on the network which establishes them.

these files is one of the duties assigned to the copyright clerks, who also serve as general clerical assistants to the copyright specialists.

Program Contact Clerks. Broadcast programs emanate from a number of different sources—for example, from various departments and divisions of the company, from outside organizations such as educational or religious institutions, and from advertising agencies representing the sponsors of commercial broadcasts. To assemble from these diverse sources the dozens of musical programs that must be cleared for each day's broadcasting, and to secure the detailed music sheets and forward them to music rights for clearance, the music division employs a staff of program contact clerks. They constitute the official channel of communications between the music rights section and all program builders, obtaining from the latter all essential program information and advising them of restrictions, deletions, special performance or rental fees, and other pertinent matters.

Miscellaneous Clerical Work. The business of the music division involves a large amount of clerical work ranging from secretarial duties to the typing, distributing, and filing of programs. For these purposes a general clerical staff is employed in addition to the special clerical groups in the several sections. It includes secretaries to the division heads, typists, and filing clerks, their number depending on the organization plan of the division and the amount of work to be handled.

Musical Research. The kind of research normally required in music broadcasting differs materially from that conducted by musicologists. Its methods are less scholarly, its purposes more utilitarian, and its tempo necessarily faster. In broadcasting there is little reason and less time for nonfunctional investigations in the musical field; but there is often occasion

to ascertain and utilize the facts disclosed by more leisurely explorers. The musical researcher in radio will rarely attempt to shed new light on such subjects as the origins of the motet or the modality of the Elizabethan ballad, but he will often undertake to assemble and correlate the information already available. His work, therefore, is concerned ordinarily with the rediscovery of existing knowledge. When he does embark on an independent exploration it is likely to lead him into fields remote from the haunts of the musicologist. Broadcasting calls on the researcher for many things other than historical data. It may send him in quest of rare musical instruments such as the clavichord or virginals, the *rondador* or *quena*. It may charge him to find and deliver to the studios an authentic singer of Gaucho songs, a Mexican *mariachi* orchestra, or an old-fashioned five-string banjo player. It may dispatch him to the Appalachians for a folk fiddler, or to an Indian powwow for a singer of tribal songs. It may even lend him to the engineering department, where his presumably cultivated ear will be used in testing new types of radio equipment.

In view of the heterogeneous nature of musical research as practiced in broadcasting it is hardly surprising to find its functions rather widely distributed. At NBC, for example, the music division and the public service department both have research specialists, and the script division has a musical research section that furnishes script writers with information needed in the preparation of musical continuity. Conductors and musical production directors often do their own research in connection with programs assigned to them, and copyright specialists and members of the music library staff also engage in research from time to time at the request of performers or program builders.

Maintenance of Musical Instruments. The studio equipment of a national network includes many musical instru-

ments. For example, the NBC studios in New York are provided with the following tools of the musician's trade:

45 pianos
1 three-manual pipe organ
11 electric organs
4 Novachords
14 vibraphones
8 xylophones
1 marimba
10 pairs of timpani
12 bass drums
1 harp
10 sets of chimes
8 sets of bells
4 sets of temple blocks
4 gongs
1 pneumatic calliope
9 celestes

Most of these instruments require servicing at more or less frequent intervals. The pianos are tuned once a week and regulated once a month by men who work every night between the hours of midnight and 8:00 A.M., which is the only time of the day when the studios are not in use for rehearsals or broadcasts. The pipe organ is tuned, regulated, and repaired as occasion requires—also, as a rule, in the dead of night. Electric organs and Novachords are serviced by specially trained members of the engineering staff. Timpani with broken heads or slipping pedals are repaired by their manufacturers or by dealers equipped for such repair work. Purely mechanical troubles, such as broken suspension cords of chimes or xylophones, refractory casters or rickety music stands, are usually remedied by carpenters or mechanics of the building maintenance staff.

Supervision of the tuning and repairing of musical instruments is generally entrusted to a member of the music division, who also supervises the assignment of instruments to studios, the purchase of new instruments or replacement of parts, and the disposal of obsolete or surplus equipment.

4

Music at the Local Station

WHILE THE MUSICAL OPERATIONS of a local station are, as previously noted, similar in many respects to those of a network, there are certain important differences, both of policy and of practice. The purpose of this chapter is to point out these differences, rather than to describe in detail the manner in which musical problems are dealt with by local stations. The reader whose interest is primarily in the local-station field will find that many of the points discussed in other chapters—e.g., program planning and building, talent selection, continuity, and production—apply equally to local-station and to network conditions.

Under the American system of broadcasting, two distinct types of program service are rendered to the public. The national networks offer programs of general interest, designed to appeal to listeners in all parts of the country, while regional and local stations cater to the special interests of the people in their service areas. The effect of this division of responsibility is apparent in the different types of musical program ordinarily presented by the networks and by the individual stations. The former, not only because of their obligation to serve a nationwide audience but also because of their superior financial resources and their access to the major talent reservoirs, tend to concentrate on those types of program—symphony concerts, operatic performances, celebrated artists—which are beyond the reach or the means of the local sta-

tion. As a rule, they avoid trespassing on the local station's territory, which comprises such attractions as vocal and instrumental recitals, chamber music, and recorded music.[1]

It does not follow that the musical activities of the local station are negligible. On the contrary, they may represent a service to the community at least as valuable and as keenly appreciated as that of the networks, and in some cases they may be of greater interest locally. There are today few communities capable of supporting a radio station that are entirely devoid of musical talent. Almost everywhere music teachers can be found who are also accomplished performers, and many of them have advanced pupils qualified to give recitals that are not only artistically adequate but of particular interest to their neighbors. In many localities there are church choirs and college or high school choruses, bands, and orchestras whose performances may—union rules permitting—be used to enrich the music schedule of the local station; and even if there should prove to be a dearth of live talent the extensive repertory of recorded and transcribed music would be available to furnish program material of virtually every kind, from symphonic, operatic, and chamber music to hillbilly music and jazz.

The promotion of local talent will call for special effort. Whoever is responsible for the musical programs of a local station will probably have to devote a considerable part of his time to scouting for talent and establishing cooperative relationships with local musical groups.

It is evident that the musical activities of the local station are not necessarily limited in scope or in variety; they may, indeed, be more varied than those of the network. The local station may, for example, broadcast a piano recital or a re-

[1] The National Broadcasting Company and Columbia Broadcasting System refrain, as a matter of policy, from transmitting recorded or transcribed music over their networks, though their stations may use records and transcriptions locally.

corded grand opera—two types of program usually considered inappropriate for network presentation. The local station does not, however, need anything like the elaborate organization of the network music division to manage its musical affairs. It does not need a staff symphony orchestra if its symphonic programs are furnished by recordings or by the local high school orchestra, nor does it need a large music library if most of the music used is furnished by the talent.

The musical staffs of individual stations differ widely in size and character. In some of the larger cities there are independent stations that cater particularly to the more serious-minded music lovers of the local audience. Such listeners, though outnumbered by the devotees of lighter forms of entertainment, are sufficiently numerous in some urban centers to constitute an audience well worth cultivating. The stations which undertake to serve them rely to some extent on recorded presentations of complete symphonies, operas, chamber compositions, and the like; but they also employ live talent, including in some cases staff orchestras of thirty-five or forty players. This type of operation naturally calls for an adequate music library as well as an administrative staff organized more or less along the lines of the network music division.

At the other extreme are stations—not all of which are located in small or remote communities—where musical conditions approximate those of the early 1920's. Their programs consist largely of recordings and transcriptions, supplemented occasionally by the personal efforts of a hillbilly group, and the small amount of administrative work involved is handled by the station executives. Some local stations, however, have staff orchestras of perhaps a dozen players. These musicians may be employed on an annual or on a seasonal basis, depending on the needs of the station and the kind of contract it has with the musicians' union. Their

leader often serves as the musical director of the station, if not as the sole administrator of its musical affairs.

While the broadcasting of music by a local station may involve many if not all of the operations performed by the network music division, they are, for obvious reasons, on a much smaller scale. More than three quarters of the radio stations in the United States are affiliated with networks that supply them with a substantial portion of their musical output. These network "feeds" require no labor on the part of the affiliated stations, and the programs that they themselves originate are mostly of a type demanding little administrative effort. The acquisition, storage, and supply of music materials may constitute only a part-time job for one person; the amount of clerical work is small; there is virtually no composing and very little arranging or copying; and supervision of the entire activity can normally be exercised by the musical director, if there is one, or by the program director.

There is one function that is no less important in the daily operation of a commercial local station than it is in network operation—namely, copyright clearance. No station that is operated for profit may legally make unauthorized use of protected music. It makes no difference whether a program be "commercial," "sustaining," or "educational"—whether it be presented under the sponsorship of an advertiser or under the auspices of an educational, religious, or civic institution; if it is broadcast by a commercial station it constitutes a public performance for profit, and any protected music it contains must be duly cleared in the manner described in Chapter 3. Even if the music is recorded or transcribed, the same requirement exists, for the fact that a composition has been recorded does not mean that a broadcaster has the right to perform it publicly for profit.

The local station, as well as the network, must be prepared to determine the ownership of any music it proposes

to broadcast, and to obtain proper licenses for any compositions or arrangements that are not in the public domain; but since the number of programs cleared by individual stations in the ordinary course of events is relatively small, the complex music rights machinery of the network music division is not needed. In some cases there may be an employee specially charged with the responsibility of copyright clearance, but more often the matter is handled by one of the station executives, such as the program director or the station manager.

The Noncommercial Station. Stations owned and operated by educational institutions, municipalities, and other nonprofit organizations are supported by appropriations from the funds controlled by their license holders. They derive no revenue from their broadcasts, which are designed primarily to serve the cultural and informational needs of their listeners; hence their objectives as well as their problems differ somewhat from those of commercial stations. In general, they avoid competition with the latter in the field of popular entertainment, preferring to concentrate their attention, at least where music is concerned, on the more serious types of program. Much of their music is presented through the medium of recordings, but live talent is employed when circumstances permit. Any disadvantages resulting from their financial dependency are offset to some extent by the willingness of performers to donate their services to the cause of education, and also by a certain leniency on the part of musical unions that enables them to pick up concerts that would be available to commercial stations only at prohibitive cost.

The noncommercial station is, therefore, in a position to undertake more ambitious musical plans than are possible for the average commercial station. In addition to its extensive schedules of recorded music, which usually embrace a very wide range of repertory, it is able to present many live

programs that would tax the physical as well as the financial resources of the commercial station. Consequently, the musical staff of such a station is likely to be rather large; but its organization and operations may be somewhat unorthodox. In a certain station operated by a large university in the Middle West the musical director not only plans most of the musical programs, both live and recorded, but also produces or announces many of them. Other members of the staff are similarly versatile, some being experienced in all phases of program preparation and presentation. They conceive program plans, build programs, write continuity, rehearse performers, and announce broadcasts. When recorded music is used they select the records, extract them from the files, convey them to the studio, and operate the turntable. Members of the musical faculty of the university also participate in the station's activities, contributing their services as performers in recitals and chamber concerts, and the local symphony orchestra broadcasts frequently over the university station. When it does, the production is usually directed by the station manager, who is both a trained musician and an expert in the techniques of musical program production.

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Program Planning

THE TERMS "program planning" and "program building" are often used interchangeably to designate any or all of the stages through which a program idea passes from its original conception to its ultimate realization. Actually, the planning and the building are two distinct processes. The planner is the architect who conceives the basic scheme of the program or series of programs to be constructed and provides the builder with blueprints showing the dimensions and general character of the proposed structure. The builder, guided by the architect's plans, assembles the necessary materials, workmen, and tools, and carries the project to completion. The same person may, of course, do both the planning and the building, but the fact remains that the two functions are essentially different, involving different problems, different approaches, and different qualifications.

Specifically, program planning has to do with the selection of subjects or types of entertainment to be presented and, in a broad sense, with the form and manner of presentation. It demands a thorough knowledge of the policies and objectives of the network or station for which the program is intended, of its general program structure, of the value of contrast and homogeneity in maintaining a balanced schedule, of the tastes and preferences of the audience, of the types of counterattraction offered by competing stations, of program costs and budget limitations, of the personnel available for

the building and production of the program, of the value of publicity and how to obtain it, and of similar programs that have been broadcast previously.

This last requirement is difficult to fulfill. With hundreds of radio stations broadcasting dozens of programs for the past twenty-odd years, it is obviously impossible for any one person to be aware of all that they have done. Broadcasters constantly receive program suggestions that their authors believe to be entirely original but that turn out to be more or less exact duplicates of programs presented years earlier, sometimes by the same station to which the "new" idea is offered.

No complete list of past radio programs is readily obtainable, but some idea of the variety of musical presentations that have been broadcast may be derived from published sources. The *Macmillan Encyclopedia of Music and Musicians,*[1] for example, contains a chronological summary of the principal musical programs broadcast by the NBC and CBS networks from 1927 to 1938. Unfortunately, similar data do not appear to have been compiled by the many individual stations that have significant musical accomplishments to their credit.

A program idea may be conceived by an individual in a sudden flash of inspiration, or it may evolve, slowly and painfully, from long hours of study and discussion by a group of planners. It may be motivated by the desire to present a new form of entertainment or to adapt a particular subject to the requirements of broadcasting; or it may be inspired by some purely practical consideration, such as the necessity of filling an open period in the schedule, of providing a contrasting interlude between two programs of similar type, of offering effective competition to rival programs, or of providing a vehicle for the presentation of featured talent.

[1] See Bibliography, No. 24.

Most sustaining programs [2] are planned by network or station personnel, and the majority of commercial programs originate in advertising agencies that specialize in radio accounts; but many programs, including some of the most successful commercials, have been created by independent writers or producers. Others have been planned by educational or religious institutions, and a few have grown out of suggestions made by listeners.

PLANNING SUSTAINING PROGRAMS

The networks, and some of the independent stations as well, have program planning boards whose duties include supervision of the general program structure of the organization and of its program policies and standards, evaluation of program plans and talent, and the creation or discovery of new program ideas. All new program plans are submitted to this board, usually in the form of an outline of the proposed series together with complete scripts for the first two or three programs. If, after studying the plan, the board is favorably impressed with its possibilities an audition may be ordered. The audition is usually recorded and the recording is subjected to a thorough critical analysis. This often results in the discovery of flaws that were not apparent in the written plan—such defects, for instance, as poor timing or miscast talent. Sometimes the program, when heard in audition, proves to have fundamental weaknesses that disqualify it for further consideration, but if its shortcomings appear to be remediable the board will usually suggest changes and order another audition. Finally, when satisfied that the program is effective both in content and in presentation, the board recommends it to the management.

[2] Sustaining programs are those presented by the broadcaster without commercial sponsorship.

Program planning is closely allied to schedule planning—that is, the planning of the complete program structure of a station or network—and this involves complex problems of balance between entertainment, information, and education, of audience preferences, program costs, availability of time, publicity value, and sundry other factors. The planners must consider whether a contemplated program would be a desirable addition to the schedule, whether it is susceptible of effective broadcast treatment, whether its potential audience appeal is sufficient to warrant its presentation, whether its cost is reasonable, whether a suitable period of time is available, whether suitable talent can be provided, and how the program compares with those on other stations with which it will have to compete for listeners.

Methods of program planning vary according to the character of the program, the purpose it is intended to serve, the policies and practices of the producing organization, and the relationship between the organization and the planner or planners. The following examples illustrate several procedures that may be followed in planning programs under different conditions:

Example 1. Program Planned to Fill a Specific Period

SITUATION: The half-hour period from 6:30 to 7:00 P.M. will become available a month hence. It devolves upon the program planning board to select a suitable program to fill the time. The problem is discussed in the light of the following considerations:

a. Audience mood. For most listeners the day's work will be done. Families will be assembled, many of them at the dinner table. It is a time of relaxation. A program presented at this time should, if possible, appeal to both sexes and all ages and should make no heavy demands on the listener's attention.

b. Schedule balance. The preceding program is a news

report, the following one a dramatic skit. The 6:30 program should contrast with both of the others. Music would provide contrast.

c. Competition. Programs offered during the same period by rival stations include dance music, news commentaries, and popular singers. The new program should be different from its competitors and, if possible, more attractive. Symphonic or chamber music would be different but would not be likely to accord with the mood of the audience at the time in question. A program of light concert music, including familiar classics, semiclassics and selections from light operas, might be appropriate.

d. Program stature. There is nothing novel about a program of light concert music. Many have been presented in the past, many are on the air at the present time. How can a new program of this type be set apart from the others, given distinction and individuality? The first requirement is, naturally, an adequate orchestra.

e. Availability of orchestra personnel. Consultation with the head of the orchestra section reveals that a concert orchestra of thirty-five players is available for the broadcast and for a sufficient amount of rehearsal.

f. Availability of arrangers and copyists. A program may gain in individuality and effectiveness through the use of specially arranged music, provided the arrangements are made with good taste, imagination, and a thorough knowledge of the capabilities of the orchestra for which they are designed. The music division reports that it is prepared to furnish the required number of special arrangements for each program.

g. Availability of program preparation staff. The proposed program will require the services of qualified personnel for its building, script writing, and production. The production division advises that a director is available who is

experienced both in building and in directing programs of this type, and the script division states that a suitable writer is available.

h. Publicity value. The presence of a "name" singer on the program would tend to attract listeners and also to obtain featured listings in the press.

i. Costs. Examination of the program department budget shows that funds are available to cover the estimated costs of the program, including talent fees and arranging.

Conclusion: The program planning board decides to recommend to the management a program of light music featuring a large concert orchestra, special arrangements, and a soloist of national reputation. If the recommendation is approved the program is auditioned, and if the audition is satisfactory the program is booked, personnel is assigned, and the work of preparing the show for the air is begun.

Example 2. Program Planned for Educational Purposes

SITUATION: It is desired to present a serious musical program of informative or educational character. The program planning board ascertains that a suitable period of time is available in the schedule and assigns a specialist to prepare a program plan. If no staff member possesses the necessary qualifications an outside specialist is engaged. The planning of this type of program involves considerations such as the following:

a. Purpose of program. Educational broadcasts differ widely in their objectives. Some are intended to provide formal instruction in some phase of a given subject and are designed for classroom reception. Others aim merely at enrichment of the school curriculum, or at adult education of an informal kind. Most network programs belong to the latter class, partly because their audience is more diversified and partly because of the difficulty of achieving on a nationwide basis the close cooperation with the educational authorities

that is essential to the success of school broadcasts. In the present hypothetical case it is assumed that the program is to be of the informal, nontechnical type.

b. Phase of subject to be treated. Certain branches of music study are obviously unsuited to broadcast presentation, particularly in nontechnical terms and for a general audience. Harmony, counterpoint, and orchestration, for example, would hardly be of interest to lay listeners, nor could they be taught effectively without personal contact between teacher and student. On the other hand, music appreciation lends itself to broadcast treatment, and experience has shown that the subject can be made attractive to both young and old. However, available records list many music appreciation programs, some of which are currently on the air. As the planner wants to avoid duplication of any past or present efforts he rejects music appreciation and seeks a fresher topic. It occurs to him that music history is a subject of potentially broad interest and varied approach. Investigation reveals that few attempts have been made to use it as the basis of a broadcast series. The planner therefore decides to explore its possibilities.

c. Adaptation of subject to broadcast treatment. The history of music may be traced in a number of ways—for example, through its relationship to contemporary political events or social customs, through the personal histories of the principal composers, or through the development of the different musical forms. The most obvious method is that used in textbooks: a chronological record of the progress of the art from early times to the present. This method has one serious drawback from the broadcaster's point of view, in that it fails to provide for sufficient variety in the individual programs. In a strictly chronological series the first several broadcasts would be devoted exclusively to ancient or medieval music whose archaic idiom, however important histori-

cally, would have slight entertainment value for twentieth-century ears. There would then be several programs devoted to music of the Renaissance, several to the classic period, several to the romantic school, and so on, until at the end of the series the listener would be treated to a succession of programs composed exclusively of ultramodern works. The planner wants to present the subject in a way that will focus the listener's attention on the music itself, rather than on extraneous matters such as historical events or incidents in the private lives of composers. He also wants to avoid the discussion of technical details that would be necessary in a course based on formal analysis. He therefore rejects all of the methods cited above and endeavors to find some variant of the chronological approach that will permit greater diversification of material in each program. The problem, he perceives, is to devise a formula whereby music of different periods may be included in each program without destroying its unity.

Conclusion: The planner decides that a combination of the chronological and formal methods will provide an acceptable balance of variety and unity. Accordingly, he proceeds to outline a series in which each program traces the development of a single form (e.g., sonata, rondo, symphony, cantata) through various periods of history, illustrating its growth by comparison rather than by analysis.

Example 3. Program Planned to Promote Talent

SITUATION: The program planning board has discovered a new singer whom it hopes to develop into a radio star. The singer is a soprano whose voice, style, and personality are suitable for light opera, musical comedy, and concert work. It is decided to present her in a weekly half-hour program with orchestral accompaniment. The following factors are considered:

a. Choice of time. A program of the type contemplated

is suitable for presentation at any time of the day or evening, but the audience will presumably be largest in the evening. If evening time is not available the best alternative is a Sunday afternoon period.

b. Program format. The program may be designed as a recital, with the soloist appearing in all but one or two numbers, or as an orchestral concert, in which she appears twice or three times. The choice will be influenced by the kind of orchestra available, the nature and extent of the singer's repertory, and the prestige of the conductor assigned.

c. Type of orchestra. The music to be presented calls for a concert orchestra, preferably of not less than thirty pieces, particularly if the concert format is to be used. For the recital program a string orchestra might serve if provision were made for special arrangements of the orchestral accompaniments. A dance unit would not be suitable.

d. Choice of conductor. Assignment to the program of a well-known conductor would be helpful to the singer. She would benefit by his prestige: his name would probably attract additional listeners. Such a conductor is doubly desirable if the program is to adopt the concert format. Otherwise, the primary objective will be to select a conductor who is an experienced and sympathetic accompanist.

Example 4. Program Planned by a Free-Lance Specialist

SITUATION: An unattached musical expert conceives what he believes to be a novel and effective idea for the presentation of a series of folk music programs. He has had enough experience in broadcasting to understand its requirements, and realizes the importance of making his plan practical as well as attractive. In working out his plan he bears in mind the following points:

a. Originality of the idea. Obviously, folk music is not a new subject for a broadcast program. In order to merit consideration the plan must have some novel aspect or fresh

approach. After a search of available records the planner is convinced that the form of presentation he has in mind differs in certain respects from any that have been broadcast previously.

b. Audience appeal. The material to be presented must be attractive and interesting to the public in general—not merely to students of folklore.

c. Manner of presentation. Folk music may be presented in its most authentic but sometimes crude aspect, as performed by folk musicians, or it may be arranged and glamorized by professionals to bring it closer to the standards of artistic performance. The planner proposes to combine authentic performances of pure folk music with compositions based on folk tunes, thus imparting glamor as well as authenticity to the program. The novelty of his idea consists in an ingenious method of introducing the two elements so that each enhances the effectiveness of the other and both contribute to the program's unity.

d. Means of presentation. If live talent is to be employed the planner must know where to find folk musicians, and he must also bear in mind the orchestral resources of the station to which he intends offering the plan. It would be useless, for example, to submit a program requiring a symphony orchestra to a station having only a dance unit. A program of this kind could be built out of recorded material, but that would make it unacceptable for network use. The planner must cut his coat not only according to his cloth but also with due regard for the figure of its prospective wearer.

e. Production costs. The planner should never lose sight of the talent costs that the presentation of his program would entail, for its attractiveness to the broadcaster will depend to a considerable extent on its avoidance of unnecessary expense. Programs should be planned so that full use is made of the talent employed. It would be extravagant, for instance, to

include one number for full symphony orchestra in a program that otherwise would require only strings.

Having crystallized his plan, the author then prepares it for submission to a broadcaster. This is usually done by making an outline of the entire series together with detailed programs for the first two or three broadcasts, sample scripts, and a summary of any information he may be prepared to furnish concerning costs, sources of unusual talent, and other points of interest to a potential producer.

PLANNING LOCAL-STATION PROGRAMS

At local stations fortunate enough to have well-organized musical staffs, adequate orchestras, access to competent professional talent, and reasonably generous budgets, program planning will naturally follow procedures more or less similar to those outlined above. Even where musical programs consist wholly of recorded material their planning will involve some of the same factors that affect the planning of live programs. For example, audience mood, schedule balance, and the character of competing programs will have to be considered, though such questions as the availability and cost of talent do not arise. Local-station programs of recorded or transcribed music often have to compete with live network programs that are on the air simultaneously in the same area. The planner of the local program will be better prepared to meet such competition if he knows what has gone into the planning of the rival program and is able to adapt its techniques as far as possible to his own purposes.

The planning of local-station live programs may at times involve considerations and methods different from any of those discussed hitherto. For instance, a station with meager resources in the way of professional talent might on occasion proceed somewhat as follows:

Example 5. Program Planned in Cooperation with Local Musical Groups

SITUATION: An independent station in a small community desires to add to its schedule a live musical program of respectable quality and stature. The professional talent locally available is inadequate for the purpose, but there are several vocal groups of some repute, including a high school chorus, a college glee club, and a church choir. The program director decides to investigate the possibility of presenting one or more of these groups in a series of weekly broadcasts.

a. Determining competence of groups. Being unacquainted with the work of these groups, the program director (or the musical director, if the station possesses one) arranges to attend their rehearsals. He finds their performances satisfactory.

b. Obtaining cooperation of groups. The program director writes to the organizations or individuals in charge of the several groups, proposing a series of broadcasts. This leads to a series of conferences in which plans are developed, problems are discussed, and agreements are finally reached.

Conclusion: A series of broadcasts is arranged in which all of the qualified local groups are presented in rotation, each group appearing every second, third, or fourth week, according to the number of groups participating.

PLANNING COMMERCIAL PROGRAMS

Some commercial programs have begun their careers as sustaining features and have been taken over by sponsors after having demonstrated their drawing power. Usually, however, they are specially planned to fit the requirements of a particular sponsor, in which case certain new factors enter into the planning.

a. The sponsor's objective. Commercial programs may be

divided into two classes: "selling" programs, designed to exert a direct influence on sales of the product advertised, and "institutional" programs, intended merely to enhance the advertiser's prestige and keep his name favorably in the public's mind. During the late war several large industrial firms that, having converted their plants to war production, had nothing to sell to the public, nevertheless sponsored network programs. The planner must ascertain at the outset which purpose the sponsor has in mind.

b. Type of audience desired. Surveys have shown that the tastes of listeners vary according to their age, occupation, geographical location, income, and other circumstances. For example, urban audiences are believed to be more receptive to sophisticated forms of entertainment than are rural listeners, whose taste runs rather to religious music, old favorites, and folk tunes. Since the sponsor naturally wants his program to appeal to the kind of people who will be most likely to buy his wares, the planner must consider the nature and price of the article advertised, as well as the age level, occupational classification, and other characteristics of its potential purchasers. He then undertakes to devise a program that will appeal to that type of audience.

c. Audience response. There are several ways of determining the effectiveness of a commercial program. The first and most conclusive test is to note its effect on the sponsor's sales chart—assuming, of course, that the program is of the type intended to promote sales. For the institutional program other methods are available, including the surveys conducted by organizations that specialize in the sampling of public opinion, and stimulated mail response. There are always listeners who spontaneously write letters of applause or criticism, but they normally represent only a small percentage of the total audience. To induce a larger proportion to write requires special measures, such as the offer of prizes or gifts.

Inducements of this kind, known as "mail hooks," are often used in commercial programs. The planner should be prepared to equip his program with an appropriate mail hook if desired; and he should also bear in mind that any contemplated prize contest or gift offer must meet with the approval of the broadcaster, whose policies and standards on this point are very strict.

6

Program Building

PROGRAM BUILDING comprises the selection of specific items to be used, determination of their suitability or adaptability to the means of presentation, determination of the approximate time required for their performance, arrangement of the various items in order of presentation, and selection of talent (except in cases where the builder has no choice, as in talent promotion programs).

As previously noted, the building of a program may be done by the person or persons who planned it, or it may be turned over to another individual or group. In network broadcasting the normal procedure is to assign the building of a program to a production director; but some musical programs are built by their conductors, often in collaboration with the production directors, while others—particularly those involving some kind of expert knowledge—are built by specialists, who may be members of the staff or persons selected from other fields. Whatever his status in relation to the broadcasting organization, whether he be a staff member or an outsider, the program builder should bring to his task certain abilities the nature of which will be indicated in the following pages.

THEORY OF PROGRAM BUILDING

Program building is an art. Being an art, it is governed by certain aesthetic principles, an understanding of which is

essential to its successful practice. Strangely enough, little effort has been made to define those principles. Innumerable volumes have been written on the theory of music, but the theory of program building has apparently been taken for granted. The present attempt to formulate such a theory will, it is hoped, be of interest to students of the art in its popular as well as its more serious manifestations. While the approach is from the standpoint of serious music, those concerned with lighter programs should have no difficulty in relating the argument to their particular field of interest, since the principles of program construction are fundamentally the same for all types of musical program. They also apply equally to "live" programs and those presented through the medium of recordings or transcriptions.

The obvious purpose of a musical program is to give pleasure to its hearers. To do so it must, first of all, attract their attention. Having done so, its next objective is to hold their interest. Finally, it seeks to leave them feeling that they have shared in an experience that was not only enjoyable but complete and satisfying as well. An educational program may also seek to inform or instruct the listener, but its duty to entertain him is no less imperative; indeed, the obligation to entertain increases in proportion to the seriousness of the educational purpose.

How to attract, hold, and satisfy an audience is the main problem in program building as it is in the analogous art of composition. The composer, particularly when writing in the larger forms, such as the sonata or symphony, is faced with the same necessities that confront the program builder. To capture the listener's interest he must invent themes of intriguing charm and distinction; to hold it he must "develop" the themes, both ingeniously and logically, taking them into different keys, expanding them, contracting them, changing their rhythm, tempo, or instrumentation—in short,

varying them in every way consistent with their nature and the character of the composition as a whole. Then, in order to give his work the *unity* that the listener instinctively demands, he returns to the original key and recapitulates his thematic material substantially in the form in which it first appeared.

Mere variety is not aesthetically satisfying. Carried to an extreme, it leads to disorder and confusion. On the other hand, unity without variety results in monotony. The aim of the artist, therefore, is to achieve in his work a just proportion of the two qualities, whether his work be the creation of a symphony or the selection and arrangement of other men's compositions to make a broadcast program. To that end it will be helpful to have in mind the factors in composition and in programing that contribute, respectively, to variety and unity.

Sources of Variety in Composition. The following sources of variety are common to all music:

Differences of pitch
Differences of tempo
Differences of volume
Differences of rhythm
Differences of timbre, or tone color

Occidental music, with the exception of atonal music, has the following additional sources of contrast:

Differences of harmonic value (consonance—dissonance)
Differences of tonality (familiar key—strange key)
Differences of modality (e.g., major mode—minor mode)

The following outline of a hypothetical set of variations will illustrate the uses a composer might make of these sources of variety:

THEME: In the key of C major, $\frac{2}{4}$ time, moderately slow tempo, the theme is introduced softly by violins and lies in their lowest register.

Variation I. The theme is repeated by the flute (variety of timbre), which plays it an octave higher than did the violins (variety of pitch).

Variation II. The theme is played *allegro molto* (variety of tempo) and *fortissimo* (variety of volume) by the brasses (further variety of timbre).

Variation III. The time changes to $\frac{6}{8}$ (variety of rhythm) and the mode to minor (variety of modality) as the oboe presents the theme in a pastoral mood.

Variation IV. The key changes to G major (variety of tonality and modality) and the harmony becomes more dissonant (variety of harmonic value).

Sources of Variety in Program Building. All the above sources of variety are available to the program builder. Which of them he uses, and how, will depend on the kind of program he has in mind and sundry other factors, but their possibilities are suggested in the following outline of a light concert program:

1. The opening number is a lively overture in D major, scored for full orchestra.

2. The second item is an *adagio* in E minor, scored for muted strings. Thus it contrasts with the first in tempo, key, mode, instrumentation, and volume.

3. The third number is a vigorous marching song in G major, for male voices unaccompanied. It introduces further variety of key, tempo, rhythm, and tone quality.

4. The fourth number is a solo for flute with string orchestra accompaniment. The high pitch of the flute contrasts with the lower register of the men's voices.

5. The program closes with a dance movement written

in an ultramodern idiom. Its dissonant harmonies contrast sharply with the conservative harmonic treatment of the preceding numbers.

The program builder also has at his disposal certain sources of variety that the composer is unable or unlikely to employ. For example, in arranging a program the builder may take advantage of the stylistic contrast between works of different periods (e.g., the Renaissance and the eighteenth century), or between different schools of composition (e.g., the romantic and impressionistic schools). Even if the program is devoted to a single school or period the personal styles of the composers may differ so greatly that ample contrast is provided (cf. Mendelssohn and Berlioz). Another source of variety is the contrast between serious music and popular, but this is a treacherous one to deal with. It has often been tried, presumably on the theory that a program containing both types of music should please all listeners, but it has rarely if ever succeeded. Its failure is probably attributable to the fact that it excludes that other essential component of an effective program: unity.

There are so many ways of achieving variety in a program that this phase of the builder's task is relatively easy. It is much more difficult to make sure that the various elements preserve a coherent and logical relationship, thereby producing an effect of unity.

Sources of Unity in Composition. Musical works derive unity from the following factors:

Style
Symmetry of the musical forms
Key relationships
Recurrent themes
Use of a "program"—i.e., a poetic, dramatic, pictorial, or other nonmusical subject.

The first of these unifying factors is inherent in the composer's personal idiom—his type of melodic writing, his use of harmony, counterpoint, and orchestration. The second derives from the balanced proportions of the structural patterns that have been used by composers for many generations. These include the forms known as *sonata,* or *first movement, rondo,* and *theme with variations,* all of which are more or less elaborate variants of the basic *three-part form.* The principle of this form is simple: The first part consists of the presentation of a musical idea; the second part presents either a new and contrasting idea or new treatment of the original idea; the third part repeats, more or less faithfully, the material presented in the first part. This return from the new to the old, from the unfamiliar to the familiar, is what gives the form its character of completeness and unity.

In tonal music—that is, music based on the diatonic scale, in which certain tones have special significance—varying degrees of relationship exist between different keys. The key of C, for example, is closely related to the keys of G (*dominant*) and F (*subdominant*) and is more distantly related to the keys of A, A-flat, E, and E-flat. The unifying value of these relationships has been applied by composers not only in modulating from key to key in a single composition but also in selecting keys for the several movements of works such as sonatas and symphonies. In classical symphonies, for instance, the normal key sequence is as follows:

First movement: C major
Second movement: G major, F major, or A minor
Third movement: C major
Fourth movement: C major

Several composers—notably, Tchaikovsky and Franck—have used a device known as the recurrent, or motto, theme with striking effect. Its unifying value lies in its familiarity

to the listener as it recurs at intervals throughout the successive movements of a work.

The most flexible of the unifying devices listed above—and probably the most effective from the standpoint of the average listener—is the program, or extramusical subject, that the music is designed to illustrate. With such a thread running through it a composition can hardly fail to convey an impression of unity to any listener who is acquainted with the subject, even if he fails to perceive the formal unity of the work.

Sources of Unity in Program Building. The program builder has at his command the following sources of unity:

Homogeneity of style
Structural symmetry
Recurrent theme
Mood
Use of a subject or topic
Use of a musical "signature"

Of these devices the first is the one most generally employed. Many programs derive unity from their dedication to a single school or period, or to works by a single composer. Others may contain a wider variety of selections and yet retain a degree of unity by virtue of the fact that all the items belong to one category, such as symphonic music, folk music, or chamber music. These examples are, of course, only a few of the most obvious kind. There are many subtler affinities that will suggest themselves as unifying factors.

One kind of structural symmetry is extensively used in broadcast programs—namely, the repetition at the end of the program of the "signature" with which it opened. Otherwise, except in rare cases when it seems appropriate to give the audience a second chance to become acquainted with a

new composition, the repetition of music heard earlier in the program is hardly to be recommended. There are other ways, however, of applying the principle of formal balance to program building. For example, where a program contains a composition new to the audience, together with two or more well-known pieces, an effect of unity can be achieved by placing familiar works at the beginning and end, with the unfamiliar piece between. Or, in a program consisting of two orchestral pieces and a solo number, the former may be regarded as representing the first and last sections of the three-part form and the solo as representing the middle section. On this basis a program containing more than three numbers might be modeled after rondo form (ABACA), as follows:

A: Orchestral number
B: Vocal solo
A: Orchestral number
C: Instrumental solo
A: Orchestral number

The recurrent theme device is frequently used in one form or another. Some programs repeat the signature as a bridge between numbers, some use a special bridge, composed for the purpose, and others fill the intervals with improvised modulations on the harp or celeste. In the latter case, although there may be no repetition of a theme, the characteristic sound of the instrument serves as a unifying factor.

Programs designed to accord with the mood of the audience at a particular time or season derive unity from the emotional atmosphere they create. An early morning program usually offers music of a lively, cheerful type; a "slumber hour" confines itself to pieces that are tranquil and soothing; Christmas programs, of course, specialize in carols.

In program building, as in composition, the most obvious, and in some respects the most effective, unifying device is the

use of a subject that the music is intended to expound, illustrate, or annotate. A rather naïve application of this device, very popular in the early days of broadcasting, was the "Magic Carpet" program, which took its listeners on an imaginary journey to foreign lands by playing characteristic examples of their respective national music. Numerous other variants followed, such as the "Parade of the States," in which the forty-eight states were honored in turn by the presentation of music by their native composers or music associated with their history or geographical features; college programs, featuring the songs, musical organizations, and traditions of the colleges and universities; "Classics *versus* Jazz" programs, using the schism between the adherents of the two schools as a pretext for offering a mixture of serious and popular music in the same program. Educational programs are usually expository, their subjects being phases or subdivisions of some general topic, such as music appreciation or music history. With such a unifying bond to hold it together a program may range through the widest variety of material without becoming incoherent.

TECHNIQUES OF PROGRAM BUILDING

Score Reading. To readers of the preceding pages it will be apparent that program building demands certain musical qualifications. In order to deal intelligently with questions of variety and unity the builder needs a broad knowledge of music in general and special familiarity with those areas from which he expects to draw material for his programs. In addition, he needs a considerable amount of technical proficiency. Unless his memory is prodigious it will occasionally need refreshing on such points as the key, tempo, or instrumentation of compositions. This means that he should be able to read a score.

Score reading is even more essential in other phases of the program builder's task. In selecting unfamiliar material—unless it is available in transcribed or recorded form—the builder has no means of determining its character and quality other than studying the score; and when, as often happens, a desirable composition requires an orchestra larger than the one at his disposal, it is only by studying the score that the builder can determine whether and how the orchestration can be reduced.

Timing. The strictness of time limitations in broadcasting necessitates the utmost care in fitting a program to its allotted period. Minor adjustments can be, and often are, made in rehearsal by the conductor or production director; but if such last-minute alterations involve too much cutting or padding the effect of the program may be seriously impaired. Therefore, it behooves the program builder to ascertain in advance the duration of the music he programs. This he may do in one of several ways. If the composition under consideration is a frequently performed work in the symphonic repertory he may find its approximate timing in some published source, such as the catalogue of the *Edwin A. Fleisher Music Collection in the Free Library of Philadelphia.* There is also a booklet [1] that contains timings of about eight hundred standard symphonic works, and recently some of the publishers of symphonic material have adopted the commendable practice of including timings in their catalogues. Timings are sometimes marked by thoughtful conductors or production directors in the scores of works they have presented; but in many cases the program builder must find out for himself how long it will take to perform a piece of music that he wants to program. If the tempo is indicated metronomically—that is, by prescribing the number of beats per

[1] T. C. York (compiler), *How Long Does It Play?* (London: Oxford University Press, 1929).

minute—the duration of the piece can be arrived at by the following simple mathematical calculation:

Multiply the total number of measures in the composition by the number of beats in each measure, then divide by the number in the metronome mark. The quotient will be the duration in minutes. For example, a composition in $\frac{3}{4}$ time contains 240 measures, and the metronome mark is "♩ = 120"; $240 \times 3 = 720 \div 120 = 6$. Assuming that there are no important deviations from the prescribed tempo, the playing time of the piece should be approximately six minutes.

In the absence of metronome marks, or if the tempo changes materially during the course of the piece, the program builder will have to study the score until he becomes well enough acquainted with it to "feel" the proper tempo, then read it through at that tempo and note the time required for the reading. In any case his estimate will be only a rough approximation, for even the most experienced and musicianly program builder can never be sure that the conductor will agree with him regarding the tempo—or, for that matter, that he will adhere strictly to the metronome indications. Therefore, he should always make allowance for possible inaccuracies in his timing estimate; but a rough estimate is better than none.

Cutting. In fitting programs to the Procrustean bed of the broadcast schedule it is often necessary to alter the length of a musical number, usually by amputation. Once in a while a composition has to be stretched, but in most cases the alteration is for the purpose of abbreviation. The difficulty of the operation, and the method of performing it, depend on the anatomy of the subject. Some forms of composition, because of their sectional structure, are relatively easy to cut without leaving noticeable scars. A march can usually be shortened sufficiently by omitting one or more repeats, a set of waltzes by omitting a section or two. Even a rondo can lose one re-

currence of its theme without suffering fatal injury, and popular dance tunes can be reduced, if necessary, to a single chorus. A fugue, on the other hand, is almost impossible to cut because of its overlapping contrapuntal texture, and works in sonata form often present difficulties. The cutting of such works can be done safely only by one who is, or can become, thoroughly familiar with the score—which serves to emphasize once more the importance of competence in score reading as a part of the program builder's technical equipment.

Leeway. The problems of timing a broadcast program never end until the program is off the air. It may be timed in preparation by the builder and in rehearsal by the director, yet the timing may still go wrong in the broadcast because of the increased nervous tension of the performers. Usually the variation is small enough to be compensated for in the closing signature, but it may occasionally assume major importance—as, for example, when a portion of the program originates outside the studio, or when there is any kind of extemporization. If there is the slightest chance of a major deviation in running time it is advisable to provide the program with a "cushion," or "buffer," in the form of a non-essential number that may be used or omitted as required. The cushion should be placed just before the final number on the program, so that the director will know within a matter of seconds how much time needs to be filled before deciding whether to use the extra number.

Program Routine. The sequential arrangement of numbers on a broadcast program is referred to in studio parlance as "routine," and the act of arranging them as "routining." [2] Ordinarily the routine of a program is determined to a large

[2] The term is also used to designate the order of presentation of the different parts of a popular tune, as introduction, verse, vocal chorus, and instrumental chorus.

extent by the principles of variety and unity that influence the selection of materials, but in some cases there may be other factors to reckon with. In programs based on historical subjects, chronological order may be the most important consideration. Such programs, however, sometimes contain archaic music of a type to which modern ears are unaccustomed, in which case it may be preferable to ignore chronology and prepare the listener for the unfamiliar idiom by proceeding backward from more familiar ground. Programs of semiclassic or popular music tend to follow a fairly conventional routine, opening with a spirited number, continuing with a series of pieces in more or less varied moods, styles, and tempi, and closing with another lively number. If a novelty is included it is usually placed somewhere near the middle of the program, though it may, if deemed of sufficient interest, be reserved to provide a climactic ending. Similarly, in programs with soloists the normal procedure is to place the solo numbers in the interior of the program, using orchestral numbers to open and close; but if the soloist is of the "Great Artist" type, whose fame and personality are expected to command the listener's exclusive attention, he or she is usually allowed to conclude the program, which otherwise might end in anticlimax.

Program Clearance. After a program is built it must be submitted to the music division for duplication and copyright clearance. To facilitate and expedite the process of clearance the builder should include in the music sheet the following information: the title of the program; the date and time of the broadcast; the station or network by which it will be transmitted; the title and composer of each composition listed and the edition to be used (unpublished pieces should be marked "MS").

For others concerned with the preparation or presentation of the broadcast the following additional data should be in-

cluded: the name of the conductor; the names of soloists; the name or type of any instrumental or vocal group to be used, as "Concert Orchestra," "Dance Unit No. 1," "Male Chorus"; the keys of all vocal numbers; the particular orchestrations or arrangements desired; and the estimated timing of each number if available.

In popular programs the composers' names are often omitted, but the names of publishers are indispensable except in programs of recorded or transcribed music, where the make and number of the disk usually constitute sufficient identification for clearance purposes. In recorded programs of popular music the name of the performing artist or group is often listed instead of the composer. The title, of course, must always be given, for the benefit of the script writer or announcer.

The following sample music sheets illustrate three forms that are commonly used.

SECOND ANNUAL FESTIVAL
OF CONTEMPORARY AMERICAN MUSIC
McMILLIN THEATRE—COLUMBIA UNIVERSITY
Saturday, May 11, 1946

WEAF & Net. 3:00–4:00 PM

1. Suite, "From These States"	Ernst Bacon (Asso. Mus. Pubs.)	20:50
2. Concerto for Piano and Orchestra	William Schuman (G. Schirmer)	20:00
3. Toccata for Orchestra	Louise Talma (Am. Mus. Center)	12:00

Leon Barzin, Conductor
Beveridge Webster, Pianist
NBC Symphony Orchestra

DAYTIME CLASSICS

Tuesday, June 11, 1946

WEAF & Net. 9:30–9:45 AM

SIG: Valse from "Tina" Selection (Chappell)

1. Tarantella Bohm (C. Fischer)
2. All through the Day (Williamson)
3. Ciribiribin (Broadcast Mus., Inc.)
4. Jewels of the Madonna (G. Schirmer)

Concert Orchestra

THE 660 CLUB

Tuesday, June 11, 1946

WEAF 5:30–6:00 AM

SIG: Oh, How I Hate to Get Up in the Morning

1. Loop de Loo	T. Pastor	Cosmos 471
2. You Are My Sunshine	L. Welk	Dec 3725
3. All through the Day	Sinatra	Col 36962
4. Old Ark's a-Moverin'	Golden Gate	Thes 1191-A
5. We'll Gather Lilacs	Crosby	Dec 23510
6. Missouri Waltz	Salon Orch	Thes 1194-K
7. Saint Louis Blues	Lombardo	Dec 2478
8. Isn't It Kinda Fun?	Haymes	Dec 18710

Research. The building of musical programs, particularly those of the more serious kind, often necessitates a considerable amount of investigation and exploration. Obscure compositions have to be found, unfamiliar scores have to be

studied, information about compositions and composers has to be collected and collated, and various other matters have to be inquired into. The program builder's equipment for these tasks comprises both tools and acquired knowledge. First and most essential among the tools are the standard musical dictionaries and encyclopedias, musical histories, guides, and analyses, followed closely in utility by the published program notes of symphony orchestras. A number of the standard reference works are listed in the Bibliography (Numbers 15 to 28). Other useful sources of information are the catalogues of publishers, rental libraries, and reference libraries, a partial list of which is given below.

The effectiveness of these tools depends, naturally, on the builder's knowledge of how to use them. Not only must he know how to use reference books and libraries, but also he must learn which sources are most likely to furnish a particular kind of information or material. Some publishers specialize in symphonic works, some in arrangements for concert orchestra, some in choral music, and others in popular music. The partial lists below are intended to indicate in a general way the kind of material that may be obtained from this or that publisher or library, but thorough knowledge of the subject can be acquired only through experience.

Publishers

Symphonic music

American Music Center, New York
Associated Music Publishers, New York
C. C. Birchard & Co., Boston
Boosey & Hawkes, Inc., New York
Broadcast Music, Inc., New York
Elkan-Vogel Co., Philadelphia
Carl Fischer, Inc., New York
J. Fischer & Bro., New York

H. W. Gray Co., New York
G. Ricordi & Co., New York
G. Schirmer, Inc., New York

Arrangements for concert orchestra, band, and smaller combinations

Boosey & Hawkes, Inc., New York
Broadcast Music, Inc., New York
Carl Fischer, Inc., New York
Theo. Presser Co., Philadelphia (Ditson and Church editions)
G. Schirmer, Inc., New York

Choral music

C. C. Birchard & Co., Boston
Carl Fischer, Inc., New York
J. Fischer & Bro., New York
H. W. Gray Co., New York
Hall & McCreery Co., Chicago
G. Schirmer, Inc., New York
Arthur P. Schmidt Co., Boston

Rental Libraries

Symphonic, operatic, and choral music

American Music Center, New York
Mapleson Music Library, New York
Tams-Witmark Music Library, New York

Reference Libraries

American Music Center, New York

Contains published and unpublished scores of contemporary American works, available for examination; also complete materials of some compositions.

Edwin A. Fleisher Music Collection in the Free Library of Philadelphia

Contains a large collection of standard symphonic works; also many unpublished works by composers of North and South America that may be borrowed with the composer's permission. Performance rights cannot be cleared through the library but must be negotiated directly with the composer or his agent. The catalogue of the Fleisher Collection is published (see Bibliography, No. 9).

Library of Congress, Music Division, Washington

Contains one of the world's largest collections of music of all kinds, photostatic copies of which may be obtained at moderate cost; also a large collection of folk music recordings, copies of which may be purchased.

New York Public Library, Music Division

Contains a large collection of music of all kinds, including much rare music and a valuable collection of Americana. Photostatic copies may be obtained.

Pan American Union, Music Division, Washington

Contains many Latin-American compositions, some of which may be borrowed under certain conditions.

BUILDING RECORDED AND TRANSCRIBED PROGRAMS

The building of programs out of recorded and transcribed material differs in several respects from the building of live-talent programs. In general it is an easier task and requires less technical musicianship on the part of the builder. He does not need to be a score reader to acquaint himself with a new work or refresh his recollection of an old one if the

music is available in recorded form, nor does he have to solve any problems of instrumentation. Timing is a simple matter, except that it is difficult to make cuts involving less than an entire movement, and talent selection becomes a factor only when there is a choice between two or more recordings of a given composition.

On the other hand, recorded-program building calls for certain special qualifications, including a keen ear for imperfections, whether of technical or accidental origin, a broad knowledge of the catalogues of recording companies, and special knowledge of the artistic and technical qualities of particular items. The builder should also be acquainted with the repertories of the various transcription libraries that issue recorded material designed especially for broadcasting and furnished only to radio stations.

With the exceptions noted above, the building of recorded programs follows virtually the same procedure and demands the same abilities as does the building of live programs. The same principles of variety and unity are applicable; the same necessity exists for obtaining proper copyright clearance, since the possession of a record or transcription does not entitle the owner to use the music it contains in a performance for profit; and the results depend to the same extent upon the taste, imagination, and musical knowledge of the builder.

The following sources of information regarding recorded and transcribed music will prove useful to the builder of recorded programs:

Commercial Recordings

Catalogues

Columbia Recording Corp., New York
Decca Records, Inc., New York
The Gramophone Shop, Inc., New York
RCA Victor Division, Camden, N. J.

Guides

David Hall, *The Record Book* (New York: Doubleday & Company, Inc., 1940)

Irving Kolodin, *A Guide to Recorded Music* (New York: Smith & Durrell, 1941)

Transcription Libraries

Catalogues

Associated Program Service (Associated Music Publishers, Inc., New York)

Lang-Worth Feature Programs, Inc., New York

C. P. MacGregor, Los Angeles

NBC Thesaurus (NBC Radio Recording Division, National Broadcasting Co., Inc., New York)

Standard Program Library (Standard Radio, New York)

World Program Service (World Broadcasting System, Inc., New York)

Transcribed Incidental Music. An important phase of program building is the selection of incidental and background music for dramatic programs, usually referred to as "cuing." [3] It differs considerably from the building of musical programs, the material being chosen not for its intrinsic value and congruity but to enhance the dramatic values of the script. The cuer's problem, therefore, is to select musical fragments and excerpts that will fit the moods and action of the play without attracting undue attention to themselves.

There is no easy solution for that problem. Appropriate and effective cuing calls for most if not all of the knowledge and skills demanded by program building, plus a sense of the theater. Even where recorded or transcribed music is used, thereby placing at the cuer's disposal an enormous

[3] See also Chapter 8.

repertory with never a worry about instrumentation or arrangements, the results will depend almost entirely on the cuer's judgment, taste, and general knowledge of music. In script cuing as in program building there is no substitute for musicianship. There are, however, certain aids of which the cuer may avail himself. For example, most of the transcription libraries include "mood music," "themes," "bridges," interludes, fanfares, and the like, specially designed for use in dramatic programs. Some of this material is original, some adapted from standard works. Most of it is listed under titles that suggest the character of each item and thus give the cuer an idea of the use for which it would be appropriate.

Where live music is used similar guidance may be found in the catalogues of certain music publishers—notably, Carl Fischer, Inc., and G. Schirmer, Inc.—who in the heyday of the silent motion picture classified their publications according to mood or dramatic significance for the benefit of cuers of films.

PROGRAM BUILDING AT THE LOCAL STATION

The chief differences between network and local-station program building are quantitative. The local station usually builds fewer and less elaborate programs, particularly if it is affiliated with a network, and much of its time may be devoted to recorded music, which, as mentioned above, demands less technical musicianship than does the building of live programs. Otherwise the problems are pretty much the same.

There is, however, one situation, rather uncommon nowadays in network operation, that often arises at local stations, especially at those operated by noncommercial organizations —namely, the presentation of local musical groups whose programs are built by their respective directors. In order to

insure the maximum effectiveness in such programs it may be necessary for the station musical director to undertake some kind of educational campaign for the purpose of instructing the local directors in the fundamentals of good programing. This might take the form of a series of conferences, or, better still, a workshop in which methods could be tested under actual or simulated broadcast conditions.

7

Talent Selection

LITTLE HAS been said thus far on the subject of talent as a factor in program building. Although in practice the choice of talent is often inextricably bound up with the choice of music, talent selection is a topic of sufficient importance to merit separate consideration.

In some cases the choice of talent is entirely subordinate to the choice of program material, as when the latter is of a standard type for which suitable performers are abundantly available; but if the program includes unusual types of music its composition may be influenced to a considerable extent by the availability of performers or instruments of the proper kinds. In programs designed for talent exploitation the choice of program material is naturally of secondary importance.

In any case, regardless of precedence, talent selection demands the program builder's most careful attention, for the effectiveness of any program depends ultimately upon the quality of the performance. The best-laid program plan will fail if the orchestra is inadequate, the conductor out of his element, or the singers miscast.

TALENT SOURCES

It is often difficult to find the right talent, even in places where talent is plentiful. New York probably affords a greater number and wider variety of singers and instrumentalists

than any other city in the world today; but even in New York the discovery of a particular type of performer may involve a long and arduous search. Generally, the problems of talent selection are in inverse ratio to the population of a city and its importance as an amusement center. Judging by the number of radio programs that originate there, Hollywood ranks next to New York in quantity and diversity of talent, and doubtless surpasses it in certain categories, because of the requirements of the motion picture industry. Chicago presumably comes third. The smaller cities and towns seldom afford any unusual or exotic kinds of talent; which means that program builders in such communities will probably have to confine their efforts to presentations that require only the more conventional types of performance.

One of the most useful attributes that a program builder can possess is a wide acquaintance among the musicians in his locality. This takes time to acquire. Unless or until he has first-hand knowledge of the local talent supply he will have to seek guidance from whatever sources of information may be available. The following sources are to be found in the principal talent reservoirs:

Artist managements, prepared to furnish vocal and instrumental soloists, chamber music groups, small choral ensembles, and similar attractions
Booking agencies, specializing in dance bands, novelty groups or teams, and popular singers
Conservatories, music departments of colleges, and public school music departments
Symphony orchestras
Opera companies
Choral societies

There are also the local headquarters of the American

Federation of Musicians (the union of instrumental musicians) and the American Federation of Radio Artists (the union of radio singers, actors, and announcers). These organizations do not act as talent bureaus, but if friendly relations are established with them it is sometimes possible to obtain from them suggestions regarding suitable talent for a given purpose. Music publishers, too, can occasionally furnish helpful information. Publishers of Latin-American music, for instance, often are in touch with visiting talent from below the border.

Once a beginning has been made in building up a backlog of talent information, one of the most productive sources is the talent already listed. If a baritone is required, a tenor or soprano previously booked may be able to recommend one. This is particularly true as regards musicians of foreign origin, who tend to gravitate together. One foreign musician is likely to know all others of his nationality in the same city, and almost equal solidarity exists among groups speaking a common language, even though they come from different countries. A Mexican guitarist, for example, will probably know any Guatemalan marimba players, Colombian folk singers, or Cuban bongoists in the vicinity.

In small communities the sources from which talent or information pertaining to talent can be obtained are naturally less numerous. Artist managements and booking agencies exist only in the chief amusement centers. Symphony orchestras, opera companies, and choral societies, though fairly widespread and constantly multiplying, are not yet as ubiquitous as radio stations, and there are towns that lack either a conservatory or a college music department; but there is hardly one that has no public school music department, no private music teachers, no presentable church choirs, and no local of the musicians' union from which talent of broadcast caliber can be procured. The high standard of musical in-

struction in the public schools has in recent years produced many student organizations that are worthy of a place on any program. Private music teachers may be competent performing artists, or have pupils sufficiently advanced to warrant their presentation to the radio audience; church choirs may be effective as groups, or contain individual voices suitable for solo work; and the musicians' union is always ready to furnish professional orchestral players in so far as they are locally available.

AUDITIONS

It hardly need be said that the only satisfactory basis for the selection of talent is first-hand knowledge of the performers under consideration. The program builder should be personally acquainted not only with their general competence but also with their styles of performance and other individual characteristics. Except in emergencies, as when illness or some other unforeseen contingency necessitates a last-minute substitution, it is inadvisable to rely on the recommendation of a third person. No matter how sound that person's judgment of talent may be, he can scarcely be expected to understand the special requirements of a program built by someone else. His recommendation may therefore lead to serious miscasting.

To illustrate the danger inherent in talent selection by hearsay the following hypothetical case is cited.

A proposed folk music program calls for the services of an authentic ballad singer. The program builder, being unacquainted with any folk singers in the vicinity, engages a folk song specialist of some reputation who is highly recommended but whom he has never heard. He learns, when it is too late, that the artist belongs to a school which holds that folk music should be modified and professionalized for popular consumption. As the program was intended to show the

characteristics of the folk ballad in its native form, the singer is a misfit for the purpose in hand, no matter how good his work may be of its kind.

There are several ways in which the program builder may acquire personal knowledge of the abilities of performers. He may hear them in concert, opera, or musical comedy, in night clubs or other broadcast programs; but the method most frequently employed is the audition. It is not an ideal one. Many artists find it more nerve-racking than a public performance and are unable to do themselves justice. Moreover, the time allowed for radio auditions is often insufficient for a thorough exposition of the artist's qualities.

On the other hand, radio auditions have the advantage of being conducted under simulated broadcast conditions. The performance takes place in an acoustically treated studio and is heard through regular broadcast facilities, so that it sounds as it would in an actual broadcast. This is a point of particular importance where singers are concerned, as many voices sound quite different on the air from the way they sound in an auditorium.

The networks, in their constant search for new talent, hold auditions almost daily. As a rule, applicants are heard first in "general" auditions by a production director experienced in talent appraisal. Those who show promise are recommended by the director for "special" auditions, which are recorded. The recordings are then heard by a committee of the production division, which selects the best for submission to the program planning board. A detailed report is made on each performer, covering such factors as tone quality, intonation, rhythm, style, diction, and personality, and both the report and the recording are filed for future reference.

Auditions are also scheduled for the benefit of program builders in search of talent for particular programs, for conductors and orchestra managers seeking replacements for

orchestra personnel, and for choral directors engaged in recruiting choristers. Occasionally orchestras or choirs are auditioned as units, but ordinarily auditions are for the purpose of appraising individuals or small groups.[1]

Standards of Talent Appraisal. The criteria for judging artistic performance are largely subjective. If a wrong note is sung or played there is no room for argument, but almost every other feature of a performance is debatable. Tone quality, phrasing, and tempo are good or bad, right or wrong, according to the taste of the hearer, and even such an apparently objective matter as pitch has been known to give rise to controversy.

Since, therefore, the selection of talent must be largely on the basis of taste, it is important that the selector's taste be formed by the widest possible experience; and it is also important that he be acquainted with the tastes of the audience that he hopes to please. He should be prepared on occasion to set aside his own standards in favor of those of the public. He may, for instance, have an antipathy to crooners, but since he may be called on at any moment to pass on the qualifications of a crooner he can hardly afford to be ignorant of the fine points and current fashions in crooning.

Rating System for Singers. To add to the difficulties of the talent selector there is the fallibility of human memory, a factor that may assume special importance when a large number of performers is heard in succession. For such occasions, and for general purposes as well, it is advisable to work out some mnemonic system which will help to recall the particular characteristics of each performer. Peter J. Wilhousky, whose duties as Assistant Director of Music in the New York public schools, as conductor of the All-City High School Chorus, and as trainer of choral groups for many of Arturo

[1] This, of course, refers to talent auditions, not to program auditions as described in Chapter 5.

Toscanini's broadcasts have involved the testing of thousands of voices, has devised a rating system that he finds indispensable and that should prove useful, perhaps with some modifications, to anyone concerned with the selection of singers. Each candidate is scored on seven performance factors, as follows:

1. *Tone quality.* This includes not only the quality of sound produced, as thin or full, nasal or throaty, open or covered, but also such contributory factors as the rapidity and the extent of pitch variation of the vibrato. This is a matter of special importance in the selection of choral singers, as a voice with an exceptionally slow or wide vibrato will not blend well with others.

2. *Intonation.* The ability to sing on pitch is naturally a primary consideration, but it is also desirable for choristers to be able to sing sharp or flat at will. A singer who lacks that ability is likely to prove too inflexible for ensemble work, even though his intonation is generally good when singing alone.

3. *Volume.* In broadcasting, the volume of tone produced by a soloist is not a matter of paramount importance, as any deficiency or excess of vocal power can usually be compensated for by the placement of the microphone. The balance of a chorus, however, cannot be so readily controlled by microphone placement. Therefore, the volume of each voice should be considered in relation to that of the other voices in the group. A weak bass or a tenor incapable of singing softly may make it impossible to obtain a satisfactory balance, particularly if the choir is a small one.

4. *Range.* Not only the compass of each voice should be determined but also the control of quality and volume at both extremes of the range. The findings will help to determine whether the singer should be classified as a first or second soprano, first or second tenor, first or second bass.

5. *Musicianship.* Under this heading are grouped several attributes essential in choral singing: the ability to read music at sight, a sense of rhythm, intelligence in phrasing, control of tone color, and the ability to follow the conductor's beat and other manual indications.

6. *Diction.* Attention to diction is, if anything, more important in choral work than in solo singing, since the multiplicity of voices tends to confuse the sound of consonants. Prospective choristers should be tested for their ability to enunciate clearly and correctly, not only in English but in several foreign languages, particularly Italian, French, Spanish, and German.

7. *Personality.* The appearance of a singer might be regarded as negligible in broadcasting—except, of course, in television—but the prevalence of studio audiences places a value on pulchritude, and publicity departments find it easier to place talent photographs if they have eye appeal. Moreover, Wilhousky asserts that an attractive-looking chorus is a source of inspiration to the conductor. It would seem, then, that the candidate's looks should be accorded some weight; but that is not the only aspect of personality which should be considered. Alertness, pliancy, and willingness to cooperate are even more important, for a singer who is sluggish or stubborn can be as detrimental to a chorus as one who sings out of tune.

Singers may be scored on the above characteristics by a point system in which any convenient number—ten, for example—represents the scorer's standard of perfection. A card file of talent, showing the score of each performer auditioned, should be kept for future reference.

Obviously, such scoring is a subjective process guided solely by the scorer's judgment; nevertheless it is valuable for purposes of comparison as well as for refreshing the

memory at a later date regarding the impression made by a particular candidate. Perhaps even more valuable results could be obtained if auditions were heard by several judges, all scoring by the same system. A comparison of their ratings should produce a verdict more nearly objective than the opinion of any one person, however expert.

Rating System for Instrumentalists. The scoring system suggested above, while designed for choral auditions, may be used practically without modification for vocal soloists, and is readily adaptable to the rating of instrumentalists. The latter might be scored on the following points:

1. *Technical proficiency.* This would include the ability to play any required passages with facility and accuracy, proper use of the pedals by pianists, control of the bow by string players, adequate command of the high and low registers by wind instrument players, and so on.

2. *Intonation.* Perhaps the most important single factor in instrumental performance—except, of course, in the playing of instruments of fixed pitch, such as the piano—is the ability to play in tune. It is closely related to technical proficiency but not invariably associated with it. One often hears stringed or wind instrument players execute the most difficult passages with consummate dexterity—and remarkable infidelity to pitch. It seems advisable, therefore, to consider intonation as a separate qualification and score it independently.

3. *Tone quality.* In judging the quality of tone produced by string players special attention should be paid to the vibrato, which should be neither too slow nor too fast, always under control, and never of a type which affects the intonation. The pitch fluctuation caused by the vibrato may be fairly extensive provided that the variation from the basic pitch is equally divided between sharping and flatting. The vibrato of some players produces only downward deviations

of pitch, that of others causes only upward deviations. The effect of such vibratos is to make the performance sound consistently a little flat or a little sharp, as the case may be. Wind instrument players, with the exception of some specialists in popular music, seldom use the vibrato to any noticeable degree. Nevertheless their tone quality may vary greatly in warmth and expressiveness as well as in clarity and brilliance.

4. *Volume.* In solo instrumental performance, as in solo singing, volume of tone is of secondary importance, since the loudness of a solo instrument can be controlled by proper use of the broadcasting equipment. In selecting orchestral players, however, tonal volume should be given due consideration, as each instrument in an ensemble should be capable of maintaining its proper dynamic relationship to the others without artificial aid. Where wind instruments are concerned insufficient volume is seldom a problem. A more common fault is the lack of ability to play softly.

5. *Musicianship.* The qualities implied here are generally similar to those listed under the same heading for choristers. Facility in sight reading, while not necessarily required of solo players, is indispensable to orchestral musicians. A sense of rhythm and a feeling for style and phrasing are equally important in solo and ensemble performance. The ability to follow a conductor's indications is essential to all orchestral musicians and to soloists who play with orchestral accompaniment.

6. *Interpretation.* The technical proficiency of an instrumental musician may be great, his tone quality excellent, his intonation perfect, and his musicianship sound; yet he may fail to convey the emotional quality, the poetic significance, or the charm of a piece of music. This factor, of obvious importance in solo performance, should not be overlooked in selecting orchestral players, as a cold first clarinet or a phleg-

matic first horn may chill the ardor and dim the luster of a fine orchestra.

TALENT COSTS

The cost of talent is usually an important factor in program planning and building. As the fees payable to performers depend to a large extent upon the wage scales and conditions of employment established by the unions that represent instrumental and vocal musicians, the program builder should have some knowledge of the nature and purposes of these organizations.

American Federation of Musicians. The union of instrumental musicians, usually referred to as the A.F. of M., was organized in 1896 and is affiliated with the American Federation of Labor. In 1946, according to information furnished by the international headquarters, it had more than seven hundred locals in the United States and Canada and a total membership approaching 200,000. Its jurisdiction extends to virtually every place in either country where broadcast programs originate. Its object, as stated in its constitution, is "to unite all local unions of musicians, the individual musicians who form such local unions of the American Federation of Musicians into one grand organization for the purpose of general protection and advancement of their interests and for the purpose of enforcing good faith and fair dealing, as well as consistency with union principles, in all cases involving or of interest to members and Local Unions or the Federation." Wage scales and most working conditions are fixed by the locals for their respective jurisdictions, except scales for certain services, including the making of recordings and transcriptions, which are fixed by the international organization.

American Federation of Radio Artists. Singers, actors, an-

nouncers, and sound effects technicians are represented by the American Federation of Radio Artists (AFRA), founded in 1937 and also affiliated with the American Federation of Labor. A list supplied in 1946 by the national headquarters in New York showed AFRA locals established in the following cities:

Atlanta, Ga.; Boston, Mass.; Bridgeport, Conn.; Charlotte, N.C.; Chicago, Ill.; Cincinnati, O.; Cleveland, O.; Dallas, Tex.; Denver, Colo.; Detroit, Mich.; Durham, N.C.; Houston, Tex.; Kansas City, Mo.; Lawrence, Mass.; Los Angeles, Calif.; Louisville, Ky.; Miami, Fla.; Minneapolis–St. Paul, Minn.; New York, N.Y.; Philadelphia, Pa.; Pittsburgh, Pa.; Portland, Ore.; Racine, Wisc.; Rochester, N.Y.; San Francisco, Calif.; Schenectady, N.Y.; Seattle, Wash.; Sioux Falls, S.D.; Springfield, Mass.; St. Louis, Mo.; Washington, D.C.

Minimum Fees. The minimum fees established by these unions and incorporated in their contracts with broadcasters vary somewhat according to locality, the highest rates generally being charged in the principal amusement centers. AFRA fees also vary according to the length of the broadcast, different scales being set for quarter-hour, half-hour and hour programs, and higher rates are charged for commercial than for sustaining programs. The minimum fees established by the New York local of the American Federation of Musicians are slightly lower for half-hour broadcasts than for longer ones, but no distinction is made between sustaining and commercial programs as far as single engagements are concerned. The scale for salaried staff musicians varies according to the number of hours per week they are required to work, and whether they are engaged for sustaining programs only or for both sustaining and commercial programs.

Where performers are paid more than the minimum union fee for a broadcast such overscale compensation is determined by negotiation between the performer and the broadcaster

or, in the case of commercial programs, by agreement between the performer and the sponsor or the advertising agency handling the program.

The program builder should have a general idea of the union scales prevailing in his locality, and should know where to obtain exact quotations. At the network headquarters information concerning AFRA scales is usually furnished by the talent booking office of the production division, while the orchestra contractor is the source of information on fees for instrumental musicians. At stations that lack either or both of these sources the program builder should ascertain what member of the staff is authorized to negotiate with the unions and obtain the desired information through that official channel.

8

Composing

IN THE DAYS of the silent motion picture, music played a more continuous if less constructive role in the presentation of a film than it does today. As there was no audible dialogue, it was not only permissible but desirable to have a musical accompaniment that ran throughout the picture at a consistently high volume level. At first the accompaniment was provided by a pianist in the pit, who used his own discretion in choosing the music to be played and whose choice was guided more often by the limitations of his library and technique than by the dramatic implications of the plot. Gradually, however, the musical part of the show began to receive increasing attention. The pit pianists were replaced by orchestras and these grew in size and capacity until in the 1920's many of the large movie theaters were maintaining full symphony orchestras, with pipe organs to relieve them for necessary periods of rest.

At the same time the value of appropriateness in the accompanying music came to be recognized. Instead of leaving the choice of music to the conductor or organist in each theater, "cue sheets" specifying the compositions to be used were prepared by the producers and distributed with the films. These sheets necessarily confined their recommendations to readily available music in the standard or popular repertory; but those repertories were considerably enlarged, during the period in question, by the addition of quantities

of "themes" and "mood music" specially concocted for use in the motion picture theater. Composers turned out "Misteriosos," "Agitatos," "Hurries," and "Love Themes" by the thousand, many of them based on works in the public domain. There were "Storms" adapted from *The Flying Dutchman,* "Dramatic Tensions" after Tchaikovsky, and "Laments" borrowed from Grieg. None of this music was composed for any particular picture. It was intended for use on any reasonably suitable occasion, and much of it was used over and over again. Some pieces were used so often that they acquired a quasi-classic status, which, unfortunately, tended to dissociate them from the scenes which they accompanied. One Misterioso in particular was so overworked that it ended by evoking snickers instead of shivers whenever it was played.

Perhaps the chief virtue of these compositions was the fact that their titles indicated their character, thus saving the trouble of searching through the standard literature for passages suggestive of love, hate, fear, and the like. However, they did represent an attempt to supply the movies with appropriate music, and they went about as far as was possible at the time. A few silent pictures during this period were provided with specially written music, but the varying size and quality of the local theater orchestras made its value rather doubtful. Therefore it was not until after the advent of the sound film that it became really practical to furnish motion pictures with original scores.

Incidental and Background Music. Radio broadcasting, which emerged during the later period of the silent film, followed for a time the motion pictures' lead in the use of music for dramatic purposes. For perhaps a decade the music that accompanied dramatic broadcasts was adapted from available sources rather than created for the occasion. The practice had both advantages and disadvantages. With the entire musical

literature to choose from, an experienced and discriminating cuer could usually find suitable music to convey any shade of emotion or accompany any kind of action; and by borrowing from the works of the masters he could be sure of the intrinsic merit of the music he selected. Moreover, much less time was required to select and assemble a series of ready-made compositions than to compose, arrange, and copy an original score, to say nothing of the expense involved in the latter procedure.

On the other hand, the effectiveness of a familiar piece of music in a given context was sometimes seriously impaired by previously established connotations in the mind of the listener. For example, the use of music from the second act of *Tristan and Isolde* to accompany a modern love scene could be disconcerting to listeners acquainted with Wagner's music drama, even though the music was emotionally appropriate. Then, too, there was the difficulty of effecting transitions from scene to scene or from one mood to another; and there was the added problem of finding arrangements of such music suitable for use by the small and variously constituted orchestras usually assigned to accompany dramatic programs.

These considerations eventually started a trend toward the use of specially composed incidental and background music in dramatic broadcasts. For a while original scores were obtained from independent composers on a piecework basis, but by the end of the 1930's the demand had become so great that networks found it expedient to retain the services of salaried composers. Their work consists chiefly of producing custom-built scores to fit dramatic scripts, but they also compose signatures and bridges for programs of various kinds, and they occasionally write a work to order for concert performance.

At one time it was thought that the technical conditions

of broadcasting, while imposing certain limitations on the composer, at the same time offered significant opportunities for new effects of sonority and color. The control of amplification, which made the crooner and the so-called subtone clarinet audible above the sound of the accompanying orchestra, suggested possibilities of timbre previously unattainable. A number of prominent composers have undertaken to explore them, but the results, as far as serious music is concerned, have not been particularly striking. Whether the possibilities were exaggerated or the composers insufficiently acquainted with the peculiarities of a monaural broadcasting system, the fact remains that the most notable achievement thus far in designing music for broadcasting seems to be the adjustment of its dimensions to fit radio timetables; and now that the increased efficiency of the microphone makes it possible to place it farther from the source of sound, thereby approximating more closely the acoustic effects of the concert hall, interest in the matter appears to be waning. Composers are evidently coming around to the engineering point of view, which is that the purpose of radio broadcasting is to serve not as a means of creating new kinds of music but as a medium for the transmission and reproduction of all kinds of music, old or new, serious or popular, with the greatest possible fidelity.

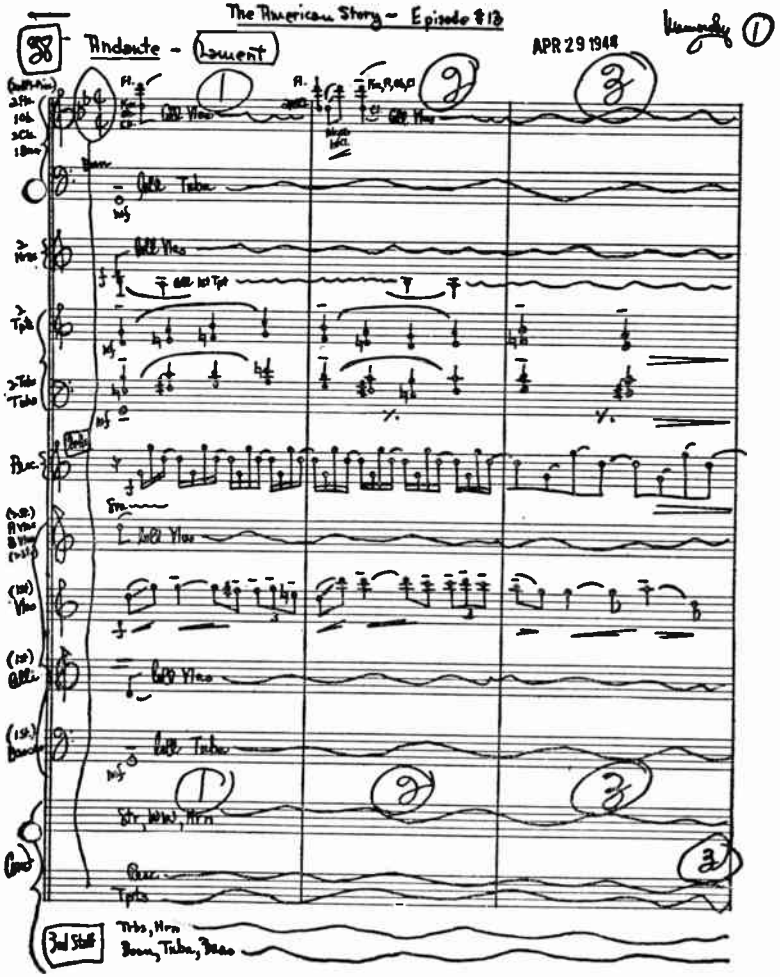
Whether or not it is necessary for the radio composer to concern himself with the acoustic peculiarities of broadcasting, there are certain tricks of the trade that he must master. He must learn to write effectively for any conceivable combination of instruments, from a trio to a symphony orchestra. He must know how to make a small group sound rich and full, how to score background music so that it will not overpower or distract attention from the dialogue. He must learn to establish a mood, suggest a scene, or intensify an emotion with a few measures of music. He must be able to compose

signatures and cushions of such elasticity that their duration may be varied from a few seconds to several minutes. And he must know how to save time.

Composing music for broadcast programs is seldom a leisurely pursuit. Normally a staff composer is expected to provide scores for no more than two or three programs a week, but emergencies may double his stint or oblige him to score a half-hour script on less than twenty-four hours' notice. In such cases the composer is really under pressure, since he must complete his work in time to allow for the copying of parts, and in order to meet the deadline he must avail himself of every possible short cut.

Radio composers do not usually leave the orchestration of their compositions to arrangers. They orchestrate them as they go, writing out a full score with each part, or pair of parts, on a separate line—a time-consuming process at best. Composers who write in haste have therefore evolved a system of signs and symbols that saves them many an hour of work and yet indicates with sufficient clarity for expert copyists the precise notation and instrumentation that the composer has in mind. Abbreviations are freely employed. For example, repeated measures are indicated by diagonal lines between dots; repeated beats, by diagonal lines without dots; repeated notes or chords, by note stems without heads. If two or more instruments are to play the same part, either in unison or at the octave above or below, the notes are written out for one instrument only—e.g., the flute—and the direction *col fl., col fl. 8va,* or *col fl. 8va bassa* is written on the staff for each instrument that is to duplicate the flute part. Where an entire passage occurs more than once the necessity for writing it out a second time is avoided by referring the copyist back to the corresponding measures of the original passage. The extraction of parts calls for skill and care on the part of the copyist, as it involves more than the mere transfer of the

composer's notation to separate sheets; but, given a properly qualified copying staff, the composer can save much time by the use of abbreviations.



Page from an original score by Morris Mamorsky, NBC staff composer

All composers have a wholesome dread of committing inadvertent plagiarism. The basic material out of which they fashion their compositions is nothing more than a series of twelve semitones, and while the number of possible combinations and permutations of these twelve pitches is enormous, by no means all of them are musically significant. It is inevitable therefore that duplications of the more satisfactory combinations should occur from time to time, even in the works of the most original composers. Witness the similarity between the themes of Beethoven's *Third Symphony* and Mozart's overture to *Bastien and Bastienne,* or between the opening passages of *Les Préludes* by Liszt and the César Franck *Symphony.*

Such resemblances may result from the entirely independent conception of the same idea by two composers, or they may be due to a subconscious memory of something heard but forgotten by the conscious mind. Whatever their explanation, they are potential sources of trouble in these days of copyright laws and commercial rivalry. The radio composer has good reason, apart from his artistic scruples, to take all possible precautions against plagiarism, for even though an unintentional quotation from a protected work would probably be discovered in time by the tune detectives of the music division, the composer cannot afford the time required to do his work over.

Certain composers who produce quantities of incidental music for commercial dramatic programs have adopted an ingenious method of avoiding the perils of plagiarism. They simply take the bull by the horns and, quite frankly, base their compositions on fragments of music that they know to be in the public domain, indicating in the manuscripts the source from which each item is derived. This procedure greatly facilitates the clearance of the music by the copyright staff. It does not absolutely guarantee freedom from pla[illegible]

rism, since the development of a public domain theme might conceivably result in a combination of notes exactly similar to some passage in a protected work, but it does lessen the danger of infringement.

As for the quality of the music produced by this method, it may be said that the results depend entirely on the talent and skill of the composer. The use of pre-existent themes does not necessarily imply a lack of originality, as the works of the great composers amply testify. Certainly, the numerous sets of variations by Mozart, Beethoven, and Brahms on themes by other composers cannot be regarded as the work of hacks. In the kind of composing referred to here the borrowed fragments are usually taken from unfamiliar works and are too brief to be recognizable. Besides, they are chosen for their adaptability to varied types of harmonic and rhythmic treatment that may radically alter their appearance. A gifted composer can take such material and make it so thoroughly his own that it becomes a stimulus rather than a handicap to his originality.

Signatures. The music used to introduce and identify many radio programs is usually notable for one of two attributes: either it is so familiar that practically every listener may be expected to recognize it and perceive its relationship to the program, or else it lacks any association in the listener's mind except with the program to which it is attached. In the former case it is customary to select music with a title more or less obviously suggestive of the character of the program. For example, NBC's "Music of the New World" programs were prefaced by a passage from Dvořák's symphony *From the New World,* and more than one series of song recitals has used Mendelssohn's *On Wings of Song* as its signature. The other type of signature sometimes consists of music rescued from ob[illegible]ion, such as *The Perfect Song,* which for so many years [illegible]eralded the appearance of "Amos and Andy" and which

few listeners know as anything but the "Amos and Andy" signature. More often, however, where a signature free from extraneous connotations is desired, it is written to order.

A signature should, of course, be appropriate in style and mood to the content of the program. A comedy program calls for a lively signature, a love story for a romantic one, a mystery melodrama for something weird and ominous. In this respect the composition of signatures differs little from the composition of operatic overtures—or, for that matter, from the composition of songs—but there are certain other aspects of signature writing that introduce factors not ordinarily encountered in other kinds of composition. One of these is the matter of variable length. If the signature is used only at the beginning of the program its duration is usually fixed. The opening generally follows the same routine in each broadcast and the signature, once tailored to fit it, seldom needs alteration. Most programs, however, also use a closing signature, which may be the same as that used at the beginning or a different one. In either case one of its functions is to fill any spare time that may remain after the conclusion of the program proper, and as the amount of time to be filled always remains an unknown quantity until very near the end, the signature should be constructed in such a way that it can be expanded or contracted to any required extent. One way to achieve such adjustability is to write a few measures of full, sonorous music leading to a double ending, the first ending being a final cadence to conclude the signature at that point if desired. The second ending provides a transition to a longer section with optional repeats and a coda to which a cut may be made upon a signal from the conductor.

If, as frequently happens, announcements are made during the playing of the signature it is advisable to score the latter so that the wind instruments may drop out at any moment,

leaving the strings to carry on unobtrusively while the announcer is speaking. Scoring of this type—that is, cross-cuing so that any instruments except the strings may be omitted without the loss of essential melodic or harmonic parts—is obligatory in the case of programs using orchestras of varying size or constitution.

Bridges. In some programs the successive numbers are linked together by connecting passages known as bridges. These often consist of improvised arpeggios on the harp or celeste in the course of which a modulation is made from the key of the preceding piece to that of the next one; but in many cases bridges are specially written for the orchestra. The composition of bridges affords interesting opportunities not only for the exercise of skill in modulation but also for ingenuity in devising transitions from one mood or style to another.

Curtains. Musical passages, usually quite brief, are often used to indicate the end of a scene or act in dramatic programs, thus serving the same purpose as the lowering of the curtain in the theater. They differ from bridges in that they are designed to convey an impression of finality rather than transition.

9

Arranging and Copying

ARRANGING

ARRANGING MAY BE DEFINED as the art of scoring a piece of music for some performing medium other than that for which it was originally written. The composer of a symphony does not "arrange" it for orchestra. He "orchestrates" it as he composes it, the distribution of parts among the various instruments being an integral part of the creative process; but he, or some other person, may subsequently "arrange" the work for a different type of orchestra, or even for a single instrument such as the piano or organ. In order to make them available for more general use many standard works for symphonic orchestra are arranged for the smaller combination known as the "concert," or "theater," orchestra, which comprises 1 flute, 1 oboe, 2 clarinets, 1 bassoon, 2 horns, 2 trumpets, 1 trombone, drums, piano, and strings. Conversely, vocal solos are often arranged for chorus, piano accompaniments for orchestra, and so on.

At the ordinary level, arranging is a form of craftsmanship requiring a sound knowledge of the basic principles of instrumentation as defined by such authorities as Berlioz, Rimsky-Korsakov, and Forsyth,[1] and a thorough familiarity with the capabilities and idiosyncrasies of all modern orchestral instruments. At its best, arranging is an art scarcely inferior to composition in the scope it offers to creative imagination. This is particularly true of popular music. In recent years

[1] See Bibliography, Nos. 34–36.

the demands of broadcasting, motion pictures, and star dance bands have given rise to a *virtuoso* school of arranging that has transformed the scoring of popular music from a mere combination of tune, bass, and afterbeats to a synthesis of melody, harmony, and rhythm which sometimes seems more artistic than the original composition. Ace arrangers often do much more than orchestrate a popular tune. They alter harmonies, add countermelodies, devise modulations, and compose introductions that give the piece an entirely new character and, in many cases, greater musical significance than it originally possessed. They have not only learned to invest a fox trot with sonority and color worthy of a Strauss tone poem but have also discovered new timbres, new combinations of instruments, and new technical possibilities.

Largely as a result of the increasing knowledge and skill of arrangers, dance band instrumentation has changed constantly since the birth of jazz. The first step—after the classic Dixie Land jazz band combination of clarinet, trumpet, trombone, piano, and traps—was the adoption of the saxophone. Then, in the early 1920's, Paul Whiteman inaugurated the era of "symphonic jazz" by increasing the number of wind instruments, adding strings, and discovering the talents of the first *virtuoso* arranger, Ferde Grofé. By 1930 the standard instrumentation for dance bands comprised the following instruments:

3 saxophones (2 altos and 1 tenor), all interchangeable with clarinets
2 trumpets
1 trombone
1 banjo
1 set of drums and traps
1 piano
1 violin
1 string bass

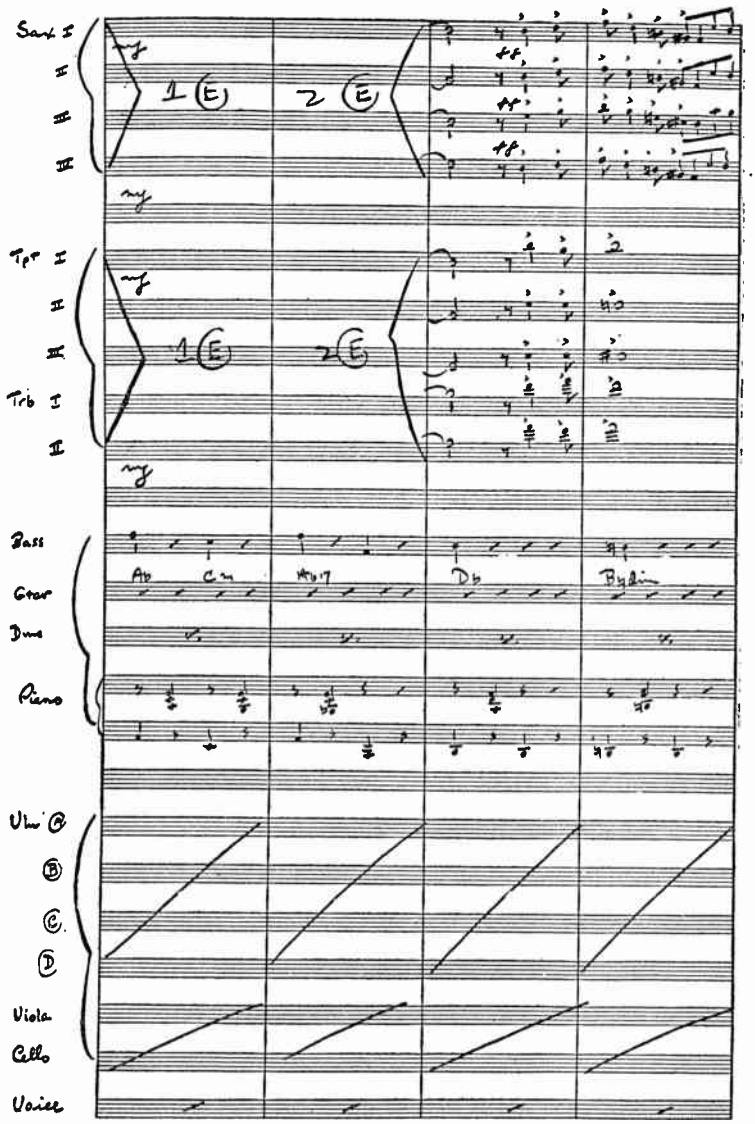
To this group were sometimes added the other wind and stringed instruments of the concert orchestra—namely, a flute, an oboe, a bassoon, 2 horns, second violin, viola, and cello.

Another decade brought further changes. The number of saxophones increased to 5 or 6 (altos, tenors, a baritone, and sometimes a bass) and their players were expected to "double" on symphonic wind instruments. The brass section expanded to include 4 trumpets and 3 trombones, and the rhythm section exchanged its banjo for a guitar. The strings, with the exception of the bass, disappeared from the ensemble. With such a combination as this it is possible to obtain massive effects of sonority and bold contrasts of color. A four-part or five-part chord can be scored for instruments of similar timbre, and melodies can be written polyphonically for three or more parts and still leave a full choir of contrasting color to provide the accompaniment.

This is not the place for a discussion of arranging techniques in general,[2] but something may be said regarding those peculiar to broadcasting.

The influence of broadcasting on popular arranging has been considerable. Its power to single out and amplify the tone of any instrument or group of instruments has enabled the arranger to achieve new effects of color and tonal balance. Thanks to the microphone, a muted violin or trumpet can be made to dominate an entire orchestra, the mysterious murmur of the subtone clarinet can be raised to any desired dynamic level, a singer can coo as gently as a dove and still be clearly audible above the accompaniment. The same conditions exist, of course, in motion-picture and recording studios, where the technical equipment and methods employed are substantially similar to those of the broadcasting studio, and also in public places such as restaurants, ball-

[2] For a list of textbooks on popular arranging see Bibliography, Nos. 29–33.



Page from an arranger's score by Paul Burke,
NBC staff arranger

rooms, and night clubs, where music is amplified through public address systems. Hence the methods used by radio arrangers have proved effective in virtually all areas of the popular music field.

The techniques of broadcasting seem to have had less influence on the arranging of serious music. They do relieve the arranger of some anxiety on the score of balance, since he knows that judicious placement of the microphone will compensate for an insufficiency of strings or a preponderance of brass, but in general he scores for broadcasting as he would for the concert hall, relying on fundamentally sound orchestration rather than special effects.

The arranger must know how to score effectively for any combination of instruments or voices, how to cross-cue a work for a large orchestra so that it may be played by a smaller one, and how to save time. He usually makes a full score but takes advantage of every method of abbreviation, particularly the indication of recurrent passages by numbering the measures to be copied from preceding pages.

Because of the disparity between the styles and techniques of popular and serious arranging it is unusual to find an arranger equally qualified for both types of work. Therefore, network arranging staffs ordinarily comprise two sets of specialists, one concerned exclusively with popular music, the other with serious works. As most of the arranging done for broadcasting belongs to the popular category, the former group is generally the larger of the two.

COPYING

When the score of an original composition or an arrangement is completed the work of preparing it for use is only half done, for the laborious task of extracting parts for the

individual instruments of the orchestra still remains. If time permitted, the composer or the arranger could, of course, extract the parts himself, but the exigencies of broadcasting make it necessary to provide a special staff of copyists who are experts not only in rapid and legible musical penmanship but also in the interpretation of the abbreviations used by composers and arrangers. They must be adept in score reading and must thoroughly understand the technicalities involved in writing for transposing instruments, such as clarinets, horns, and trumpets, inasmuch as some composers write their scores "in concert"—that is, they indicate the actual pitches to be sounded rather than the notes to be written for the instruments pitched in keys other than C. Copyists must also be prepared to transpose accompaniments to accommodate the ranges of different singers, and to mark cuts, bowings, and other special indications in the orchestra parts. In short, to be qualified for the varied and exacting tasks that radio work imposes, they require musical training as thorough as that of composers or arrangers.

The chief timesaving devices employed in copying are the "stencil" and the photostat. The former consists of translucent music paper, conventionally ruled, on which the copyist writes any part of which duplicate copies are needed—for example, the string parts of a concert or symphonic orchestration. The original copy serves as a negative from which any number of prints may be made by a speedy and economical photographic process.

The photostatic method is used for duplicating music already in existence. For instance, an arrangement originally made with only one set of string parts may be scheduled for use by an orchestra requiring several sets, in which case photoduplication offers the most expeditious means of producing the additional copies. It also makes possible the reproduction of manuscript scores, rare music, or publications that

are out of print and therefore unobtainable in quantity from music dealers.

The function of radio broadcasting as a medium of mass entertainment and mass information combined obliges it to be ready for anything at any time. If a war begins or ends, if a statesman dies, or if a new celestial body is discovered, broadcasting not only reports the occurrence but often adds a commentary upon it in the form of a musical program, such as the Victory broadcasts conducted by Toscanini to celebrate the surrender of Italy, Germany, and Japan in the Second World War. At other times the commentary may take the form of a dramatic program with specially written music.

Besides being responsive to events, broadcasting is highly susceptible to its own impulses. It has a way of conceiving program ideas that must be put into effect before the next sun goes down; and when, as often happens, these schemes involve original or specially arranged music, the arranging and copying staffs are in for a strenuous time. It is no uncommon occurrence for an assignment to be given out late in the afternoon that calls for the completion of a dozen or more numbers by noon of the following day. Arrangers and copyists who aspire to work for radio need, besides the essential qualifications, rugged constitutions, calm dispositions, and the ability to go without sleep for at least thirty-six hours at a stretch.

10

Conducting

ORCHESTRA CONDUCTING is a glamorous occupation, the goal not only of most musicians but also, it would seem, of many laymen, including such exalted personages as jurists and mayors. It is doubtless logical that conducting should attract leaders in other fields, for few activities permit such direct control over the behavior of one's fellow men or produce such immediately discernible results. Besides, the risks are slight. As long as a conductor retains his amateur standing he is relatively immune from criticism and from the subtle forms of sabotage that callous orchestral musicians reserve for the professional conductor who is not a thorough master of his trade.

The conductor's trade, by the way, is widely misunderstood. To the layman it may seem an easy one—and, in certain ways, it is, though probably not in the ways the layman has in mind. The conductor does not have to read every note in a complex passage as does the player in the orchestra, who, at the same time, must keep one eye on the baton. He does not have to worry about fingerings, bowings, or embouchure. As he is not required to produce, personally, any of the sounds called for by the score, he is in no danger of perpetrating a wrong note, and he need have no fear of beating out of tune.

He has other things to fear, however. He may very well beat out of time, or in the wrong tempo, or without the

necessary clarity and decisiveness. Occasionally one hears a conductor referred to as a "mere time beater"—which seems to imply that beating time is both easy and unimportant. It is neither. The motions of the hand and arm that appear so simple and natural to the casual observer are actually complicated and difficult to master. Let anyone who doubts this attend a beginners' class in conducting and note the awkward attempts of students to beat the simplest measure; or, better still, let him try it himself. He will find that it is even difficult to give the first beat correctly, for unless it is preceded by a preparatory beat in the proper direction and of precisely the right duration the players will neither know when to begin nor what the tempo is to be. And this is only the most elementary part of the technique of the baton. A conductor must be able to beat, clearly and rhythmically, in any time or tempo, and to change his beat as often as required. In some modern works, such as Stravinsky's *Le Sacre du printemps,* the time signature changes every measure, varying from ordinary duple or triple time to such odd metres as $\frac{5}{8}$, $\frac{5}{4}$, $\frac{7}{8}$, $\frac{7}{4}$. Moreover, the beat must convey, by its amplitude, incisiveness, fluency, or other visible characteristics, the conductor's intentions with respect to expression.

The ability to beat time well is apparently as much a matter of native talent as is any other musical aptitude. Many gifted musicians have devoted years to the study of conducting without mastering the peculiar art of rhythmic gesture which constitutes a "good beat." They fail to acquire the essential coordination between mind and hand, or to learn the trick of keeping the arm constantly in motion while marking the beats with flicks of the wrist. They waste effort in unnecessary or misleading gestures and are given to excessive subdivision of beats. However competent they may be in other respects, these conductors can never hope to be "mere time beaters."

No less important than the technique of beating time is the technique of score reading. The conductor of serious music must be able to read his score as readily as the instrumentalist reads his part, which means not only that he must be throughly familiar with the various clefs and transpositions used in orchestration but also that he must have an ear trained to hear harmonically. His ear must also be exceptionally keen, to enable him to hear and correct mistakes and faulty intonation; he must have an impeccable sense of rhythm, a "feeling" for tempo, an instinct for style, and a wide acquaintance with the music of different schools and periods; and he must have authority in his bearing, his voice, his beat, and his facial expressions.

Dance band conducting is somewhat less exacting, particularly as regards techniques. Dance music, being mostly in straightforward duple or triple time and seldom varying in tempo during the course of a single piece, calls for no great virtuosity in the use of the baton; and, as scores are seldom provided, the conductor of dance music has little need for proficiency in score reading. He does need a good ear, however, and a flair for showy effects, and his chances of success will be improved if he also possesses an attractive, well-groomed appearance and an ingratiating, informal manner.

CONDUCTING FOR BROADCASTING

Whether, or to what extent, conducting for broadcasting differs from other types of conducting depends on the kind of program to be presented. A symphonic concert performed for the radio audience, rather than for one assembled in a concert hall, involves no special approach or procedure on the part of the conductor except greater care in timing. One distinguished batonist has asserted that special techniques

are desirable in broadcasting. He claims, for instance, that inasmuch as the volume range of a symphony orchestra must be reduced for home consumption, from something like ninety decibels to about thirty, it is advantageous for the compression to take place in the studio, at the conductor's discretion, rather than in the transmission system, at the discretion of the engineer. Therefore, the conductor should take pains to avoid both extremes of volume, keeping *fortissimo* passages down to a moderate *forte* and raising the level of *pianissimo* to *piano* or *mezzo piano*. The theory is plausible but difficult of application, for when a temperamental conductor calls on an enthusiastic orchestra for a *crescendo* no paltry theory is likely to hold either of them back.

Here again it may be said that the value of microphone technique is not what it used to be. There was a time in the history of broadcasting when many concessions had to be made to its relatively crude equipment, but radio has reached a stage at which such treatment is rarely necessary except for the production of special effects or for certain types of vocal and instrumental solo performance. The symphonic conductor is fairly safe in assuming that the methods and styles of performance which prove effective in the concert hall will work out satisfactorily in the broadcasting studio. It may, of course, be advisable to alter to some extent the seating plan of the orchestra, but this is a problem for the production director rather than the conductor, and it will be discussed in a later chapter.

Staff Conductors. The networks, and also certain individual stations, maintain staffs of salaried conductors whose services are available for whatever programs may be assigned to them. Ordinarily the conducting staff is composed partly of men experienced in the more serious types of music and partly of dance band experts, though occasionally a conductor is found who is qualified for both kinds of work. In any

Toscanini conducts the NBC Symphony Orchestra in filming of *Hymn of the Nations.*

Frank Black conducting background music for a dramatic program. The headphones enable the conductor to adjust the volume of the music to that of the actors' voices.

Paul Whiteman, ABC Director of Music, conducting his orchestra.

case, the most essential attribute of a staff conductor is versatility. If his field is standard music he must be prepared to conduct a symphony concert, a band concert, a program of light classic or semipopular pieces; an opera, operetta, or musical comedy; choral music, or incidental music for dramatic programs; and virtually any other kind of program except popular dance music. He must also be expert in accompanying singers and instrumental soloists. The specialist in dance music must know how to handle all types of dance unit, from the five-piece jazz band or small novelty group to the full dance orchestra, with or without strings, and he must be well versed in the styles of performance proper to the several schools of jazz, sweet, and swing.

Efficiency in rehearsing is another prime requisite. With staff musicians limited, as they are in New York, to a five-day week and a four-hour or five-hour day there is never a moment to waste in rehearsal. The conductor must know, therefore, how to use his time as economically as possible, concentrating on difficult passages and never dwelling on easy ones, judging accurately the extent to which the orchestra may be trusted, and curbing his own, as well as the orchestra's, propensity for conversation.

Contrary to the common belief that conducting necessarily involves quasi-dictatorial powers and arbitrary attitudes, the work of the radio conductor demands a liberal amount of cooperative spirit and a good deal of self-effacement. He has to cooperate with program builders in the planning of programs and the selection of program materials and talent; with the orchestra contractor in the scheduling of rehearsals and assignment of orchestra personnel; with production directors in the selection of music for dramatic programs, in the placement of instruments before the microphone, and in timing, making cuts and providing for fills. Timing, particularly, depends on the ability of the conductor to col-

laborate with the production director. The latter is held responsible for the production of the program. If it runs over its allotted span, or fails to fill it, the director is the one who bears the blame. Consequently, he is vitally interested in obtaining during rehearsal an accurate timing of each number on the program. The conductor can greatly facilitate his task by playing each piece through once without interruptions—or make his life miserable by stopping the orchestra repeatedly, rehearsing the same passage over and over again, delivering lectures on bowing and phrasing, and never remembering to let the director know when he finally decides to go ahead.

Conductors vary considerably in their consistency in timing. Some can be relied upon to adhere very closely in the broadcast to the timings established in rehearsal, while others seem incapable of conducting a piece twice at the same tempo. A certain amount of variation is natural and permissible, but a conductor who varies his timings by as much as twenty per cent is of doubtful value in a broadcasting studio. The cause of such inconsistency is perhaps debatable. It might be argued that the conductor who is given to wide variations of tempo is peculiarly sensitive and is easily influenced by changing moods—that by allowing himself to be swayed by his feeling of the moment he is enabled to give exceptionally spontaneous and moving performances. On the other hand, it might be claimed that he either doesn't know the score or doesn't know what he wants. It may be of interest in this connection to note that Toscanini is possibly the most consistent of all conductors in the matter of tempo, rarely varying materially in his timing of a given work, even when years elapse between his performances of it.

Certain types of variety program make unusual demands on the conductor's versatility. Basically their musical content is popular, but they frequently interpolate such serious items

as operatic airs, overtures, excerpts from ballets, or even symphonic movements. Therefore, they usually have orchestras of symphonic proportions, with added saxophones and other instruments required for the proper rendition of dance music, and their conductors are expected to be equally at home in the atmosphere of Carnegie Hall, the Metropolitan, or Tin-Pan Alley.

Choral Conducting. Broadcasting, particularly in the commercial program field, has developed a highly specialized type of choral performance notable for its emphasis on precision, intonation, voice blending and clarity of diction. The voices are often treated as if they were orchestral instruments, with the vibrato minimized or entirely eliminated, and novel effects are achieved by the use of women's voices in their highest register, by humming, by sustaining the consonant sound of words ending in "n" or "ng," and by other comparable devices. Choral conductors are expected to have a stock of such tricks, as well as to be thoroughly grounded in the fundamentals of choral training and directing. They are not often called upon to conduct orchestras, but in case they should be it is well for them to remember that the technique of beating syllables, which some choral conductors affect, is not a reliable method to use with orchestras. Instrumentalists find such rhythmic dissection confusing rather than helpful.

Few radio stations maintain permanent choral organizations, but some commercial programs have staff choruses and highly qualified coaches to train them. Others engage choral groups from time to time through independent coaches who make a profitable business of organizing, training, and supplying choruses to such programs as require them. These coaches, who are very competent musicians, experienced in both the traditional styles and latest fashions in choral singing, keep extensive rosters of singers with whose abilities and characteristics they are well acquainted, and are prepared to

furnish on short notice groups of virtually any size or kind that may be desired. Some of them also specialize in choral arranging and are responsible for many of the novel arrangements of popular tunes heard on the air.

11

Musical Continuity

ONE OF THE MOST perplexing questions pertaining to musical broadcasting is what to say about the music. Should it be analyzed, explained, criticized, or merely introduced? Do historical data or personal anecdotes about the composer contribute to the listener's enjoyment? Will he benefit by hearing somebody's "interpretation" of a composition, or should he be left to decide what it means, if anything, to him?

The answers to these questions will vary according to the views of those who attempt to supply them, and also according to the nature and purpose of the program. No writer of continuity for popular music, for example, would be likely to advocate an analytical approach to the products of Tin-Pan Alley, nor would the annotator of a symphonic program be likely to treat it with the breezy irrelevance generally considered appropriate to the presentation of popular dance tunes. In a program of educational pretensions a more academic approach is justified than would be desirable in programs designed purely for entertainment. A series based on the musical forms obviously calls for some discussion of the formal aspects of the works presented; but how far such discussion should go, how technical it should be, whether it should be illustrated with thematic fragments played before the complete performance of the work—these are points on which there is no unanimity of opinion. And even if general agreement were reached concerning *what* to say about music

the problem of *how* to say it would still remain. Should the language be scholarly or colloquial, the style formal or familiar? Should musical terminology be admitted freely, used sparingly, or rigorously excluded?

There are doubtless many music lovers who would prefer that continuity in musical broadcasts be confined to the briefest possible announcements of the titles of compositions and the names of composers, and there may be some who would welcome the abolition of talk, including the identification of the program, its sponsor, and the facilities through which it is transmitted; but there are reasons why such economy of words is not attainable in broadcasting. One of them is that governmental regulations require all radio stations to identify themselves at stated intervals and to announce the sponsorship of every program. Besides, in network broadcasting there are cues that have to be given for the switching of interstation telephone lines and other operational functions. Another reason—less mandatory, perhaps, but understandable—is the broadcaster's desire to keep the listener reminded of the source of his presumed enjoyment. Finally, there is the important consideration that a musical program without continuity is exceptionally difficult to time. Symphonic and other serious programs, consisting usually of a small number of rather long works, offer formidable timing hazards unless they are provided with a script that can be cut or padded as occasion demands. Lighter programs, being generally composed of shorter and more flexible numbers, are sometimes presented with opening and closing announcements only, but even these require cushions and telescopic signatures and have to be rehearsed with special care.

Since, therefore, there has to be some talk in every musical broadcast, and a considerable amount of talk in some, the problem is to determine, if possible, the kind of talk that will do the most good and the least harm—that will arouse the

listener's interest, dispose him favorably towards the music, and help him to enjoy it; that will not bore him or confuse him or irritate him. The solution of the problem demands three qualifications:

1. Natural ability as a writer
2. Knowledge of the techniques of radio writing
3. A definite concept of the purpose of musical commentary and the function of the commentator in the presentation of music

Of these three qualifications the first shall be taken for granted.

The second presents no serious difficulties to the otherwise competent writer. The techniques of script layout, spacing, paragraphing, and punctuation as practiced in broadcasting; the various formulas for identifying programs, sponsors, and the stations or networks by which they are transmitted; the proper wording of switching cues; methods of periodically reidentifying programs for the benefit of late tuners-in, and of postannouncing important numbers for the information of listeners who may have missed the preannouncement—these and other conventions of radio writing should give him little trouble. Moreover, they have been fully dealt with by authorities whose writings are readily available to the student.[1] The present discussion is therefore confined to the third qualification, which seems to merit more attention than it has hitherto received.

The following observations, made from a musician's point of view, are not offered as the final word on the subject. They are submitted for the purpose of stimulating inquiry into the underlying principles of continuity writing and in the hope that they may help the student to formulate for

[1] See Bibliography, Nos. 53–55.

himself what may be termed a philosophy of musical commentary.

The Writer's Function. The continuity writer is not a critic. No matter how keen his critical faculty or how strong his opinions concerning the music he writes about, he is not entitled, in his capacity as continuity writer, to express his personal evaluation of it. The principal reason for this is that he is anonymous. If he were writing a commentary for delivery by himself, and if his reputation were sufficient to lend weight to his views, he would be entitled to offer them to the listener; but in most cases what he writes will be read by an announcer, who is also anonymous and who, anonymous or not, can rarely be regarded as an authority on music. It is hardly fair, either to the announcer or to the audience, to put into the former's mouth opinions that are not his own and that, if they were, would have no authority. Many listeners resent being told by an announcer that a piece of music is the greatest of its kind, or even that it is great or good. They do not resent being told that it is lively or brilliant or full of pathos, since these are qualities concerning which there is little room for disagreement, nor do they object to quotations of the opinions of acknowledged experts; but they instinctively reject, as unwarranted attempts to influence their opinion, any critical comments by persons not obviously qualified to make them.

In a sense, the continuity writer is a salesman—not a high-pressure salesman but one whose task is to point out the attractive features of his wares without urging the customer to buy. He should avoid superlatives, clichés, and adjectives, and resist the temptation to characterize a composition as "the immortal," "the thrilling," or "the incomparable" this or that, not only because such epithets are annoying to listeners who have their own conception of the music but also because they sometimes lead to ineptitudes such as the intro-

duction of Rimsky-Korsakov's coloratura air as "the *majestic* 'Hymn to the Sun.' " Being a salesman, the continuity writer will naturally avoid patronizing or belittling what he has to offer. He will never say "This is *not* one of Mozart's best symphonies." His job is to help the listener enjoy the program, not to warn him that what he is about to hear is mediocre stuff. The listener's normal reaction would be "If it isn't good why ask me to listen to it?"

Accuracy. In giving factual information the writer should take every precaution to insure its accuracy. He should supply himself with all the standard musical encyclopedias and other reference works,[2] and, since no such books are ever quite up-to-date, he should supplement those sources with a file of clippings from current musical periodicals and the music columns of newspapers.[3] With the aid of these sources he should check and recheck every fact before passing it on to the listening public. He should also try constantly to improve his general knowledge of music and music history, for only by thorough familiarity with his subject can he avoid occasional blunders, such as the assumption that a composition by Castelnuovo-Tedesco should be announced as "by Castelnuovo, arranged by Tedesco."

If the introduction of a composition calls for a description of its formal or other characteristics the writer should familiarize himself with it, either by studying the score, by listening to a recording of it if one is available, or by attending rehearsals. Before stating that a work is in rondo form he should make sure that it *is* in that form, and he should not attempt to discuss its style, orchestration, or other features unless he knows exactly what he is talking about.

Interest. The continuity should not be cluttered up with

[2] See Bibliography, Nos. 15–28.

[3] A file of this kind is kept by the music research section of the NBC script division.

unessential or irrelevant details. It should be informative, easy to follow, and, if possible, entertaining. Humor often has its place, provided that it is not forced, but flippancy should be reserved for popular programs. Dates should be used sparingly. They seldom have definite significance for the listener and are likely either to confuse him or to make no impression at all. If it is necessary to establish the date of some musical event it can usually be done more effectively by relating it to an event in history with which the average listener is probably acquainted. The fact that Haydn was born in the same year as George Washington is likely to interest American listeners more than would the bare statement that he was born in 1732. Biographical data are sometimes pertinent and illuminating, but they are often used without sufficient justification. It can hardly add to the listener's enjoyment of a Mozart symphony, for example, to learn that he was having trouble with his creditors when he wrote it. Anecdotes, too, serve a useful purpose when they throw side lights on the character of a composer or his works, but too often they tend to distract the listener's attention from the music instead of preparing him for it. In some types of program it is permissible to enliven the continuity with touches of local color, such as a brief description of the court of Esterhazy, where so many of Haydn's works were created, or of the scene that inspired the *Hebrides* overture by Mendelssohn. The facts, however, should never be colored.

Phraseology. Professional jargon should be avoided whenever plain English will serve. References to *tessitura, melos,* and the like may sound learned, but they also sound high-falutin, and it is doubtful whether many listeners will have a very clear idea of what they mean. Purisms such as *violoncello* and *flautist* also are of questionable value, and there seems to be no good reason for the conductor to *mount the podium* when he could just as well take his place on the plat-

form. This does not mean, of course, that the writer should try to limit himself to words of one syllable. He should assume that the listener is neither a musician nor a moron and address him as a person of intelligence who is interested, though not necessarily expert, in the subject under consideration. He should be specially careful to avoid any hint of condescension. If, for instance, it becomes necessary to use an unfamiliar musical term he should try to imply its meaning in the context rather than to translate it in a manner that the listener might regard as patronizing.

Style. The writer should remember that he writes for the ear and not for the eye, that the words he sets down on paper will reach the audience through the medium of an announcer's voice, and that the announcer speaks not to an assembled throng but to a multitude of isolated individuals. He should therefore cultivate neither a literary nor an oratorical style, but write simply, in terms such as a reasonably fluent person might use in conversation. He should also be considerate of the announcer and not force him to struggle with alliterative articulation, polysyllabic polynomialism, or successions of susurrous sibilants such as these. He should try not to involve him in a maze of subordinate clauses or exhaust him with nonstop sentences; but neither should he confine himself to sentences so brief that they sound dry and disconnected. One thing he should particularly shun is the habit of beginning introductions with the words "And now . . ." He should seek variety of expression but not strain after it, for an undistinguished style is better than a precious one. Finally, when the script is finished, the writer should read it aloud to determine whether it contains stilted phrases, ambiguities, or tongue twisters. If it does, he should write it over again.

The above paragraphs are intended, of course, to apply to continuity for programs of a more or less serious type, such

as symphony concerts, grand opera, chamber music, or educational programs. Popular program continuity is another matter. It requires a different approach, a different kind of talent, different knowledge and experience; but it is not necessarily easier to handle. In fact, really good continuity in the popular style is probably rarer than the serious kind, one reason being the difficulty of discussing popular music in terms that would appeal to its audience. Another is that the generally lighthearted mood of popular programs calls for bright and sparkling continuity, the production of which is no mean achievement, for it is harder to be entertaining than to be informative.

Besides, it is not enough for the writer to be clever. He must also be an expert, as thoroughly grounded in the popular branch of the art as the serious writer is in his own. He must know the latest fashions in jazz, and the old ones too; he must know who's who in the swing set today, and who was who yesterday; he must be letter-perfect in the language of "jive," and know that last year's novelty is this year's "corn." What makes his task peculiarly difficult is the fact that he deals with constantly changing values. Popular tunes are notoriously ephemeral. Most of them are here today and gone tomorrow, and the styles of arranging and performance are hardly more stable. To write about popular music in a manner acceptable to its devotees the writer must keep up with the procession, and it takes an agile mind to do it.

SAMPLE CONTINUITIES

The following examples of musical continuity illustrate the various ways in which network writers approach the presentation of different types of program, from symphony concerts and educational programs to semipopular programs and dance music.

1. *Continuity for a Symphony Concert (by David Hall)* [4]

NBC SYMPHONY ORCHESTRA

WEAF & Net. *September 27, 1942* *Sunday*
5:00–6:00 PM

OPENING ANNOUNCEMENT: (*Over orchestra tuning up*)

ANNOUNCER: The National Broadcasting Company takes pleasure in bringing you the first of five autumn concerts prior to the opening of the regular NBC Symphony season on November first under the baton of Arturo Toscanini.

This afternoon the orchestra is under the direction of the eminent Belgian conductor, Désiré Defauw, and he has chosen for us an unusually interesting and varied program of 19th and 20th Century French music. Paul Dukas' dance-poem, *La Péri,* opens our concert. This is followed by *Pelléas et Mélisande,* a suite of music for Maeterlinck's drama, by Gabriel Fauré. Next come Debussy's two familiar Nocturnes, *Nuages* and *Fêtes;* and our program concludes with Emmanuel Chabrier's Rhapsody, *España.* As you can see, Mr. Defauw's choice of music provides us with a striking over-all picture of what the great composers of France have contributed to symphonic composition during the past fifty years.

For many concertgoers in America, the name of Paul Dukas has become associated almost exclusively with his orchestral scherzo based on Goethe's poem, *The Sorcerer's Apprentice.* Although Dukas was not a prolific composer, he has enriched the art with a

number of other important works, notably the opera *Ariane and Bluebeard* and the dance-poem we're about to hear, *La Péri,* written in 1910 for the dancer, Mademoiselle Trouhanova.

The music describes the search by the Persian monarch, Iskender, for the flower of immortality. One day, before the steps that lead to the hall of Ormuzd, he finds the flower in the hands of a sleeping Péri. He snatches it in triumph; but gazing upon the face of the Péri, he becomes overwhelmed by desire for her. She dances the dance of the Péris, and at the end he gives back without regret the coveted flower of immortality. Iskender sees her disappear into nothingness. He knows then that his end is near. The darkness closes in around him.

Désiré Defauw conducts the NBC Symphony Orchestra now in Paul Dukas' dance-poem, *La Péri.*

(*LA PERI . . . dance poem with introductory fanfare*)

ANNOUNCER: (*Following ad lib over applause*)

One of the most illustrious names in French music of the past half-century was that of Gabriel Fauré. Born when Schumann and the early German Romantic masters were at the height of their careers, he lived to see Brahms, Wagner, and Debussy rise to world-wide fame; while among his own pupils he numbered such brilliant modern masters as Maurice Ravel, Georges Enesco, Florent Schmitt, and Nadia Boulanger.

In 1898, while Debussy was still at work on his operatic setting of Maeterlinck's *Pelléas et Mélisande,* Fauré wrote incidental music for a London production of that drama. In contrast to Debussy's opera,

which stresses the mysterious, unearthly aspect of Maeterlinck's characters, Fauré's incidental music emphasizes the subtle and fateful melancholy which pervades every moment of the play.

We hear now the suite, *Pelléas et Mélisande,* by Gabriel Fauré.

(*PELLEAS ET MELISANDE . . . suite . . . three movements*)

ANNOUNCER: (*Following ad lib over applause*)

Among Debussy's works for the orchestra none are more completely characteristic of the composer than the Nocturnes, *Nuages* ("Clouds") and *Fêtes* ("Festivals"). While generally wary of explanations of his works, Debussy is said to have written the following description of his Nocturnes when they were first played, in 1900:

> The title "Nocturnes" is to be interpreted here in a general and, more particularly, in a decorative sense. Therefore, it is not meant to designate the usual form of the nocturne, but rather all the various impressions and the special effects of light that the word suggests.
>
> *Nuages* renders the unchanging aspect of the sky, with the slow and melancholy passage of clouds, dissolving in a grey vagueness tinged with white.
>
> *Fêtes* gives us the vibrant dancing rhythms of the atmosphere with sudden flashes of light. There is the episode of the procession, a dazzling fantastic vision which passes through the festive scene and becomes merged with it, but the background remains always the same, always the festival and its blended music, luminous dust participating in the universal rhythm of all things.

Désiré Defauw leads the NBC Symphony Orchestra in *Nuages* and *Fêtes* by Claude Debussy.

(*Nocturnes: NUAGES and FETES*)

ANNOUNCER: (*Following ad lib over applause*)

The final composer represented on our program is Alexis Emmanuel Chabrier. Like his countrymen, Bizet, Debussy, and Ravel, Chabrier loved Spain. During a visit to Seville, just before composing *España,* Chabrier wrote:

> The gypsies sing their malagueñas or dance the tango, and the manzanilla is passed from hand to hand and everyone is forced to drink it. These eyes, these flowers in the admirable heads of hair, these shawls knotted about the body, these feet that strike an infinitely varied rhythm, these arms that run shivering the length of a body always in motion, these undulations of the hands, these brilliant smiles . . .

Such were the scenes that inspired Chabrier's colorful and brilliant tribute to Spain—the *España* Rhapsody.

(*Rhapsody: ESPANA*)

ANNOUNCER: (*Following ad lib over applause*)

The eminent Belgian conductor, Désiré Defauw, has just led the NBC Symphony Orchestra in a concert devoted to music by French composers of the 19th and 20th Centuries. (*Recap of program if required to fill*)

Next week at this time the NBC Symphony Orchestra will be heard under the baton of the noted Russian conductor, Nikolai Malko. Be sure to join us at that time.

THIS IS THE NATIONAL BROADCASTING COMPANY.

2. ***Excerpts from Continuity for an Educational Program (by John Tasker Howard)*** [5]

MUSIC OF THE NEW WORLD

WEAF & Net. *November 12, 1942* *Thursday*
11:30–12:00 PM

6. PILGRIMS & PURITANS

(SIG. . . . *Finale of "NEW WORLD" Symphony . . . Dvořák . . . down for:*)

ANNOUNCER: Music of the New World! This evening the NBC Inter-American University of the Air presents the sixth program in its series on the music of the Western Hemisphere, from the times of the Incas and the Aztecs down to the present day.

(SIG. . . . *Up and finish*)

ANNOUNCER: Tonight's program tells about the music of the early settlers in New England—the Pilgrims in Plymouth, and the Puritans in Massachusetts Bay, now Boston. The first English colonists to settle in New England were the Pilgrims. They belonged to a Separatist congregation which had emigrated from England to Holland in 1608. In 1620 they went back to England, and from Plymouth sailed for America in the *Mayflower.*

Edward MacDowell wrote a musical description of the Pilgrims' voyage. It pictures the calm determination of this company of one hundred men, women, and children, and gives a suggestion of the stormy seas and the Pilgrims singing their psalms.

Dr. Frank Black conducts the NBC Orchestra in MacDowell's *A.D. 1620.*

(ORCHESTRA: . . . *A.D. 1620* . . . *MacDowell*)

ANNOUNCER: That was MacDowell's *A.D. 1620,* which describes the voyage of the Pilgrims in the *Mayflower.*

The Pilgrims brought with them from Holland a psalm-book, or psalter, which had been prepared by Henry Ainsworth and printed at Amsterdam in 1612. Longfellow told of the Pilgrims' psalter in *The Courtship of Miles Standish.* He describes Priscilla:

(*Fade in bg . . . Priscilla singing PSALM 100, from AINSWORTH PSALTER*)

ANNOUNCER: "Open wide on her lap lay the well-worn Psalm book of Ainsworth, Printed in Amsterdam, the words and the music together; Rough-hewn, angular notes, like stones in the walls of a churchyard, darkened and overhung by the running vine of the verses."

(*PSALM 100 . . . Up and finish*)

ANNOUNCER: Ten years after the Pilgrims settled in Plymouth another religious sect came to America from England. These people were known as the Puritans. They brought with them an older psalter, prepared by Sternhold and Hopkins in 1562. Some of the texts in the Sternhold and Hopkins psalter were truly beautiful, even though the language sounds a bit stilted to modern ears. Here is the way the Twenty-third Psalm was translated:

(CHORUS A CAPPELLA . . . *PSALM 23* . . . *Whole Booke of Psalms*)

ANNOUNCER: Much has been written about the austerity of the Puritans. It has been believed by many that they

had no instrumental music of any sort. This tradition came from their not allowing instrumental music *in church,* but there are documents to show that they did not object to the *private* use of musical instruments. In 1686 Samuel Sewall wrote in his diary that the King's birthday was celebrated by people marching through the streets "with viols and drums, playing and beating by turns." Sewall's diary also makes one reference to a keyboard instrument, one of those small harpsichords which were called virginals. In 1699 he refers to his wife owning such a harpsichord. We do not know, of course, how expert a performer Mrs. Sewall was, nor even what music she played; but she might have played a Pavana by John Bull, which was one of the numbers in the Fitz William Virginal Book and was popular in the 17th Century. We hear this Pavana now, played on the harpsichord.

(HARPSICHORD . . . *PAVANA . . . John Bull*)

ANNOUNCER: In 1625 an Englishman named Thomas Morton established a settlement at Mount Wallaston, near the present town of Braintree. This settlement became known as Merry Mount. Morton was not a Puritan; he was an adventurer, and the worldly life at Merry Mount was a thorn in the sides of the Puritans. Morton is said to have sold liquor and ammunition to the Indians. Another of his alleged offenses was setting up a May-pole, around which he and his companions danced. This sounds harmless enough today; but originally the May-pole dance was a rite which came from the days of the ancient Romans. The Calvinist Puritans considered it heathenish and pagan. Several American composers have written operas about Merry

Mount. The most widely known was composed by Howard Hanson and produced at the Metropolitan Opera House in New York. We hear the *May-pole Dances* from Hanson's *Merry Mount.*

(ORCHESTRA: . . . *MAY-POLE DANCES from MERRY MOUNT . . . Hanson*)

CLOSING ANNOUNCEMENT.

3. ***Excerpts from Continuity for an Educational Program (by Gilbert Chase)*** [6]

THE STORY OF MUSIC

WEAF & Net. *October 11, 1945* *Thursday* *11:30–12:00* PM

1. CANON

(ORCHESTRA: *Sig. . . . CHORALE . . . Bach*)

GRAUER: *(Over sig.)* The Story of Music! The NBC University of the Air brings you the first program of a new series presenting the history of music through the performance of music . . . with the NBC Orchestra and a chorus under the direction of Henri Nosco. Tonight's program features the musical form known as "Canon"—from the Middle Ages to the 20th Century.

(ORCH: *Sig. up and finish*)

(CHOS. *in bg: THREE BLIND MICE*)

GRAUER: *(Over music)* Believe it or not, that familiar nursery ditty is what is technically known as a "canon"—more

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specifically, "a circular or infinite canon at the unison." You probably know it by the simpler name of "round." The term "canon" comes from a Greek word meaning "law" or "rule." In early times a canon was often a sort of musical cross-word puzzle that had to be solved according to a certain "rule" or "key." A 17th Century Italian composer wrote a canon of this kind having more than two thousand possible solutions! But a canon can also be just as simple as "Three Blind Mice."

(CHOS: . . . *THREE BLIND MICE . . . Up and finish*)

GRAUER: In the Middle Ages the round, or circular canon, was called *rota,* from the Latin for "wheel." This conveys the same idea of a composition that goes 'round and 'round—until either the singers or the listeners get tired.

One of the most famous compositions in the whole history of music is the medieval English *rota,* "Sumer is icumen in." It's famed as the earliest known canon, and as the first composition written for six voices. For a long time scholars believed that it dated from about the year 1240, but recent research indicates that it was composed considerably later, between 1310 and 1325. This discovery rated a story in *Time* magazine, headlined "Sumer Icumeth in Later."

You'll notice that the four upper voices sing the principal melody in canon, while the two lower voices accompany them with a ground bass, also in canon. The original text of this *rota,* by the way, was written in the old Wessex dialect, but tonight you'll hear it in something more like English—"Summer Is a-Coming In."

(CHOS: . . . *SUMER IS ICUMEN IN* . . . *Anon.*)

GRAUER: In musical language, canon is said to be in "imitation" because each voice repeats, or imitates, the same melody. In the round, all voices sing exactly the same notes, either in unison or an octave apart. But when the voices imitate each other at some other interval—such as the fourth or the sixth—they produce a richer harmonic effect and a more interesting counterpoint, or combination of melodies. For example, the composition you'll hear next is called a canon in the fourth and octave below, because the baritone sings a fourth lower than the tenor while the bass sings an octave lower. This music was written by the 16th Century English composer, William Byrd. The title: "Non Nobis Domine."

(MEN'S VOICES: . . . *NON NOBIS DOMINE* . . . *Byrd*)

GRAUER: Obviously, a canon may be written either for voices or for instruments, or for both together. And it may be either a complete composition in itself, or just a section or movement of a larger work. . . . Dvořák begins one of his *Slavonic Dances* with a brisk and jolly canon between the oboe and the bassoon. Notice how the bassoon enters one measure after the oboe, but at the fifth measure, by a sudden rhythmic change, it reduces the oboe's lead to half a measure. . . . The NBC Orchestra plays Dvořák's *Slavonic Dance No. 7.*

(ORCH: . . . *SLAVONIC DANCE NO. 7* . . . *Dvořák*)

GRAUER: To bring this program up to the 20th Century, we have selected a work by a young American composer who was born in New York City thirty years ago—David Diamond. Last year Mr. Diamond wrote

a set of three pieces for string orchestra which he called "Rounds." This doesn't mean that these compositions are rounds in the literal sense, but the composer does make use of canonic imitation in this work. Henri Nosco conducts the orchestra in *Round No. 3* by David Diamond.

(STRING ORCH: . . . *ROUND NO. 3 . . . Diamond*)

CLOSING ANNOUNCEMENT.

4. ***Excerpts from Continuity for a Commercial Program of Mixed Standard and Popular Music (by Ed Jurist)*** [7]

RCA VICTOR SHOW

WEAF & Net. *July 14, 1946* *Sunday*
2:00–2:30 PM

COSTELLO: Presenting the RCA Victor Program!

(ORCH: *Sig. . . . YOU ARE MUSIC . . . Up and hold for:*

COSTELLO: As always, RCA Victor brings you . . . Music America Loves Best!

(ORCH: *Sig. up briefly and under*)

COSTELLO: It's time for the brilliant baritone voice of Robert Merrill, popular RCA Victor recording artist and sensational new star of the Metropolitan Opera—with the RCA Victor Orchestra under the distinguished conductor, Frank Black . . . in a program of music secure in American hearts . . . songs and melodies known

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and loved all across the land. Here is—Music America Loves Best!

(ORCH: *Sig. up to finish*)

(APPLAUSE)

(ORCH: *Intro to PLAY GYPSIES and under for:*)

BANGHART: How do you do, everyone—this is Kenneth Banghart, welcoming you to "Music America Loves Best."

Countess Maritza is an operetta in which every heart is young and gay and breaking—and nobody works for a living—a fine state of affairs which gave the composers the idea for the operetta's best-loved tune—"Play Gypsies, Dance Gypsies." Here is Bob Merrill to sing it for you.

(MERRILL and ORCH *up . . . PLAY GYPSIES, DANCE GYPSIES*)

(ORCH: *Intro to MY MOONLIGHT MADONNA and under for:*)

BANGHART: Here's a rare melodic confection . . . made from a pretty complicated recipe. You begin with a violin solo called "Poème" by Zdenko Fibich. Then, you take its melody and turn it into a popular romantic ballad known as "My Moonlight Madonna." Now—as long as we started this, let's go whole hog. A dash of Beethoven's "Moonlight Sonata"—just *so* much of Debussy's "Clair de Lune" and that does it! Result—a potpourri, a musical montage, a blending of classic moon tunes—awaiting only the distinctive touch of Frank Black and the RCA Victor Orchestra.

(ORCH: *Up . . . MY MOONLIGHT MADONNA*)

(ORCH: *Intro to HORA STACCATO and under for:*)

BANGHART: Any G.I. who got himself a leave in France was bound to head straight for Paris. And if he liked music, he was sure to take in the famous Army concerts at the Palais de Chaillot. Maybe he was there the night Jascha Heifetz gave a recital—then he certainly won't forget that very exciting moment at encore time, when 4000 Joes got up as one man and yelled for "Hora Staccato," the Roumanian folk air which the great violinist has popularized all over America. Frank Black and the RCA Victor Orchestra repeat it now for Joes and ex-Joes everywhere—and their relatives too!

(ORCH: *Up . . . HORA STACCATO*)

5. ***Excerpts from Continuity for Program of Light Popular Music (by Richard Davis)*** [8]

MUSIC FOR SATURDAY AND STUFF LIKE THAT
WEAF & Net. *February 9, 1946* *Saturday*
12:30–1:00 PM

(*Music: Flourish*)

ANNCR: NBC—The National Broadcasting Company, presents . . .

(*Music: Flourish*)

ANNCR: Music for Saturday and Stuff Like That!

(*Music: Sig. which fades for billboard*)

[8]

ANNCR: With all kinds of good things to listen to! . . . Like music by H. Leopold Spitalny and his all-boy orchestra. . . . Vocal exercises, distorted according to the current fashion by our first . . . (and ONLY!) . . . baritone . . . Johnny Corvo. . . . And scintillating, exhaustive, and definitive type program notes containing all new material straight from New York which will be spoken by yours . . . Truly Bob Sherry. . . . And that's who I am. Now, let's get this tub-thumping contest under way!

(*Music: Sig. up and out*)

BOB: The thing which attracts us most to the initial effort by our maestro and his jolly note-knockers is the "running theme"—(if I may read)—A FADISTI PRODANZA MANJARAY KEECHEE DON FOLLA DONNA A NOTO GUS. A comment attached to the fourth violin part in which the violinist—Gus—states vigorously that he has stepped out for a quick coffee, but will be back in time for the dress rehearsal.

(*Music: BEYOND THE BLUE HORIZON*)

ANNCR: Recently, a guy named Johnny Corvo walked into NBC and said "I'd like to sing." Right away another guy snapped back with "Who wouldn't?" and in turn was snapped up as radio's newest, freshest, and most promising comedian. This guy Corvo was so impressed by that rapid recognition of new talent that he stayed around to make good for himself and come here and sing for us today. . . . Johnny Corvo. . . . Here he is . . . who will sing . . . "Till the End of Time."

(*Music: TILL THE END OF TIME*)

ANNCR: Once again we travel to sunny Spain. As we pass through the market place we hear very little of anything, because the clocks over there are three hours ahead of ours and it's siesta time and everybody is asleep. Everybody, that is, except a melancholy group of roving organ grinders, who play with quiet restraint the famous comedy song by Villoldo called "El Choclo" . . . or "Someone to Chockle Over Me."

(*Music: EL CHOCLO*)

12

Musical Program Production

THE PRODUCTION of a musical broadcast is a complex operation, rich in potential conflict. Artistic aims may collide with technical considerations, showmanship may challenge policy, temperaments may clash—and lurking always in the background is the inexorable specter of time. To reconcile conflicting interests, discover workable compromises, and insure the smooth and effective production of the program it is necessary to vest in one properly qualified person the authority to control the operation. That person is known variously as production director, producer, producer-director, or simply as director (the designation used here except where it seems necessary to differentiate between the production director and the musical director).

The director is in full charge of all personnel and matériel used in the production except the technical equipment, which is under the control of the studio engineer. The relationship between the director and the engineer is an interesting example of efficient cooperation. According to the regulations, the director is authorized to control the placement of microphones if he so elects, and if the engineer should disagree the director's view would prevail. However, such disagreements almost never occur between directors and engineers who thoroughly understand their jobs. No matter how much he knows about the technical characteristics of microphones—and the more he knows, the better—the direc-

tor realizes that a good engineer knows far more than he does. Therefore, instead of dictating where a microphone shall be placed, the director usually tells the engineer the acoustical results he wants to achieve and leaves it to the engineer to find the best method of achieving them.

The director determines the placement of performers, times the musical numbers and continuity, gives cues to the conductor, the announcer, and the engineer, and, in general, coordinates the artistic and technical functions of the production as the conductor coordinates the work of the musicians in the orchestra; and his responsibility is commensurate with his authority. If anything goes wrong—if the balance is poor, if the program runs over or short, if music is performed without proper clearance—it is the director who is held to account. His job is onerous, but it is interesting, and it calls for an unusual combination of abilities.

Ideally, the director should be both an artist and something of a scientist. He ought, theoretically, to be as good a musician as the conductor—as well acquainted with the music performed and as competent a judge of balance and of the relative importance of parts. In addition, he should have a working knowledge of acoustic principles and microphone characteristics, and should understand the limitations inherent in a monaural transmission system. There are also certain personal traits that are indispensable, such as energy, alertness, the ability to make quick decisions, ingenuity, and tact.

The value of tact may not be immediately apparent, but it should not be underestimated. Musicians, especially conductors, are proverbially sensitive and jealous of their prestige, and the director who fails to make allowance for those human frailties will find it harder to obtain their cooperation. If, in rehearsal, he happens to hear a wrong note that escapes the conductor's attention he should refrain from pointing it out through the "talk-back." The conductor would resent

the implication that he doesn't know his business and would probably retort that the director had better mind his own. A more effective way of handling the situation is for the director to discuss the matter privately with the conductor during the next pause. The error can then be corrected without injury to anybody's sensibilities.

PRODUCTION TECHNIQUE

Production technique may be defined as the combination of knowledge and skills employed by the director to adapt the conditions of broadcasting to the requirements of a program. It should not be confused with microphone technique, which is used by the artist to adapt his performance to the requirements of broadcasting.

The director is concerned primarily with production technique, but he should also be familiar with microphone technique. He should try to achieve a satisfactory pickup without calling for any modification of the performance, but he should be prepared to assist the artist in modifying his performance if necessary. The more efficient his production technique, the less need there will be for microphone technique, but there are certain types of performance—crooning, for example—that will probably always demand it; and many sopranos have to cultivate it.

Theoretically, the objective of production technique is so to control the pickup of a performance that it will sound to the radio listener exactly as it sounds in the studio. Actually, such fidelity of reproduction is not attainable by conventional broadcasting methods. As we have seen (Chapter 2), true fidelity requires not only a wide channel and perfectly efficient equipment but also a stereophonic system. In the absence of these desiderata the director's aim is to achieve the highest fidelity possible under existing conditions.

The first step is to recognize what constitutes fidelity in a monaural system. When he listens to the loudspeaker in the control room the director must remember that what he hears should not be expected to sound exactly like the music he hears in the studio. Otherwise he is likely to be confused and unable to discriminate between satisfactory and unsatisfactory reproduction. Some directors make it a habit to go into the studio from time to time to compare the actual sound with its reproduction as heard in the control room. The validity of this test is greatly enhanced if, while in the studio, the director stops one ear, so that he obtains an impression approximating the monaural effect of loudspeaker reproduction. Those who have never made the experiment may be interested to note how closely the sound of "live" music resembles that of broadcast or phonographic reproduction when the former is heard with one ear.

Having acquainted himself with the limitations of the medium, the director is in a position to determine the optimum results obtainable within those limitations. In order to achieve the optimum results, however, he must be familiar with certain other factors that influence the transmission of sound.

Studio Acoustics. The acoustical properties of the studio, concert hall, or other room from which music is broadcast are of interest to the director, chiefly because of the effect of reflected sound on the pickup. In the early days of broadcasting, when technical equipment was far less efficient than it is today, even a small amount of reflected sound was considered objectionable. Studio walls were draped with materials that absorbed a large proportion of the sound waves generated in the studio, particularly those of higher frequency. Such studios were described as "dead"—a term that might have been applied with equal justice to the quality of musical sound transmitted from them. Gradually, however, as tech-

nical equipment and methods improved, the preference for dead studios gave way to an appreciation of the value of reflected sound as an aid to realistic reproduction. Methods of controlling reverberation also improved, so that it became possible to design studios with any desired acoustical properties. In modern studios the reverberation time—that is, the time required for a sound of moderate intensity to become inaudible—ranges from about half a second to one second or longer, depending on the size of the studio and the frequency of the sound, the reverberation time being longer in large studios and at low frequencies.

The proportion of reflected sound to direct sound in a pickup is determined only partly by the acoustical characteristics of the studio. Other contributory factors are the directional characteristics of the microphone, the directional characteristics of the sound-producing agent, and the distance of the microphone from the source of sound. The last factor is particularly important. For example, in a studio of given size and acoustical properties, with the microphone at a distance of six inches from the source of sound, reflection may account for only 1 per cent of the total sound energy received by the microphone, while at a distance of eight feet the ratio of reflected sound to direct sound may be 3 to 1. These ratios vary, of course, according to the size and absorptive qualities of the studio. The latter must therefore be considered in deciding upon the placement of the microphone and the performers.

The director should ascertain—accurately if possible, but at least approximately—the reverberation time of the studio or hall in which his program is to originate. Some studio control rooms contain graphs showing the reverberation times at all frequencies of the studios to which they are attached, and if that information is not posted in the control room the engineer can usually supply it. The problem is more difficult in public places, where acoustical information is seldom

available, but the director, with the aid of the engineer, can usually determine their characteristics accurately enough for practical purposes. One thing that the director should note particularly is whether there are any hard, flat surfaces so located that they might reflect sound waves directly towards the microphone, as direct reflection may cause wave interference, a troublesome phenomenon which will be discussed presently. Acoustical considerations also influence the choice of the microphone to be used, as some types admit more reflected sound than do others.

There are various ways of adapting a setup to the acoustical conditions of the room. Some of them are described below, not with the intention of laying down rules but merely to illustrate the variety of ways in which acoustical problems can be approached.

In live rooms the effect of reverberation may be lessened by

1. Placing the microphone nearer to the performing group. As we have seen, the ratio of reflected sound to direct sound increases rapidly as the distance between the microphone and the source of sound is increased. Decreasing the distance naturally has the opposite effect.

2. Placing the performing group nearer to the wall behind the microphone (Figure 3). This method is effective only with a bidirectional microphone—that is, a microphone that is receptive both on the side facing the source of sound and on the opposite side. If the pickup is made at one end of the studio, so that the microphone is nearer to the wall behind the performers than to the opposite wall, the apparent reverberation is relatively high. It will be lower if the setup is moved toward the other end of the studio until the microphone is within six or eight feet of the wall behind it.

3. Arranging the setup so that the microphone faces a side wall rather than an end wall (Figure 4). In an oblong room the reverberative effect is greater when the axis of the micro-

phone is parallel to the longer axis of the room, less when it is parallel to the shorter axis of the room.

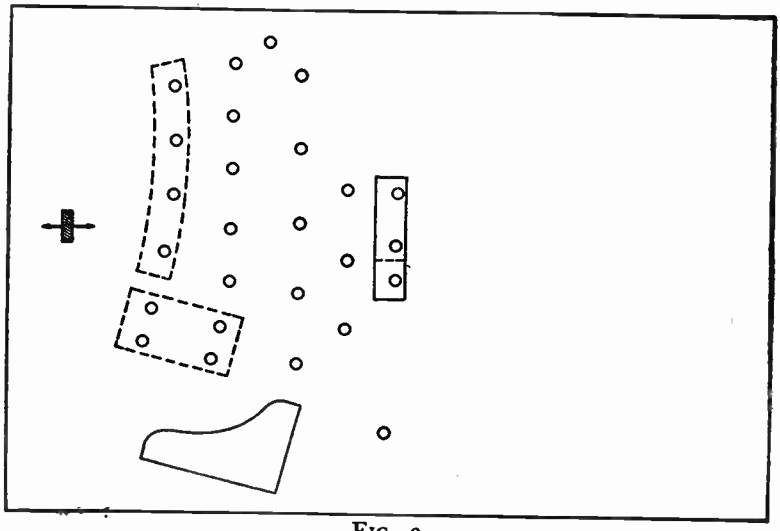


FIG. 3.

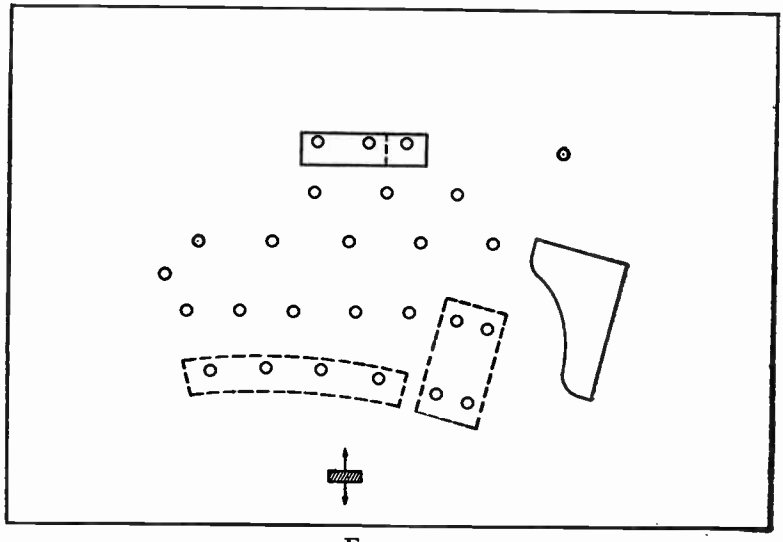


FIG. 4.

4. Placing the performing group diagonally, facing a corner of the room. Care must be taken not to place the microphone too close to the corner walls, particularly if they are not acoustically treated. Generally it is advisable to raise the microphone to a height of eight or ten feet and tilt it at an angle of 45 degrees. This will prevent it from receiving direct reflections either from the walls or from the ceiling (Figure 5).

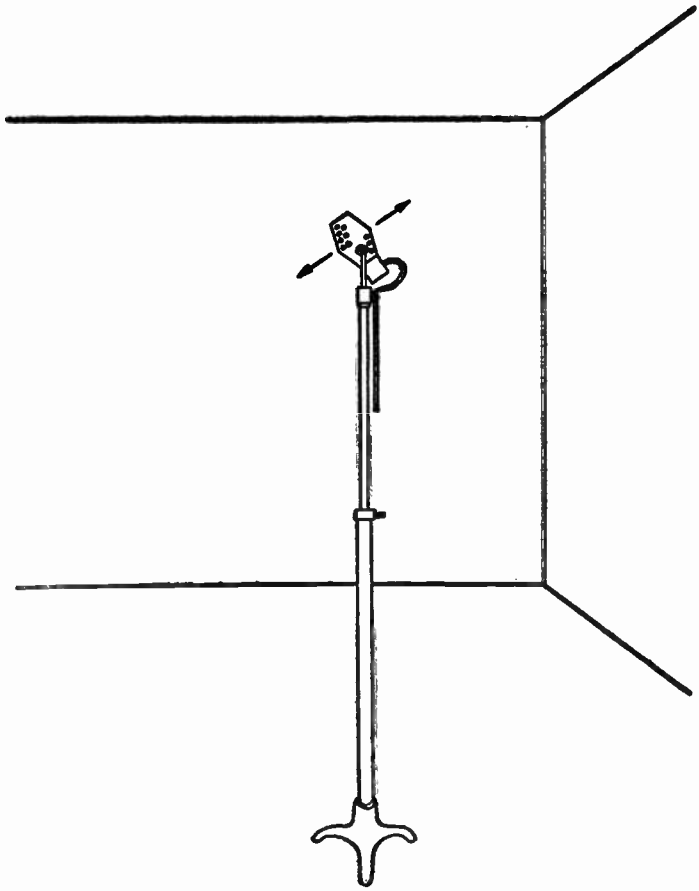


FIG. 5.

In dead rooms the apparent reverberation may be increased by

1. Placing the microphone farther from the performing group.

2. Placing the performers nearer to the wall behind them, leaving as much empty space as possible behind the microphone (Figure 6).

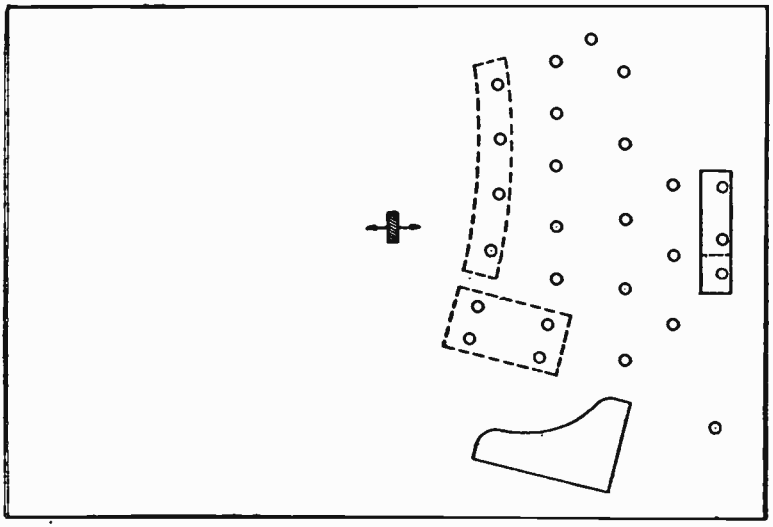


FIG. 6.

3. Placing the performers with their backs to an end wall, so that the axis of the microphone is parallel to the longer axis of the room.

4. Increasing the height of the microphone.

5. Placing the microphone so that it receives no direct sound at all. This may complicate the problem of balance, particularly if the performing group is inherently unbalanced, as broadcasting orchestras sometimes are, but surprisingly good results can occasionally be obtained by the in-

direct method. "Presence," of course, is lacking, but there is an effect of depth and an illusion of perspective reminiscent of the concert hall.

Studios designed for large orchestras may be too live for small groups, and those designed for dramatic programs or speakers may be too dead for any kind of music. As it is hardly possible for any broadcasting organization to provide enough studios of different acoustical properties to meet all requirements at any time, some studios have been constructed so that their acoustical characteristics may be varied. An early method of accomplishing this was to hang the walls with sound-absorbent draperies that could be drawn back, when desired, to expose reflecting surfaces. Later and more efficient devices include the "live-end–dead-end" studio, which, as its name implies, has reflecting surfaces at one end and absorbent surfaces at the other, and the movable-panel studio, which has reflecting surfaces behind absorbent panels that can be opened to increase the liveness of the studio.

Even in the most fully equipped studios small groups, such as trios or quartets, are sometimes obliged to broadcast from rooms that are overlarge and too live for performances of that type. Under such conditions reverberation may be minimized by the use of screens so placed that they enclose the group at the back and sides (Figure 7).

Microphone Characteristics. It is not necessary for the director to have an engineer's knowledge of microphones, but he should at least be familiar with the several types in use and understand how they differ in their response to sound waves. Full technical details are available to those who desire them in manuals published by the manufacturers or in handbooks for radio engineers.[1] For the present purpose a brief nontechnical treatment of the subject will suffice.

[1] See Bibliography, Nos. 46 and 49.

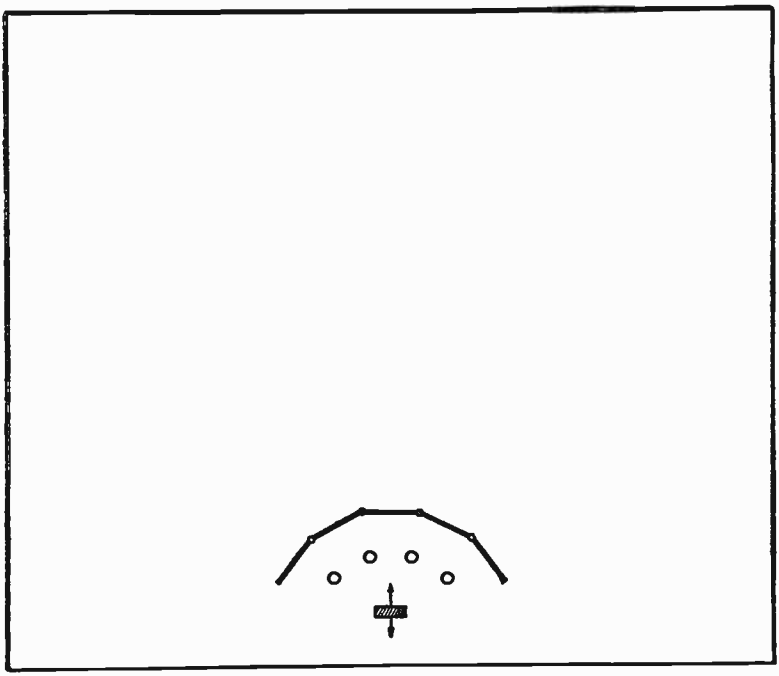


FIG. 7.

Microphones are usually classified under two headings: pressure-operated and velocity-operated, the former type being actuated by the pressure of sound waves against a diaphragm, the latter by the velocity of sound waves past a metallic ribbon. However, a more convenient classification from the standpoint of the director is according to directional characteristics. On this basis microphones may be divided into two categories: those which respond unequally to sounds originating at different angles, and which are referred to as directional microphones; and those which are equally responsive in all directions and are called nondirectional microphones. Directional microphones may be either unidirectional—responsive only to sounds originating on one

side—or bidirectional—responsive to sounds originating on two sides.

Carbon, condenser, dynamic, and inductor microphones, all of which are pressure-operated, are generally classed as unidirectional, though they are actually nondirectional at low frequencies. The crystal and so-called "eight ball" microphones, also pressure-operated, are nondirectional at all frequencies. The velocity-operated ribbon microphones are of three kinds, the one most widely used being the bidirectional RCA 44-B. This type has two exactly similar fields of response, one on each side of the ribbon (Figure 8). Sound

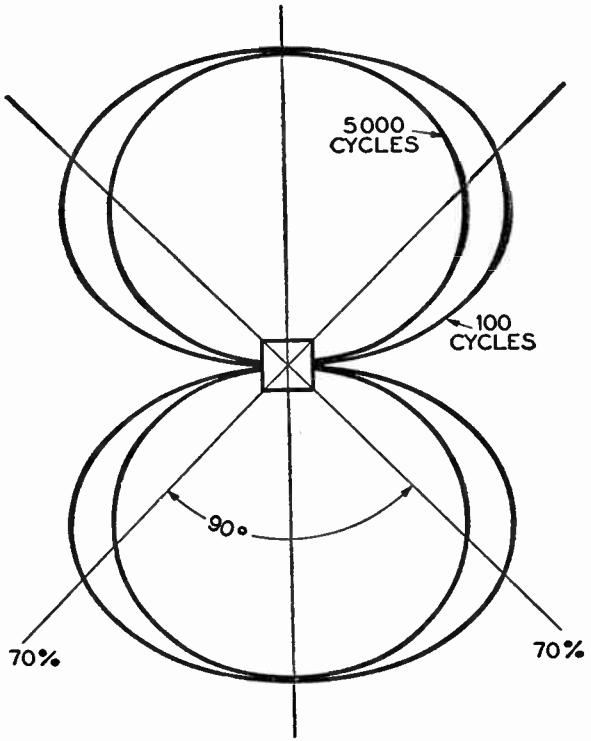


FIG. 8.—Response pattern of RCA 44-B microphone

waves originating in either field along an axis perpendicular to the plane of the ribbon have the maximum effect upon it, while those approaching at right angles produce no response. At 45 degrees the sensitivity is about 70 per cent, which is generally considered the minimum allowable for a satisfactory pickup. Thus the RCA 44-B has an effective pickup angle of 90 degrees—that is, 45 degrees to either side of the perpendicular axis.

The other types of ribbon microphone are the RCA 77-B, which is unidirectional and has a pickup angle of 150 degrees (Figure 9); and the RCA 77-C, which is convertible by means

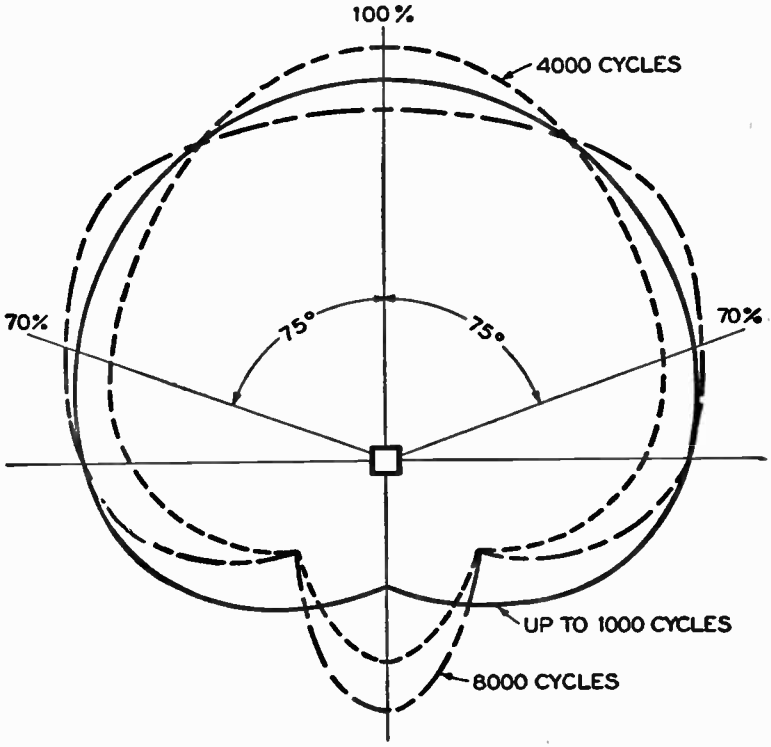


FIG. 9.—Response pattern of RCA 77-B microphone

of a switch from a unidirectional to a bidirectional or non-directional microphone. Another convertible microphone, having directional characteristics similar to those of the 77-C, is the Western Electric "cardioid" (639-A).

It will be noted that in the following pages the microphone is referred to almost invariably in the singular. This is intended to emphasize the fact that in monaural transmission the use of more than one microphone may result in distortion due to wave interference and should, therefore, be avoided except in special cases, examples of which will be mentioned in due course.

In order to understand the nature and effect of wave interference it is necessary to recall that sound waves, as explained in Chapter 2, consist of alternate areas of compression and rarefaction of the air molecules, one complete wave representing the cycle of changes from normal atmospheric pressure up to maximum compression, thence down to maximum rarefaction, and back again to normal (Figure 10). When a

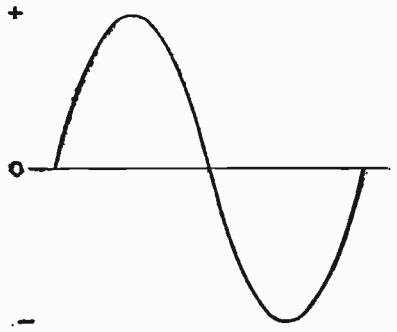


FIG. 10.

sound wave impinges on the ribbon (or diaphragm) of a microphone the increasing pressure forces it away from the source of sound until the area of compression passes, when

the area of rarefaction that follows causes the ribbon to move back toward the source of sound. Thus the compression area, usually called the crest of the wave, may be said to exert a positive influence on the microphone, while the area of rarefaction, or trough of the wave, exerts a negative influence.

Let us suppose now that in a broadcasting studio a sound is generated the wave length of which is two feet, and that these waves are intercepted by two microphones, one of which is one foot, or half a wave length, farther from the source of sound than the other. As the *crest* of each wave reaches the nearer microphone it affects it positively, then passes on to exert a similar positive influence on the second microphone; but as it reaches the latter the *trough* of the wave simultaneously reaches the first microphone, which is affected negatively. The result, if both microphones are connected to the same circuit, is that one cancels the other, so that there is no flow of current in the circuit and therefore no sound is produced by the loudspeaker at the other end (Figure 11). On the other hand, if the microphones are

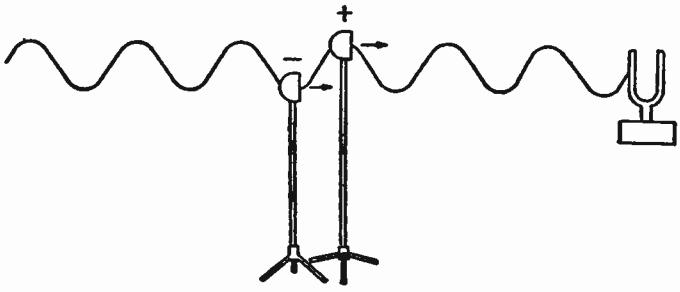


FIG. 11.

spaced a full wave length apart, instead of a half wave length, the flow of current will be reinforced and the reproduced sound intensified.

When music is performed by an orchestra the various instruments are usually producing at any given instant a number of different fundamental pitches together with their respective harmonics. The result is an extremely complex pattern of different wave lengths, some of which, when picked up by two or more microphones, will be canceled while others will be reinforced. This not only distorts the timbres of the instruments, whose individual tone qualities are determined largely by the relative strength of their upper harmonics, but often generates in the transmission system new frequencies that are unrelated to the musical sounds and that emerge from the loudspeaker as unpleasant, rasping noise.

Wave interference may also be caused by reverberation, even when a single microphone is used. For example, if the bass viols, which usually stand at the rear of the orchestra, are placed in front of a reflecting wall, some of the sounds they produce will be subject to cancellation or reinforcement by reflection, depending on the relationships between their wave lengths and the distance of the instruments from the wall. It is advisable therefore to avoid placing any instruments close to an untreated surface that may reflect their tone directly towards the microphone.

Placement of Microphone and Performers

1. *Instrumental music*

a. SOLO INSTRUMENTS. The pickup of a single instrument is usually a simple matter. In the case of the piano, the microphone is placed about opposite the curve in the rim of the instrument and usually some five or six feet away, though the optimum distance may vary considerably in rooms of different acoustical properties. The microphone is generally raised to a height of five or six feet, tilted downward, and aimed diagonally across the strings in the direction of the

keyboard to bring the short treble strings into focus (Figure 12). If it is aimed too far to the right the bass will tend to predominate. The lid of the piano should be raised to the maximum height of the prop stick. It may be removed altogether, but greater brilliance is obtained through the use of

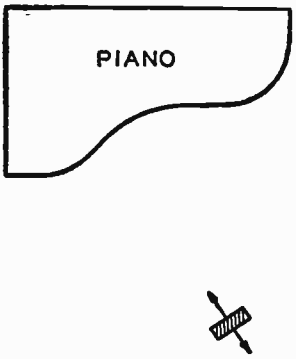


FIG. 12.

the lid as a reflector.[2] Care should be taken not to place the microphone close enough to pick up mechanical noises produced by the piano action. Under normal studio conditions a bidirectional velocity microphone should give satisfactory results, but if the performance takes place in an unusually large and reverberant room a unidirectional microphone may be preferable. The engineer will know which type to use.

Pipe organ pickups are sometimes troublesome, chiefly for acoustical reasons. Churches and other buildings in which organs are usually located are in most cases extremely live, their reverberation time being long enough to cause a perceptible echo. Fortunately, the ear seems to tolerate more reverberation in organ music than it would in orchestral

[2] In duo-piano performances it is necessary to remove the lids from both instruments to prevent the lid of the nearer one from obstructing the tone of the other.

music, possibly because listeners are accustomed to hearing the organ in live places. Nevertheless it is sometimes advisable to guard against an excess of reflected sound by using a unidirectional microphone. Its placement will be governed largely by two considerations: It should be far enough from the organ loft to bring all the pipes within the 90 degree angle, and near enough to maintain a satisfactory ratio of direct sound to reflected sound. Organs located in acoustically treated studios present fewer difficulties and can usually be picked up effectively from a considerable distance.

Electronic organs of the types used in broadcasting often suffer from a lack of reverberation. The tone of these instruments is produced almost instantaneously at full volume, which sometimes causes a percussive attack suggestive of the xylophone. The remedy is reverberation, which tends to soften the sharp edges of sound. Late models of the loudspeakers furnished with these organs have built-in reverberation chambers, but they are not always adequate, particularly in dead rooms. The echo chambers with which some broadcasting studios are equipped afford controlled reverberation that can often be used to good advantage in picking up electronic organs. Otherwise it is advisable to place the microphone, preferably a bidirectional one, at a sufficient distance to take full advantage of the inherent reverberation of the studio.

The harpsichord has recently been rescued from oblivion to win a degree of popularity that could hardly have been foreseen a quarter of a century ago. Having succumbed in the latter part of the eighteenth century to the superior dynamic power of the piano, it needed, apparently, only the amplification made possible by the vacuum tube to restore its utility. Now, thanks to the techniques of broadcasting, the harpsichord can hold its own against the largest orchestra. The chief difficulty in picking it up is to avoid transmitting

the considerable amount of noise produced by its action. That is sometimes done, when other methods fail, by placing the microphone under the soundboard.

b. Solos with Piano Accompaniment. Instrumental solos with piano accompaniment are also fairly easy to deal with as a rule. If difficulty arises in balancing the two instruments it can be eliminated by placing the microphone so that the weaker instrument is directly in the beam and the stronger more or less out of it (Figure 13). Where a bi-

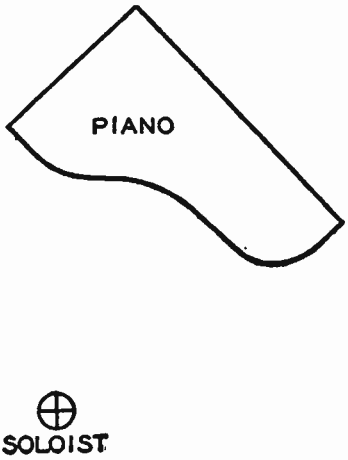


Fig. 13.

directional microphone is used it is sometimes advantageous to place it between the solo instrument and the piano (Figure 14), an arrangement that is conducive not only to good bal-

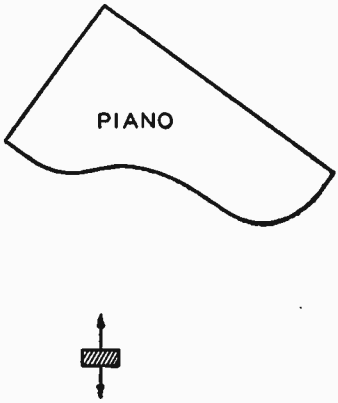


FIG. 14.

ance but also to precision of ensemble, since the players can usually work together more smoothly when they face each other.

c. SOLOS WITH ORCHESTRAL ACCOMPANIMENT. It is sometimes advisable, in picking up instrumental solos with orchestral accompaniment, to use more than one microphone. When the performance takes place in a broadcasting studio, where acoustical conditions are good and the disposition of the performers is under the director's control, a single microphone is usually sufficient; but if the orchestra is large and the solo instrument one of limited volume capacity—the harpsichord, for example—a separate microphone will generally have to be provided. In such cases the solo microphone should be placed so that it will pick up little or no direct

sound from the orchestra, the purpose being to minimize the effects of wave interference.

Piano solos, even when the accompanying orchestra is of full symphonic proportions, can usually be picked up satisfactorily with a single microphone, either in a broadcasting studio or in a concert hall. The usual position for the piano in public concerts is at the right of the conductor, and this arrangement is generally effective in the studio, as far as acoustical results are concerned. If it should prove inconvenient for spatial reasons there are several alternative positions that give equally good results. The piano may be placed, for instance, at the conductor's left, or directly in front of him. In all cases the keyboard should, of course, be on the left (as viewed from the auditorium), so that the opened lid will project the tone towards the microphone and not towards the back of the studio or stage. This means that when the piano is placed at the right of the conductor's platform the soloist sits with his back to the conductor. The alternative positions mentioned above would therefore appear to be preferable in that they permit visual contact at all times between the conductor and the soloist.

Soloists on stringed or wood-wind instruments usually stand or sit at the conductor's left. Sometimes it is necessary to place the soloist a few feet nearer the microphone, which puts him slightly behind the conductor. No serious inconvenience results, however, as the soloist usually faces so that he can keep one eye on the conductor, and the conductor can see the soloist by glancing over his shoulder. If a separate microphone is used it should face at right angles to the orchestra microphone. This helps to prevent wave interference and at the same time enables the soloist to face the conductor. Pickups of solo passages in popular music involve special considerations that will be discussed in the section on dance bands (see page 177).

d. SMALL GROUPS. Trios, quartets, and quintets composed of stringed or wind instruments and piano involve pickup problems similar to those presented by solos with piano accompaniment, though the former groups are generally easier to balance. The main difficulty to overcome in balancing a violin or cello solo with the piano accompaniment is the tendency of the piano to predominate by reason of its greater volume and the percussive character of its attack. Increasing the number of stringed instruments in the ensemble tends to reduce the quantitative disparity between string tone and piano tone; however, in the kind of music usually played by such groups the piano part is not a mere accompaniment, to be subordinated to more important parts, but ranks equally with the other instruments and should therefore be given equal prominence.

The methods used for picking up solos with piano accompaniment may generally be used, with some modifications, for pickups of piano trios, quartets, or quintets. However, "split pickups"—that is, placement of the microphone between the piano and the other instruments—is less advisable, and at the same time less necessary, since the group is inherently better balanced and therefore may be picked up from a greater distance. When the microphone is placed close to an instrumental group the effect produced at the loudspeaker is one of high definition. The several instruments tend to assert themselves individually instead of blending together as they do when heard directly in an auditorium. Placing the microphone farther from the group decreases the definition and increases the blend, largely because of the increased ratio of reflected sound, and thereby contributes to a more normal and realistic reproduction.

String quartets and wood-wind ensembles are sometimes picked up by placing a bidirectional microphone in the middle of the group, but, for the reason just cited, this practice

is not recommended unless the acoustical properties of the room are such as to make a more remote pickup impractical. Ordinarily, better results will be obtained by seating the players in a semicircle facing the microphone, placing the microphone at a distance of eight or ten feet from the nearest instruments, raising it to a height of seven or eight feet, and tilting it at such an angle that it bears directly on the group (Figure 15).

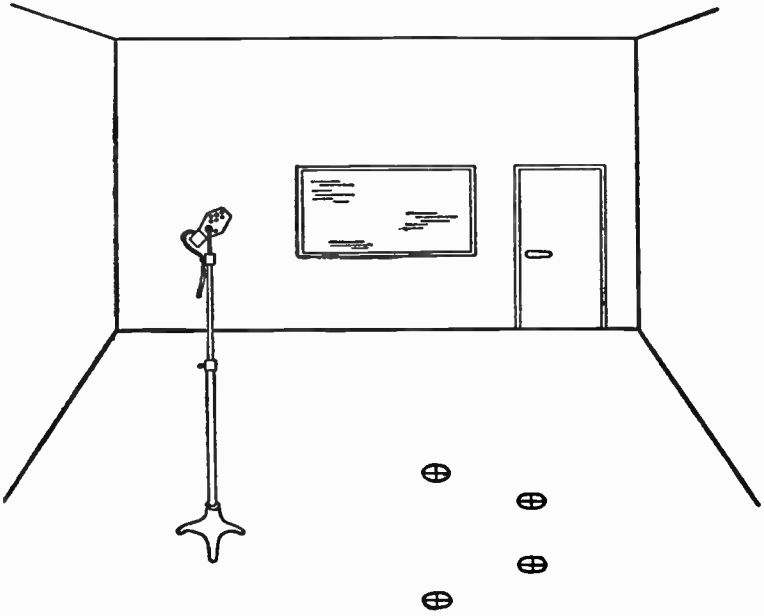


FIG. 15.

The optimum distance and height of the microphone in any pickup depends on so many factors—for example, the acoustical conditions, the size and character of the performing group, and the type of music to be presented—that it can be accurately determined only by trial and error. A routined director with a clear concept of the effect he wants to produce

usually has in advance a general idea of the setup required to produce it, but it rarely happens that the preconceived setup is completely satisfactory. When he listens to the reproduction by the control room loudspeaker the director finds almost invariably that the balance can be improved by some change in the placement of the microphone, the players, or both; which means that the effectiveness of a musical broadcast, as far as fidelity of reproduction is concerned, depends to a large extent on the director's keenness of ear and knowledge of how the music ought to sound when reproduced monaurally.

e. ORCHESTRAS. During the first decade of broadcasting, orchestra pickups posed some knotty problems. The carbon microphones used at that time suffered from what was known as "carbon hiss," a noise somewhat like the sound that may be heard by holding a rather small empty sea shell close to the ear. As the hiss could not be eliminated, it had to be drowned out by the greater volume of the "signal"—that is, the sounds of the program being transmitted; and in order to insure a sufficiently high ratio of signal to noise it was necessary to place the microphone so close to the orchestra that a large part of the group would lie outside the effective angle of response. This necessitated multiple-microphone pickups and often called for radical changes in the traditional seating plan of the orchestra. Besides, the carbon microphone's lack of directivity at low frequencies made it difficult to control the relative volume of low-pitched instruments such as the bass viols, timpani, and bass drum.

With the advent of the more sensitive and comparatively noise-free velocity microphone the problems of orchestral pickup were simplified. The microphone could be placed far enough from the orchestra to bring the entire group within the effective 90 degree angle, and its uniform directivity at all frequencies eliminated the trouble formerly caused by

low-pitched instruments. With such a microphone—provided that acoustical conditions in the hall or studio are favorable—almost any arrangement of the orchestra that gives satisfactory results in the hall will prove reasonably satisfactory for broadcast transmission. There are, however, certain factors that tend to prevent the best conditions for direct listening from corresponding exactly with the best conditions for a broadcast pickup.

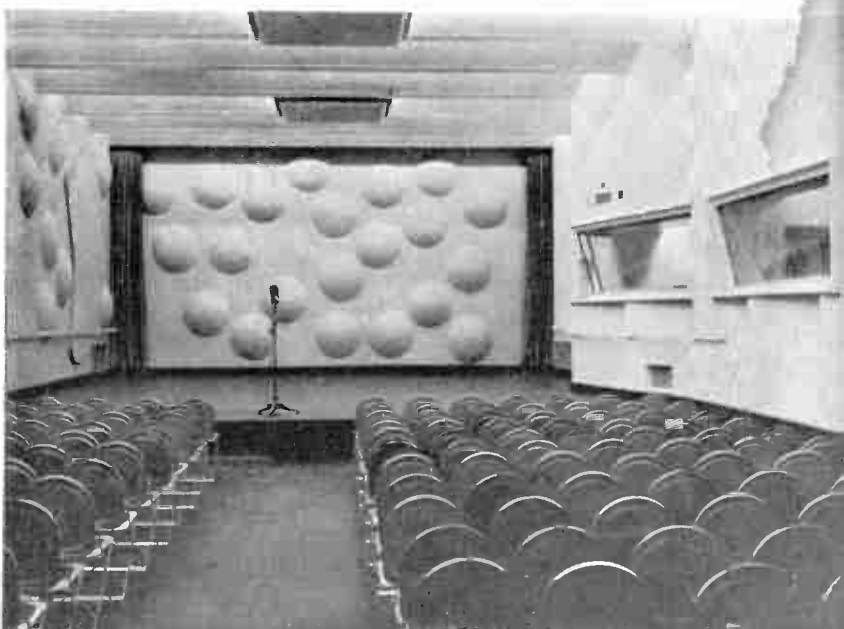
The "best seat in the house"—that is, the point at which a person hears most advantageously—is usually at a considerable distance from the stage. That point is, theoretically, the ideal location for the microphone, but for practical purposes it is usually too remote because of random noise, the relative volume of which increases with the distance between the microphone and the source of desired sound. Coughing, rustling programs, creaking chairs, and other sounds that the listener in the auditorium usually ignores when intent upon the music are accepted without discrimination by the microphone and transmitted, along with the program, at what seems to the radio listener an abnormally high volume level.

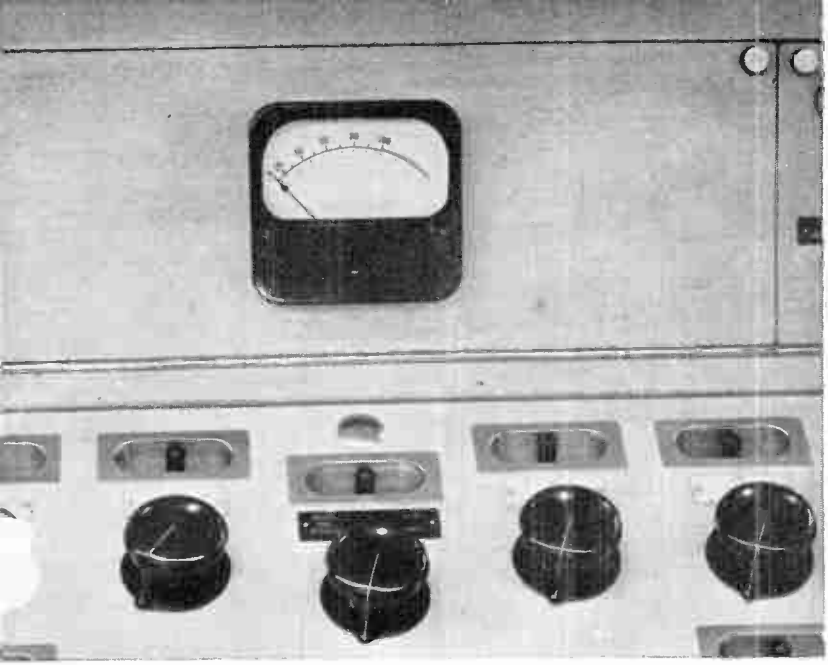
While the microphone lacks the power of the human ear—or, more accurately, the brain—to discriminate against undesired sounds, it discriminates more sharply than does the ear against sounds originating at acute angles. Consequently sounds originating along the perpendicular axis of the microphone cause a relatively stronger response in it than they would produce in the ears of a human being located in the same position, while sounds originating "off the beam" affect the microphone less than they would the human ear.

Another factor is the varying directional characteristics of orchestral instruments. Brass instruments project their tone most strongly in the direction in which their bells are pointed, while stringed and wood-wind instruments are virtually nondirectional. To the listener in the hall the direc-

Above: A broadcasting studio in 1922 (Station KPO, San Francisco).

Below: A modern broadcasting studio (NBC, New York, 1945). The spherical protuberances at the back and side of the stage are functional, designed to aid in the diffusion of reflected sound.





Volume indicator.

RCA 44-B microphone.

RCA 77-B microphone.

tivity of the brasses is offset to some extent by the large amount of reflected sound received by his two ears, and also by the fact that one ear is usually directed away from the brass section. The monaural microphone is more strongly affected by such directional instruments, and if its beam coincides with those of the brass instruments the weaker and less directional instruments will obviously be placed at a great disadvantage.

Adding to the foregoing considerations the fact that at a given angle the apparent volume of a sound is inversely proportional to the distance of its source from the microphone, we may draw the following conclusions regarding orchestral pickups:

The strings, being the weakest instruments as well as nondirectional, should be placed nearest the microphone. Theoretically, they should also be placed in the most favorable position with respect to the directional characteristics of the microphone, but this is hardly feasible because of the large area occupied by the string section. At all events, they should be in the forefront of the orchestra and well within the microphone's effective angle of response.

The wood-wind instruments, though not greatly superior to the strings in volume, have more characteristic, penetrating timbres that enable them to compete with a high volume of string tone. They may therefore be placed farther from the microphone and at less favorable angles.

The brasses, being much more powerful than the strings and wood winds and also highly directional, should be farthest from the microphone and farthest from its line of maximum response.

The percussion instruments are capable of almost unlimited volume. They should be at least as far from the microphone as are the brasses; but since they are nondirectional they may be placed nearer the line of maximum response.

There is nothing in these conclusions that is fundamentally at variance with the conventional methods of seating an orchestra for nonbroadcast performances. In the typical concert hall setup the strings are at the front of the stage—except the basses, which are generally at the back and at one side, the wood-wind section is behind the central stands of strings, and the brass and percussion sections are placed well back and at the side opposite the basses. The horns are often seated in the center, behind the wood winds, since they frequently serve as members of the wood-wind choir. This arrangement is usually quite satisfactory for broadcasting, since the bells of the horns are directed backwards rather than toward the microphone. However, care should be taken to avoid placing the horns immediately in front of a reflecting surface that might unduly amplify their tone, or in front of a too-absorbent surface which would tend to smother it.

It is usually advisable to seat the wood-wind and horn players on platforms high enough to enable each row to see over the heads of the players in front. This not only helps those at the rear to follow the conductor's beat but also helps to prevent the blanketing of their instruments by the bodies of other musicians—a consideration that, by the way, also influences the height at which the microphone should be placed.

The usual microphone position in symphonic pickups from broadcasting studios or acoustically satisfactory halls is from five to twenty feet behind the conductor and from ten to twenty feet above the level of the stage. The best position, it must always be remembered, can only be determined by experiment. In some cases fairly good results may be obtained by suspending the microphone horizontally over the center of the string section, but reflections from the floor may cause trouble when the microphone is in this position. Figures 16 and 17 show, in seating plan and vertical section,

respectively, the setup used for the NBC Symphony Orchestra. The pickup is normally made with one bidirectional velocity microphone.

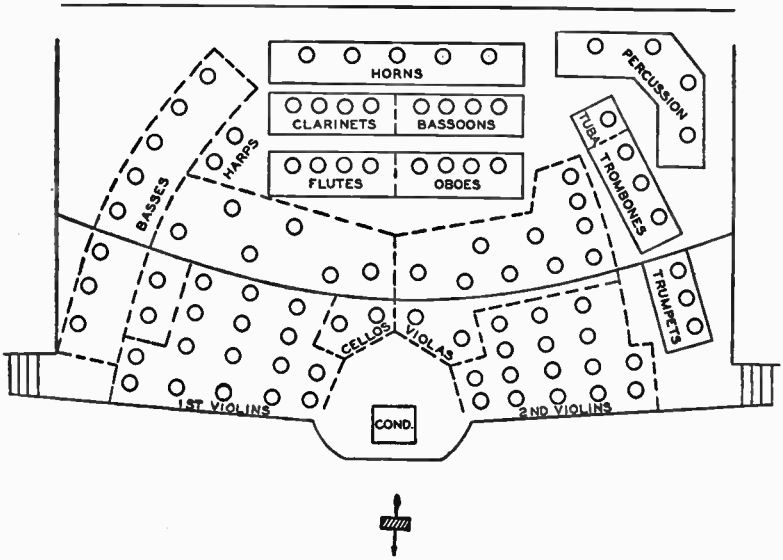


FIG. 16.—Seating plan of NBC Symphony Orchestra

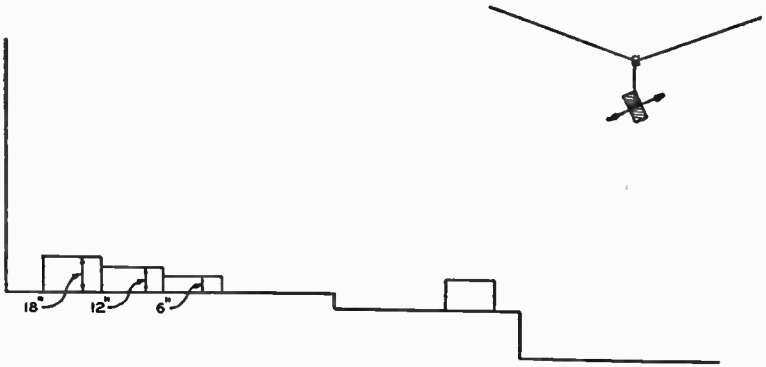


FIG. 17.—Seating arrangement of NBC Symphony Orchestra, vertical section

The symphony orchestra, as constituted for concert hall performances, generally includes from eight to twelve, or even sixteen, wood-wind instruments, from ten to twelve brasses, a varying number of percussion instruments, one or two harps, and about sixty-five strings. For broadcasting purposes the proportion of strings may be, and often is, reduced without serious detriment to the balance, though the quality of tone produced by the smaller body of strings is thinner. Such unbalanced orchestras call for special care in the placement of microphone and instruments. The reduced string section must be favored as much as possible, and the other instruments—whose number cannot be reduced, because each of them plays a separate and indispensable part—must be placed farther back or farther off the beam than usual.

Burton Paulu [3] has pointed out that proper orchestral balance is more important in broadcasting than in the concert hall, the reason being that the eye reinforces the ear, sometimes to the extent of misleading it. If, for example, the listener in the auditorium *sees* the string section exerting itself to compete with the brasses he may imagine that it is producing a greater volume of sound than is actually the case. The radio listener, unbeguiled by any visual impression, is more critical and readily detects a lack of balance.

Pickups of concert orchestras, which ordinarily number from eighteen to thirty players, call for substantially the same treatment as do symphonic pickups. The same principles as to volume and directivity must be borne in mind and the weaker instruments must be placed in the most favorable positions, but the smaller size of the unit makes it easier to set up satisfactorily, unless the studio happens to be one of inadequate dimensions.

Salon orchestras of ten or twelve pieces are proportionately easier to handle than concert orchestras, and string orchestras,

[3] Manager of Station KUOM, University of Minnesota.

being composed entirely of nondirectional instruments of comparable volume, are the easiest of all.

Figure 18 shows the setup used by the "Voice of Firestone" orchestra, an aggregation of some sixty-five players, and

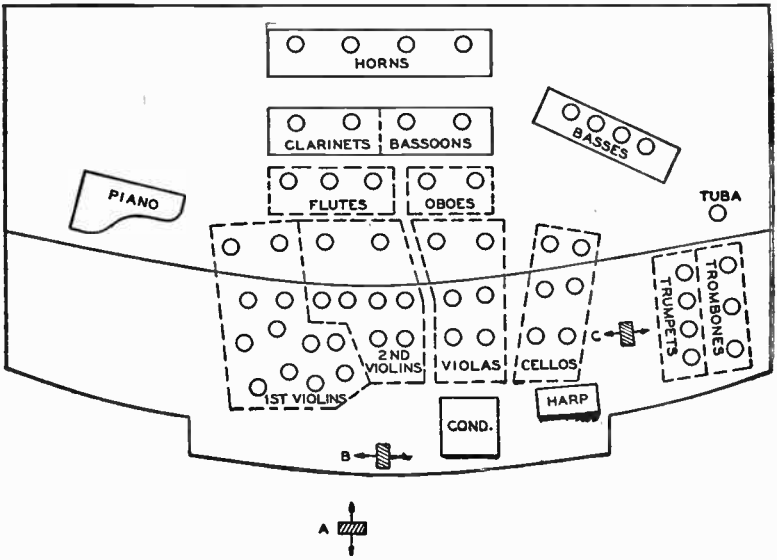


FIG. 18.—Seating plan of "Voice of Firestone" Orchestra
A—Suspended microphone, approximately 20 feet high
B—Soloist's microphone
C—Supplementary microphone used for muted brass effects only

Figure 19 represents a typical NBC seating plan for concert orchestras.

f. BANDS. Band pickups involve few factors that have not been considered in connection with orchestra pickups. In certain respects the former are less difficult to handle. For instance, the volume range of a large band is less extensive than that of a symphony orchestra, for though its maximum volume is greater it never attains the extreme *pianissimo* of which stringed instruments are capable. This makes

it easier for the engineer to find a setting for his gain control that will accommodate both extremes of volume, and it also permits the microphone to be placed farther from the band without fear that the softer passages may be obscured by

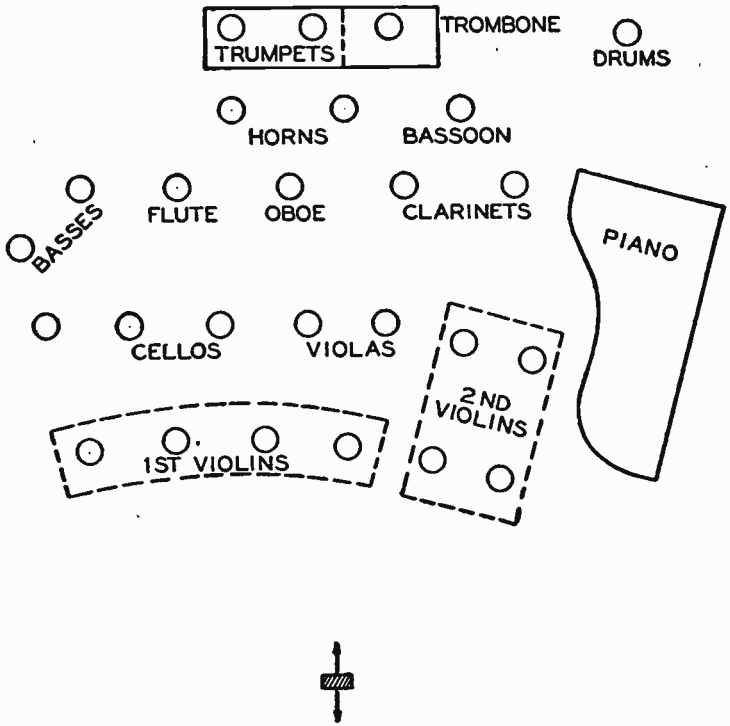


FIG. 19.—Seating plan of a concert orchestra

random noise. The band is also easier to balance than the orchestra, partly because there is less discrepancy in volume between the various wind instruments than there is between wind and strings, and partly because a band occupies a smaller space than does an orchestra of equal numerical

strength, owing to the fact that wind instrument players need little elbow room.

The conventional seating plan for bands, as used in the concert hall, generally needs little revision for broadcast purposes (Figure 20). The clarinets, which are to the band what

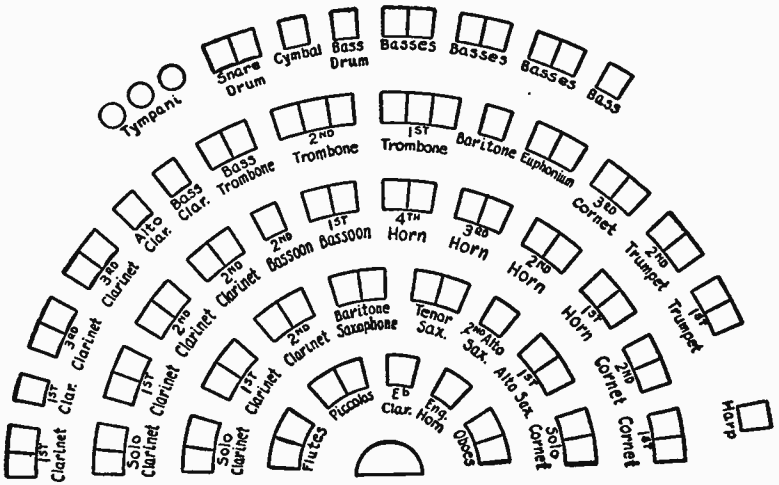


FIG. 20.—Seating plan of United States Marine Band

the violins are to the orchestra, should be given a specially favorable position with respect to the microphone, while the directional trumpets and trombones and the usually irrepressible percussion section should be kept well away from the line of maximum response.

At this point a few words of caution are in order:

In taking advantage of the directional characteristics of the microphone it is possible to go too far. That is, an instrument, or a group of instruments, in a band or orchestra may be moved so far to one side that the microphone will receive only reflected sound from it. This may not only affect its timbre but, if the microphone receives sound directly from

the rest of the group, it may create a kind of false aural perspective, as if the instrument in question were not in the same room with the others.

Radical changes in the seating plan of an orchestra may upset the musicians to a degree that will affect their ability to perform efficiently. If players accustomed to sitting on one side of the stage are moved to the opposite side they will have to adjust themselves to an entirely new set of acoustical conditions. Instrumental parts that they are used to hearing distinctly will become less audible, while others will assume what seems to them abnormal prominence. The general balance will be so altered, to their ears, that they will have difficulty in adjusting their own volume to that of the orchestra as a whole, and they may even find it hard to play in tune. If violins, violas, or cellos are seated in rows instead of in columns their attack, phrasing, and bowing are likely to be less confident and less precise, since the rear stands are deprived of the guidance that they are accustomed to receive from their section leaders. Unusual alterations of the normal seating arrangements should be undertaken only as a last resort, and no material changes should be made without consulting the conductor, who is both vitally concerned with and qualified to judge the effect that such changes will have on the efficiency of the players.

When monitoring[4] a rehearsal in the control room directors should use their eyes as well as their ears. On the engineer's control panel is an instrument known as the volume indicator, or V.I., which registers visually the sound energy being received by the microphone at each instant. The scale of the V.I. (see illustration, page 169) is marked from 0 to 100, the latter figure representing the maximum amount of sound energy that can be transmitted without distortion.

[4] To "monitor" is to listen to the reproduction of a program or rehearsal by loudspeaker or headphones.

Since the apparent loudness of a sound depends to some extent on its pitch and harmonic content as well as on its intensity, it is not always possible to determine by ear alone which of several sounds is actually the most intense. It sometimes happens that an instrument which does not sound too loud nevertheless emits so much sound energy that the engineer is forced to lower the setting of his controls, thus reducing the volume of the entire orchestra. By watching the needle of the V.I. and noting the sounds that coincide with its most extreme movements the director can usually identify the offending instrument. It can then be moved to a more suitable location, or its player cautioned to restrain his enthusiasm. The V.I. is also indispensable in determining when the volume of soft passages is in danger of falling below the minimum level required for effective transmission. The control room loudspeaker is not a reliable guide to the absolute volume of sound energy passing through the system, as it has an independent volume control which may be set so that it reproduces at a high level sounds too weak to be heard at all over the air. The V.I. always indicates the actual amount of sound energy that is going to the transmitter.

g. DANCE BANDS. The dance band is one instrumental combination for which a multiple-microphone pickup is often justified. There are several reasons for this. In the first place, many dance band programs originate in places such as restaurants, night clubs, or ballrooms, where there is usually a considerable amount of noise. To exclude as much of the noise as possible it is necessary to pick up the music from such a short distance that instruments on either flank of the group will be outside the field of a single microphone. Secondly, the special effects that figure so prominently in modern dance music include various kinds of low-volume sounds which cannot compete unaided with the accompanying parts.

Trumpets and trombones use several types of mute, some of which reduce their tone to a fraction of its normal volume. As it is sometimes inconvenient for the players of muted solo passages to leave their seats and approach the microphone, a separate one is usually placed in front of the brass section. In some setups one other microphone suffices for the remainder of the band—saxophones, strings (if any), and rhythm instruments, including the piano. In others, three or more microphones are used, the number varying with acoustical conditions, the size, character, and seating arrangement of the group, the effects called for by its arrangements, and other factors (Figures 21 and 22). The advantages gained in dance band pickups by the use of more than one microphone are regarded as sufficiently important to offset any detrimental effects that may be caused by wave interference.

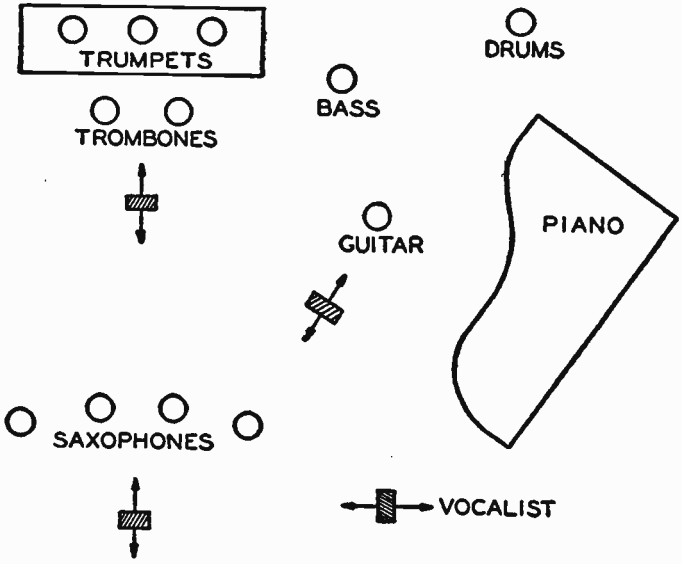


FIG. 21.—Seating plan of a small dance band

2. *Vocal music*

a. SOLOS WITH PIANO ACCOMPANIMENT. Vocal solos accompanied by the piano are generally picked up in the same ways as instrumental solos with piano accompaniment. If the microphone is unidirectional the singer stands between the piano and the microphone, which is so placed with respect to distance and direction as to achieve the desired balance between voice and accompaniment. The proper distance between the singer and the microphone may vary considerably according to the type of voice and style of performance, but ordinarily it is between two and four feet. Concert and opera singers who are accustomed to projecting their voices in large auditoriums sometimes tend to overload the microphone.

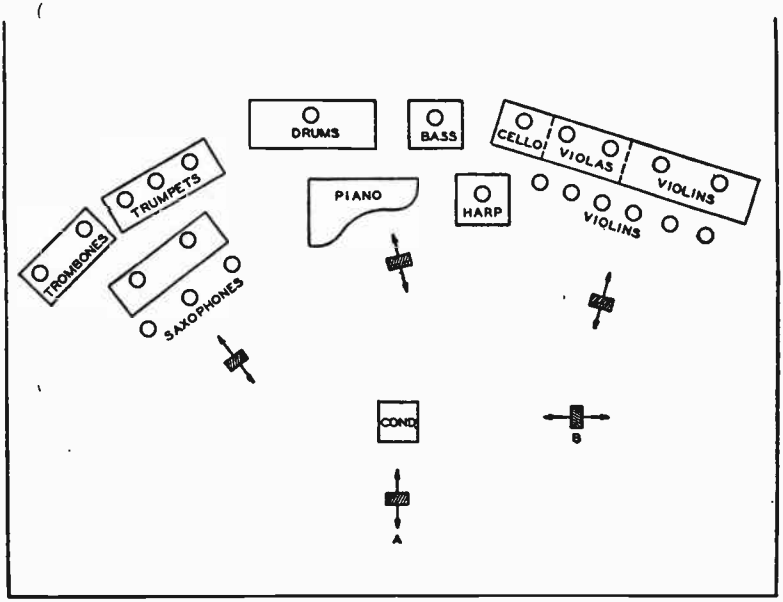


FIG. 22.—Seating plan of a large dance band with strings

A—Principal microphone, for pickup of entire group
B—Soloist's microphone
The other microphones are for pickups of the several sections

One way to overcome this difficulty is to tilt the microphone upward at an angle of about 45 degrees, so that the impact of the sound waves on the ribbon is lessened. Popular singers who specialize in an intimate style and consistently low volume level often approach within a few inches of the microphone. If a bidirectional microphone is used the singer generally stands on the opposite side from the piano, which is advantageous to the performers as well as to the director who has to balance the program. Ordinarily, voice-and-piano pickups should involve few balance problems. One occasionally hears a broadcast vocal recital in which the accompaniment is too loud, but the general tendency seems to be to err, if at all, in the opposite direction and suppress the piano part to an exaggerated degree. In either case the error is probably attributable to faulty judgment on the part of the director rather than to any abnormal difficulty in achieving a balance.

Singers who play their own piano accompaniments are usually picked up by means of a "gooseneck" or a "boom" microphone. These are not special types of microphone but merely special standards on which any conventional type of microphone may be mounted. The gooseneck standard is bent at right angles so that the microphone may be suspended over a table or piano keyboard. The boom standard has a counterbalanced crossarm, adjustable in all directions, which serves similar purposes. In this type of pickup the balance is controlled by tilting the microphone to favor either the voice or the piano, as desired.

b. Solos with Guitar Accompaniment. Singers who accompany themselves on the guitar are sometimes difficult to pick up, owing to the low volume level of the guitar and the position in which it is usually held—namely, in the singer's lap or on one knee. The problem is to find a position for the microphone that is low enough to do justice to the

guitar and yet high enough for the singer. The usual solution is to place the microphone at about the level of the singer's mouth but tilt it downward to face the guitar.

c. SOLOS WITH ORCHESTRAL ACCOMPANIMENT. Singers with strong and well-projected voices can generally be picked up most effectively by the same microphone that is used for the orchestra, in which case the customary position for the soloist is at the conductor's left. If, however, a satisfactory balance cannot be achieved this way a separate microphone may be provided for the singer. Where a separate microphone is used it should be placed with its "dead" side toward the orchestra in order to prevent objectionable wave interference (Figure 23). Popular singers appearing with dance bands are nearly always provided with separate microphones.

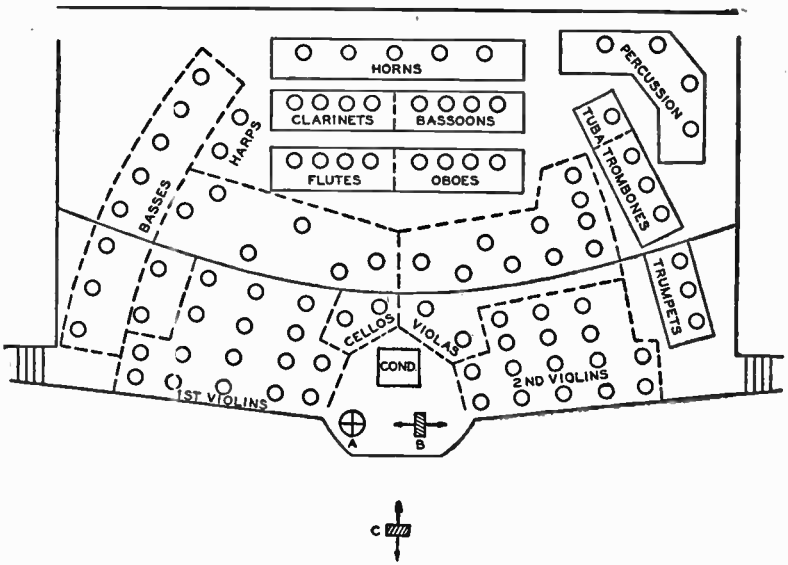


FIG. 23.—Setup for soloist with large orchestra
A—Soloist
B—Soloist's microphone
C—Orchestra microphone

d. QUARTETS. The normal setup for vocal quartets with piano accompaniment is somewhat similar to that for a solo voice with piano. If the microphone is unidirectional all the singers must necessarily stand on the same side of it, the piano being placed diagonally at their right so that it extends partly behind them. In mixed quartets the soprano and alto are usually in the middle of the group, with the tenor flanking the soprano and the bass at the other end of the row. Male quartets stand with the tenors inside, the baritone and bass on the flanks. With a bidirectional microphone it is possible to place two singers on each side, so that they face each other and the microphone, but this arrangement, as previously noted, is more conducive to definition than to blend and should be adopted only when a particularly intimate effect is desired. Quartets singing with an orchestra rarely use the split setup since, with the microphone between them, it is difficult for all of them to see the conductor without turning away from the microphone.

e. CHORUSES. The difficulty of picking up a chorus depends to a large extent on the size of the group, the kind of accompaniment used, if any, and the amount of space available in the room where the performance occurs. Large *a cappella* choirs, comprising fifty or more voices, are perhaps the easiest to cope with. They require far less space than an orchestra of equal numerical strength, their voices are about equally directional and of comparable volume, and there is no accompaniment to be balanced with the choir. They do, however, need to be placed on platforms, so that each row can see over the heads of the row in front and also have a clear "shot" at the microphone. There are various ways of placing the singers, almost any of which will be reasonably satisfactory for broadcasting, provided that the choir is a large one. The sopranos may be ranged in one or more rows, in front, with the altos behind them, the tenors behind the

altos, and the basses at the rear. This calls for a fairly high microphone aimed slightly above the heads of the sopranos and altos, so that the tenors and basses will not be at a disadvantage because of their greater distance from the microphone. A somewhat more practical plan, particularly for very large choruses, is to place the sopranos at the left (as viewed from the microphone position) with the tenors behind them, and the altos at the right with the basses behind them. One noted choral conductor departs from the established sectional arrangement and distributes the different voices in what seems a haphazard manner, claiming that this produces a better blending of parts. Such an arrangement is hardly to be recommended for the average chorus, since it requires that each singer be able to stick to his or her own part though surrounded by other singers carrying different parts.

Performances of works for chorus and orchestra often present extremely difficult pickup problems, especially if they take place in broadcasting studios. In the concert hall it is customary to place the orchestra on one level at the front of the stage, with the chorus rising in tiers behind it. This usually works out very well if the chorus is large enough to hold its own against the orchestra, even from its more remote position, but few broadcasting studios are large enough to accommodate such a number of singers in addition to the large orchestra that works of this type ordinarily demand; and even if sufficient room can be provided, the chorus is so far from the microphone that it is easily overpowered by the orchestra. This makes it necessary to use a separate chorus microphone, which, being in line with the orchestra microphone, can scarcely fail to cause serious wave interference. If such a setup is unavoidable it is advisable to use a unidirectional microphone for the chorus, placing it far enough back so that it receives no direct sound from the orchestra; or, if a bidirectional microphone is used, to

raise it to a height of eight or ten feet and tilt it toward the chorus at an angle of 45 degrees, so that the opposite face is aimed well above the orchestra. A better arrangement, if the physical limitations of the studio permit, is to place the chorus at one side, or even in front of the orchestra, facing across the studio. A microphone set up in front of the chorus will then face at right angles to the orchestra microphone and there will be less danger of distortion.

Of all vocal groups the small chorus of twelve to sixteen voices is the hardest to pick up effectively. Because there are only three or four voices to a part, it is difficult to make them blend into a composite choral tone, and any deviation in pitch or peculiarity of vibrato is readily noticeable. With such groups both balance and blend may be improved by placing the singers on a curved platform having three or four levels and arranging the sections in files instead of rows (Figure 24).

Timing. The musical numbers on a program should be timed in advance by the program builder, who should indi-

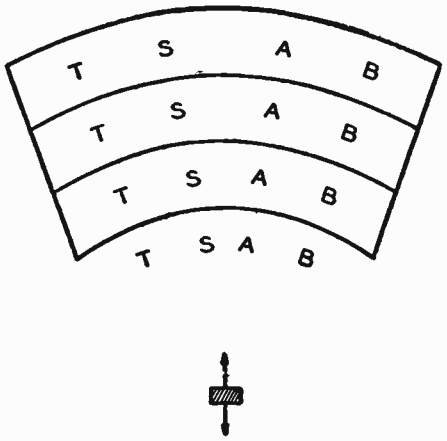


FIG. 24.—Setup for small chorus

cate his estimated timings on the music sheet. The continuity should be timed by the director, prior to the rehearsal if possible, so that when he goes into the studio he will know whether the program is likely to need cutting or padding. The director then prepares a timing sheet, using a form provided for the purpose. The form used by the National Broadcasting Company is shown below.

REHEARSAL TIMING SHEET

_____

(Date)

_____

(Program)

Items	Individual timings	Running time	Dress rehearsal

In the first column are listed, in the order of their occurrence, the various items of which the program is composed, including announcements, together with their estimated timings. As each number is rehearsed, the actual timing is entered in the second column, and when all numbers have been timed the individual timings are added together. The

total will indicate the amount of material to be cut or, if the program is short, the amount of supplementary material required. Musical cuts or fills are then arranged for in consultation with the conductor or soloists, and the length of the continuity is also adjusted if necessary. Leeway is provided for as explained in Chapter 6.

When the timing of every portion of the program is determined the director works out a running schedule in the third column. This schedule is somewhat like a railroad timetable, showing the time of arrival at the end of each item. If a dress rehearsal is held the fourth column is used for a final check of the running time; otherwise it may be used to record the running time of the broadcast. This is extremely useful, as comparison of the broadcast timing with that of the final rehearsal will show at the conclusion of each item whether the performance is running according to the schedule.

Microphone Technique. Although microphone technique is no longer the vital necessity it once was to all types of radio performers, it still has its uses. The player of a solo passage for muted trumpet or trombone, the specialist in subtone effects on the clarinet, the violinist who plays a muted obbligato to a popular tune, must learn exactly how far from the microphone he should hold his instrument in order to achieve the best results. The crooner, of course, would be lost without microphone technique, and even the "legitimate" singer will profit by acquiring an instinctive feeling for the proper relationship between volume of tone and distance from the microphone.

The principles of microphone technique for singers are simple enough. Experienced performers observe them unconsciously, but ignorance of them often handicaps the novice. The following hints may be helpful to those who are new to the ways of broadcasting:

1. Always face directly toward the microphone, except when turning the head deliberately to avoid "blasting" on high notes. The human voice is a directional instrument. Turning the head to one side will therefore decrease the volume of sound picked up by the microphone. If the conductor is not directly in your line of vision as you face the microphone, learn to watch him out of the corner of your eye while continuing to sing straight into the microphone.

2. Do not move or sway from side to side. At a distance of three feet from the microphone a lateral shift of a few inches may appreciably affect the volume level.

3. Stand with one foot ahead of the other, your weight balanced evenly on both feet. This stance will enable you to lean forward or backward if necessary to maintain the proper volume level, varying your distance from the microphone by as much as two feet without taking a step in either direction.

4. Do not sing—or speak—too close to a velocity microphone. It has the characteristic of abnormally emphasizing low-frequency sounds originating within less than two feet. Male voices, particularly, tend to sound "boomy" when picked up from a distance of less than twenty-four inches.

5. Clarity of enunciation improves with proximity to the microphone. If you want to make sure that the words you sing are distinctly audible, lean a little closer to the microphone, reducing the tonal volume proportionately if necessary.

The successful application of these methods depends partly on the musical sensitivity of the singer. A native sense of dynamic values is invaluable in maintaining a proper balance between the volume of the voice and that of the accompaniment, and sound musical taste will prevent indulgence in explosive *fortes* or exaggerated variations of volume; but experience alone can develop that knack of using both the

voice and the microphone to the best advantage which is known as microphone technique.

Common Sense in Production. In the foregoing pages an attempt has been made to outline the principles applicable to musical program production and to indicate the results that may be expected from various types of microphone, setup, and acoustical conditions. No attempt has been made to formulate rules. The broadcasting of music involves too many imponderables to admit of strict regulation. There are methods and procedures that have served long enough and effectively enough to be regarded as standard, but few if any can be said to rank as laws.

The success of a broadcast sometimes depends on the intelligent violation of precedent. Usually the best results can be achieved by adhering to conventional production methods. but there are times when it is necessary to throw tradition overboard and proceed by dead reckoning. Some years ago the National Broadcasting Company scheduled a studio performance of a new choral work that called for three soloists, a narrator, a chorus of eighty mixed voices, and a sixty-piece orchestra. The director assigned to the program was faced with the problem of balancing these elements under conditions that precluded any extensive rearrangement of the setup during the rehearsal. He was therefore obliged to work out a scheme whereby the balancing could be done at the control panel. That necessitated the use of several microphones, which were of the bidirectional velocity type. The setup decided on was as follows:

The chorus was placed on tiered platforms at one end of the studio, facing the opposite end, and a separate platform was provided for the soloists immediately in front of the chorus. The orchestra was seated in the other end of the studio, facing the chorus. In the space between was the conductor's platform, facing across the studio, and the narrator's desk,

Above: Arturo Toscanini conducts a rehearsal of the NBC Symphony Orchestra in Studio 8H, Radio City, New York. Note that the basses have been moved from their customary position at the left (see Figure 12) to make room for an auxiliary brass band, and that the Maestro is consulting the score, as he sometimes does in rehearsals. He will dispense with it in the performance. Only one of the three microphones is used for the pickup, the others being spares.

Below: The Boston Symphony Orchestra, Serge Koussevitzky, conductor, broadcasting from Symphony Hall, Boston, over the ABC network.

The Lombardo family—Rose Marie, Carmen, Leibert, and Guy—broadcasting over the MBS network.

Fred Waring conducts his chorus and orchestra in a popular program.

facing the conductor. Between the conductor and the narrator two microphones were placed side by side and about twelve feet above the floor. One was tilted so that it focused on the chorus but received no direct sound from the orchestra; the other was tilted in the opposite direction, so that it received direct sound only from the orchestra. The narrator's microphone was placed on the desk before him in such a position that its "dead" sides were turned toward the chorus and the orchestra. By this placement of the microphones wave interference was reduced to a minimum, and the balance obtained by adjusting the microphone faders was probably better than could have been achieved in the limited time available by adjusting the placement of the performers.

Another example of successful improvisation was the arrangement of microphones devised by Charles Grey, of the NBC Engineering Department, for the regular weekly broadcasts from the Metropolitan Opera House, which began in 1931. The situation was an unusual one. For nearly a decade the authorities of the Metropolitan had rejected proposals to broadcast their performances. When they finally consented, it was with their fingers crossed and also with the strict proviso that no microphone should be placed where it would be visible to the audience. This meant that a single-microphone pickup was out of the question, since the microphone, in order to bear on both the stage and the orchestra pit, would have to be placed at a point on the line of vision from the boxes and balconies to the stage. The problem was solved in the following manner:

For the orchestra pickup two microphones were suspended high over the pit in a horizontal position. Being well above the bottom of the flies, they were in deep shadow when the curtain was up, and therefore attracted no attention. The stage pickup was accomplished by means of four microphones placed in the footlights. These were so spaced that

together they commanded the entire area of the stage, though naturally with varying efficiency according to the directional patterns of their fields of response. In effect there were four separate beams which, since the microphone positions were not subject to change during a performance, could not be made to follow the singers as they moved about the stage. Preliminary tests proved that with the microphones aimed upward to receive sound directly from the singers there was constant fluctuation of volume as the performers moved in and out of the beams. The difficulty was eventually overcome by aiming the microphones at the floor of the stage, so that they received only reflected sound. One problem remained, however. For reasons with which the reader should be sufficiently acquainted by this time, it was inadvisable to have all the microphones open at once; but how else could the engineer be sure of having the right one open at the right time? In some scenes the stage would be thronged with people, any of whom might burst into song at any moment. Unless the engineer knew the opera virtually by heart he could hardly expect to know where the next vocalization would come from. The solution was to have the director, who sat beside the engineer, provided with a score. Thus equipped, the director could anticipate the entrance of each voice or group of voices and indicate to the engineer by a prearranged system of hand signals the proper microphone to fade in.

These cases serve to illustrate three points: first, the necessity for flexibility and ingenuity in production methods; second, the importance of providing the director with a score of each composition to be broadcast; third, the value of cooperation between the director and the engineer. The latter, with his superior knowledge of the technical aspects of their joint task, can save the director many a headache. He can be trusted to deal expertly with questions pertaining

to microphone placement, and often has constructive suggestions to offer regarding the placement of performers. Once he has a clear idea of the acoustic effects—the balance, the quality of sound, the "presence," or the perspective—that the director wants to achieve, he will do his best to realize them. The director, on the other hand, being better acquainted with the music performed and not being preoccupied with the V.I. and the controls, can greatly facilitate the engineer's task by giving him advance notice of developments involving changes in the control settings. He should warn the engineer, for example, of abrupt variations of volume, such as unexpected loud chords, and of changes of microphone, as from program to announce microphone or vice versa. Where the controls are housed in a soundproof booth, as they are in all broadcasting studios, these signals may be given orally. In pickups from places not designed for broadcasting, the portable equipment used often has to be set up in a location where silence must be maintained. Communication between the director and the engineer must then be by hand signals.

Hand signals are also used by the director to communicate with performers during a broadcast. Among those most commonly used are the following:

Speed up: Describe small circles in the air with the extended index finger.

Slow down: Join tips of fingers and thumbs of both hands and move hands apart, as if stretching a rubber band.

Program running according to schedule: Place tip of index finger on end of nose.

Stand nearer the microphone: Hold hands about two feet apart and move them toward each other.

Stand farther from the microphone: Place palms of hands together and move them apart.

Play the signature (theme): Extend one index finger vertically and place the other across its tip, to form a **T**.

Make cut tentatively provided for: Draw finger across throat.

Do not make cut: Place side of index finger against throat and shake head negatively.

To express commendation or reassurance: Form circle with thumb and index finger, extending the other fingers.

13

Vocational Requirements of Music Broadcasting

HAVING CONSIDERED the various kinds of work performed by the musical staff of a broadcasting organization, persons contemplating a career in this field will presumably be interested in knowing the aptitudes, training, and experience needed to qualify them for positions in its several branches. To a certain extent the qualifications required for a given job may be inferred from the nature of the tasks performed, but some of the requirements may not be self-evident to those without actual broadcasting experience. For that reason the qualifications that have proved essential or advantageous in the various phases of music broadcasting are summarized here.

EXECUTIVE POSITIONS

This category includes managers of network music divisions and heads of station musical staffs, however designated. Such jobs are, of course, limited in number and greatly sought after. They are usually reserved for musicians of wide experience and at least local renown who have demonstrated both executive ability and a capacity for the development of program ideas.

The head of the musical staff should have the personality to deal competently with his subordinates, with other execu-

tives of his organization, and with the public. His knowledge of music and musicians should be extensive and his tastes catholic. If, as is usually the case, he is a "serious" musician by predilection, training, and experience, he should nevertheless be familiar with and sympathetic toward popular music of all types. He should be able to recognize excellence in jazz as readily as in the classical forms of music, to evaluate a popular singer as shrewdly as he judges an operatic voice. Quantitatively, popular music plays a larger part in broadcasting than does serious music, except at a few stations that cater to special audiences. In the majority of cases it is important for the director of broadcast music to know his way about in both fields.

If his organization is a commercial one the musical director should cultivate a sympathetic attitude toward the views and aims of sponsors. He may often feel compelled to oppose them, but he should at least give them respectful consideration. It is his duty to defend the integrity of serious programs, and to maintain the policies and standards of his own organization, but this can be done without assuming an uncompromising attitude toward the client's interests. If a suggestion is made that, in the musical director's estimation, is detrimental to the program, it can generally be modified or replaced with a better plan acceptable to the client, if the problem is approached in a cooperative spirit.

The head of the musical staff should also be a good organizer and a judge of ability in others. He should understand thoroughly the operation of his division and be capable of devising ways to improve its efficiency. He should know how to delegate responsibility and authority and how to select subordinates competent to assume both. Finally, he should be a practical business man. The artistic idealist to whom budgets are a bore and figures a mystery has a poor chance of survival as a radio executive. Musical programs

are expensive and their cost can easily become prohibitive. Unless the director can keep within his appropriations and get full value for his expenditures his own value to the organization will be open to question.

THE MUSIC LIBRARY

Under this heading are grouped directors and assistant directors of the music library, music buyers, cataloguing clerks, music and record supply clerks, composers, arrangers, and copyists. The qualifications needed for these jobs include the following:

Directors. The music libraries maintained by the major networks are rather formidable. That of the National Broadcasting Company, for example, contains more than half a million titles, the symphonic section alone comprising well over five thousand orchestrations. The work of such a library is both extensive and complicated. Its director should be a musician of sound training and broad experience, familiar with all kinds of music and the sources from which it can be obtained, with the make-up of orchestras and choral groups of all types, and with library methods, including cataloguing and filing systems. Previous experience in a music library or music store would be valuable. Executive ability—that is, the ability to see the broader aspect of an operation, to systematize work, to select and guide personnel —is essential. If composing, arranging, and copying come under his jurisdiction he should be familiar with the methods employed in those activities and acquainted with their leading exponents in the local field.

Local-station libraries, having less work to do and fewer persons to supervise, are unlikely to require a director. Many of them employ only one librarian, who performs all the duties connected with the maintenance and supply of music

materials. In such cases there is less need for executive ability and more for orderliness and attention to details. Musical training and experience, preferably in orchestral work, are prerequisite in all cases.

Music Buyers. These jobs exist only in very large libraries whose operations involve the acquisition of considerable quantities of music material. They require a thorough knowledge of the sources from which music and recordings can be obtained, and of photoduplication and other expeditious methods of reproducing music materials. The buyer should know the type or types of music contained in each publisher's catalogue, and the resources of local music dealers, rental libraries, and reference libraries. Experience in a music store would be valuable as a preparation for the job, particularly if the store were a large one dealing in all kinds of music.

Cataloguing Clerks. This work requires musical knowledge and training in library methods. A college music course supplemented by practical experience in the cataloguing and filing of music should provide adequate preparation.

Radio music libraries are usually catalogued under three headings: composer; title; and subject or type. The third classification is designed to help program builders in selecting compositions suitable for a particular kind of program or related to a given topic, occasion, or place. It requires accurate and comprehensive musical knowledge on the part of the cataloguer.

Libraries differ in their filing methods. Some use an alphabetical system, filing standard works alphabetically by composers and popular compositions alphabetically by titles. Others prefer to file all music numerically in the order of acquisition. Prospective applicants for cataloguing jobs would do well to familiarize themselves with both systems. They should also be able to type with speed and accuracy.

Music Supply Clerks. The principal requirement for this work is a knowledge of the make-up of different orchestral combinations, from jazz bands to symphony orchestras. The music supply clerk's first task is to determine from the music sheet the compositions to be used on a given program and the kind of orchestra assigned to play them. He then obtains the proper orchestrations from the files and "lays out" the parts—i.e., distributes them to separate folders provided for the individual instruments of the orchestra. In order to make sure that each orchestration is complete, the clerk must know how to determine the exact combination of instruments for which it is scored, and he must know whether the scheduled orchestra includes all the required instruments or whether it will be necessary to crosscue any of the music on the program. He must also be able to determine the keys of accompaniments, in order to be sure that those he supplies are in the proper keys. It is apparent, therefore, that his job demands musical training and practical experience in the use of music. Work in the orchestra department of a music store would help to prepare him for it. The job of the record clerk, who files and supplies phonograph records and transcriptions, calls for less musicianship but requires an extensive knowledge of recorded music. Experience as a record salesman would be advantageous.

Composers. The first requisite for a staff composer in a broadcasting organization is that he be a good composer. In other words, he should have creative talent and be thoroughly grounded in the techniques of composition. The second requirement is a talent for writing descriptive music. Most of the music composed for broadcasting is used in dramatic programs to establish an atmosphere, intensify a mood, or heighten the emotional value of a scene. The radio composer should therefore have the knack of giving musical expression to extramusical ideas. He should also be adaptable, coopera-

tive, and able to work rapidly under pressure. Experience in composing for the stage or screen would be valuable.

Arrangers. The arranger, like the composer, should be a master of his trade before seeking a job in broadcasting. His musical training should be sound and his experience in orchestration extensive. He should be familiar with past and current styles of instrumentation, and should know how to arrange for choral groups of all kinds. If his field is serious music he should know how to score the accompaniment of a song in the style of its period. If he specializes in popular music he should be prepared to make arrangements in any of the popular styles, such as "hot," "sweet," and "swing."

The kind of previous experience that would be most valuable to a radio arranger depends on the type of arranging he expects to do. Many arrangers of serious music have worked for publishers before turning to broadcasting. Popular arrangers have usually had experience in publishing houses, in the theatrical or motion picture field, or with dance bands. Whatever his background, the arranger will probably find that the tempo of his work will have to be accelerated when he joins the staff of a broadcasting station.

Copyists. The kind of copying that broadcasting demands is something more than the word implies. It rarely consists of mere duplication. More often the copyist is expected to be something in the nature of a translator, cryptographer, and mind reader combined. He must take the condensed and abbreviated scores provided by composers, interpret their frequently obscure indications, and transcribe them into conventional and legible notation. He must also be able to transpose accompaniments from their original keys to any other keys. In order to do these things he must be thoroughly familiar with the peculiarities of instruments—their ranges, capabilities, limitations, and transpositions. Such ability can be acquired only through training and experience equal to

those of the arranger. Many network copyists, in fact, are fully qualified arrangers who happen to be expert in musical penmanship. Practical experience in copying may be gained in such establishments as publishing houses, theaters, music schools, and libraries.

THE STAFF ORCHESTRA

Contractors. The orchestra contractor should be a musician of broad experience and wide acquaintance among orchestral players. He should be a good judge of talent and have both executive ability and the special kind of tact needed in dealing with personnel of a sensitive and temperamental species. Membership in the musicians' union is obligatory. The contractor usually is or has been an orchestral player himself and has demonstrated his fitness for an executive position by a consistent display of intelligence, level-headedness, and willingness to accept responsibility. Special training for the position is neither available nor essential, as its requirements, apart from musical experience, are of a personal rather than technical nature. However, previous experience in a similar position—as, for example, in a symphonic or theater orchestra—would be of value.

Staff Musicians. The members of radio staff orchestras are expected to be highly qualified players of their respective instruments and excellent sight readers. In some cases they are also required to be unusually versatile. The large orchestra staffs maintained by the networks generally comprise two separate groups of musicians, one for serious music and the other for jazz, but the members of smaller organizations may be called on for both types of performance.

Staff pianists and organists have to render an even greater variety of services. The former must be prepared to take their place in the orchestra when its instrumentation includes

the piano, to participate in chamber music, accompany soloists and vocal groups in rehearsals, auditions, and broadcasts, and to perform from time to time as soloists in their own right. Organists have similarly varied duties, and are usually required to be equally competent as players of the pipe organ, electronic organ, and harmonium. Both pianists and organists spend long hours in the stand-by studio, ready at an instant's notice to fill any gap in the regular program service. All staff musicians must belong to the union. The performing musician needs no special preparation for radio work. The talent, training, and experience required for success in other fields are sufficient to qualify him for duty in a broadcasting orchestra.

MUSIC RIGHTS

Copyright Specialists. Few positions in broadcasting are harder to fill than that of copyright specialist, owing to the difficulty of acquiring the peculiar kinds of knowledge and experience that the work demands. The qualifications include familiarity with the copyright laws of the United States and other countries; with all types of music; with the catalogues of music publishers, both domestic and foreign; and with the repertories of American licensing agencies and their foreign affiliates. Unfortunately, there appears to be no school that offers training in all these subjects, and no line of business where experience in all phases of the work can be obtained. The editorial departments of publishing houses afford perhaps the best available training ground, but the emphasis there is on publication rights rather than performance rights, and some of the problems that arise daily in broadcasting, such as the clearance of phonograph records and transcriptions, are never encountered there at all. Consequently, broadcasting organizations are obliged to train

their own copyright people, selecting promising candidates from among the available personnel, starting them out as copyright clerks, and eventually promoting them to the rank of copyright specialist.

Copyright Clerks. These assistants to the copyright specialists should be competent typists, expert filing clerks, accustomed to dealing with music, alert, and generally intelligent. As their job may be a stepping stone to that of copyright specialist, they should be capable of learning the complexities of copyright work while performing their own duties. Previous experience in the music publishing or music merchandising fields would be advantageous.

Lyric Editor. The work of a lyric editor calls for little in the way of special training but its requirements are exacting with respect to intelligence, judgment, taste, and sense of responsibility. Thorough familiarity with the broadcaster's program policies is essential, and a naturally courteous and tactful manner is eminently desirable, inasmuch as the lyric editor deals chiefly with clients, publishers, and the general public. A knowledge of foreign languages is helpful in clearing the numerous foreign language lyrics that are submitted for broadcasting.

Duplication Clerks. The principal requirements for this job are experience and accuracy in maintaining and using indexed files, and familiarity with musical titles, particularly those of popular compositions. Experience as a music salesman would constitute a desirable background for this work.

Program Contact Clerks. Orderliness, accuracy, dependability, and a capacity for detailed work are some of the qualities that the program contact clerk should possess. Also, because of his dealings with clients of the company, he should be patient, considerate, and courteous. He should be able to type his own programs. Musical training and experience are desirable if not essential, and previous experience in

some kind of public relations work would be advantageous.

Miscellaneous Clerical Jobs. Secretaries should, of course, be thoroughly trained in stenography and typing. Musical training and a knowledge of who's who in the musical world are highly desirable, particularly in secretaries to division heads or musical directors.

The chief requisite for typists is speed and accuracy. Familiarity with musical terminology and the names of composers is helpful.

Filing clerks should have had some experience in filing, preferably in a library or music store. Musical training is not required but would certainly do no harm.

RESEARCH

Musical Research Specialists. It is difficult to define the types of training and experience needed to qualify for musical research work. However, any or all of the following qualifications are desirable:

Training in the theory and history of music; training in applied music and experience as a performing musician; experience in the use of reference libraries; familiarity with sources of musical information, such as musical encyclopedias and other reference works; familiarity with publishers' catalogues; knowledge of sources of rare music; knowledge of accessible collections of musical instruments in museums or in private hands; knowledge of local talent sources and of current musical activities; ability to read scores and to decipher archaic musical notation; reading knowledge of foreign languages, particularly French, German, Italian, and Spanish.

It should be noted here that broadcasting employs few people exclusively for musical research, as much of that work is done as an incidental part of other assignments.

Skill in research is therefore more likely to prove helpful to those engaged in program building or conducting than to provide an entree to broadcasting on its own account.

SUPERVISION OF MUSICAL INSTRUMENTS

Requirements for this job include a knowledge of the leading musical instrument manufacturers, dealers, and repairers, and of the construction and operation of various keyboard and percussion instruments. A sensitive and well-trained ear is a desirable attribute, since the supervisor is often called on to test the tuning or voicing of pianos, organs, and other tunable instruments. Experience in instrument making or repairing would be advantageous.

PROGRAM BUILDERS

There was a time when program building was a specific job in broadcasting. People were hired as program builders and devoted their attention exclusively to that work. Fashions change, however, and the program building staff no longer exists as a separate unit, its functions having been transferred to other members of the organization. As stated in Chapter 6, most programs are now built by production directors, though symphonic programs are generally built by their conductors and certain types of educational program are sometimes assigned to specialists who may or may not be regular employees.

Since program building has become a collateral or subsidiary task, the qualifications needed for it vary according to the nature of the primary job to which it is attached. If the program builder belongs to the production staff the chief requirement is that he be a competent production director; if he is a conductor he should be, first of all, proficient in conducting.

The qualities and techniques that contribute to effective program building have already been discussed in Chapter 6. All that need be added here is that he who aspires to build musical programs for broadcasting should equip himself for one of the primary jobs of which program building is a component part—unless he happens to be a recognized authority on some subject suitable for broadcast presentation. In that case he may, if his scholarship is properly seasoned with showmanship, succeed in devising a program plan so attractive that some broadcaster will accept it and retain his services for its preparation.

CONDUCTORS

The most essential part of a conductor's equipment is talent—that is, talent for conducting. Keenness of ear, sense of rhythm, interpretative insight, and the instinct for leadership are among the qualities that enable one musician to direct the performance of others. Formal training in the techniques of conducting is secondary. That is not to say that a conductor needs no *musical* training. On the contrary, his general musical education should be exceptionally broad and thorough. He should be a competent player of at least one instrument and should be able to read a score. Experience as an orchestral player is most desirable. A musician with such a background and genuine talent for conducting is likely to be better prepared than many a graduate of conducting classes.

However, before he seeks a job in broadcasting he should have experience—extensive and diversified experience—in conducting. He should have directed performances of various kinds of music under various conditions, and he should have learned to think fast, react instantaneously, and keep his head in emergencies. There used to be a school in which the

conductor could learn the routine of his craft more rapidly and more thoroughly than anywhere else. That was the vaudeville theater, where anything was likely to happen, where rehearsals were of the sketchiest kind and cues had to be caught on the fly. Now that vaudeville is a thing of the past, the best remaining schools are the motion picture theater orchestras, of which there are few nowadays, and the musical comedy theaters.

Unfortunately, it is probably as hard for a young conductor to get a job in the theater pit as it is for him to become a radio staff conductor. Conducting jobs of any kind are difficult to obtain without experience—and experience is difficult to acquire without a job. It is a vicious circle. The aspiring conductor may take courage from the knowledge that others have broken it and that if he possesses the qualities necessary for success in the profession he will find a way to break it too.

MUSICAL CONTINUITY WRITERS

The basic qualifications for a writer of serious musical continuity are a good general education, a sound knowledge of music, and the ability to write about it interestingly and rapidly. Experience in journalistic criticism or in writing explanatory notes for concert programs would be helpful but would not do much to develop the knack of writing for the ear rather than the eye. Many schools and colleges offer courses in radio script writing that should help the student to cultivate ear-mindedness. Such courses undoubtedly afford valuable if not complete preparation for a job in broadcasting.

The writing of popular continuity calls for less learning and more wit. Musical erudition is hardly essential, though it need not be a handicap if the writer has sufficient knowl-

edge of and sympathy for popular music. Humor, lightness of touch, and familiarity with the latest slang are desirable attributes. It is doubtful whether training in this type of writing is available anywhere, but experience in the field of popular entertainment should constitute a suitable background and tend to develop the proper state of mind.

MUSICAL PRODUCTION DIRECTORS

It goes without saying that a director of musical programs should be a well-trained musician. In addition he should have at least a general understanding of the characteristics and functions of the various electrical devices used in broadcasting. The ideal preparation for the job would be a course in radio engineering superimposed on a musical education of the type afforded by the leading music schools of the country. However, as few graduate musicians are likely to have either the time or the inclination to study engineering, a more practical plan is to take a course in production at some college or university. These courses, which are now available at many schools, give instruction in the techniques of the job and in many cases include experience in directing programs under real or simulated broadcasting conditions.

BREAKING INTO BROADCASTING

To those who have prepared themselves for work in the musical branches of broadcasting—and to many who have not —the all-important question is "How can I go about finding a job?" The answer is that there are various ways, none of them guaranteed to succeed.

Approaches differ according to the kind of job sought, the qualifications of the seeker, and the type of organization to which he applies. The networks, having larger musical staffs

than the individual stations, provide more opportunities, but the competition for them is keen and the requirements very exacting, particularly with respect to previous broadcasting experience. Applicants for network positions will find their chances much improved if they can point to a record of successful achievement at some local station. Lacking such experience, they may still hope to gain access to the music division by way of the junior guide, page, or messenger jobs which, in the case of certain networks, constitute a sort of apprenticeship. Young people hired in these capacities are given an opportunity to study the organization of the company and the operations of the division in which they are specially interested, and when a vacancy occurs in that division those with suitable qualifications are encouraged to apply for it. Many responsible positions at NBC have been filled by alumni of these staffs.

The staff orchestra serves a somewhat similar purpose as regards conducting, many conductors having played for years in the orchestra before finding an opportunity to demonstrate their fitness to lead it.

The networks have personnel departments that screen applicants, record their qualifications, and help to place them if possible. The annual turnover of musical employees is small in normal times, which means that vacancies are seldom very numerous. They do occur, however, and persons with the necessary training, experience, and persistence may reasonably expect to find one eventually.

14

Music on Tomorrow's Air

IN THE quarter century since the first crystal receivers found their way into the hands of the public, radio broadcasting has changed in many ways. The crystal has long since been replaced by vacuum tubes, the headphones by loudspeakers. Transmitters have increased their power and efficiency, new frequency bands have been explored and exploited, program schedules have been expanded, and vast networks have been formed. Great advances have been made, but they have consisted chiefly of refinements of existing techniques and equipment. Except for two radical innovations, the effects of which have not yet been very widely felt, broadcasting in 1945 was basically the same as in 1920. The exceptions referred to are frequency modulation, which represents a fundamentally different method of harnessing sound to the hertzian waves, and television, which makes radio the servant of a second sense.

Both frequency modulation and television were stunted in their youth. They had survived the perils of infancy and were beginning to show great promise when their development was arrested by the Second World War. During its long years they were forced to remain dormant, and even when the war ended their troubles persisted, for they then had to undergo an operation on their frequency allocations. That is over and done with now. The operation has been pronounced

successful, and the patients appear to be convalescing, slowly but surely.

What their eventual recovery will mean to music broadcasting remains to be seen. Will FM ultimately replace amplitude modulation, or will it remain what it has been thus far, a supplementary service? Will some other method of modulation prove superior to either FM or AM and supersede them both? Will the newer forms of modulation, such as pulse-time or velocity modulation—the latest method of all, concerning which very little information has been released [1]—hasten the advent of stereophonic broadcasting? Will television evolve new types of musical program presentation?

These are questions of prime interest to broadcasters, and, presumably, to listeners as well. The future holds the answers, and until it reveals them we can do no more than speculate concerning them, basing our guesses on what is known of the latest developments in radio. Speculation may be idle but it is often fascinating; which may account for the fact that while the crystal detector is obsolete the crystal ball is still in use—and no less reliable than it ever was. With its aid the curious reader may possibly catch in the following pages a glimpse of things to come.

FREQUENCY MODULATION

As mentioned in Chapter 2, frequency modulation differs from amplitude modulation—the method of modulation first used in broadcasting and still used by standard-wave and international short-wave stations—in that it converts the impulses of audio-frequency current into variations of the frequency, rather than the amplitude, of a carrier wave. It has the following advantages:

[1] See *The New York Times*, April 24, 1946, p. 27.

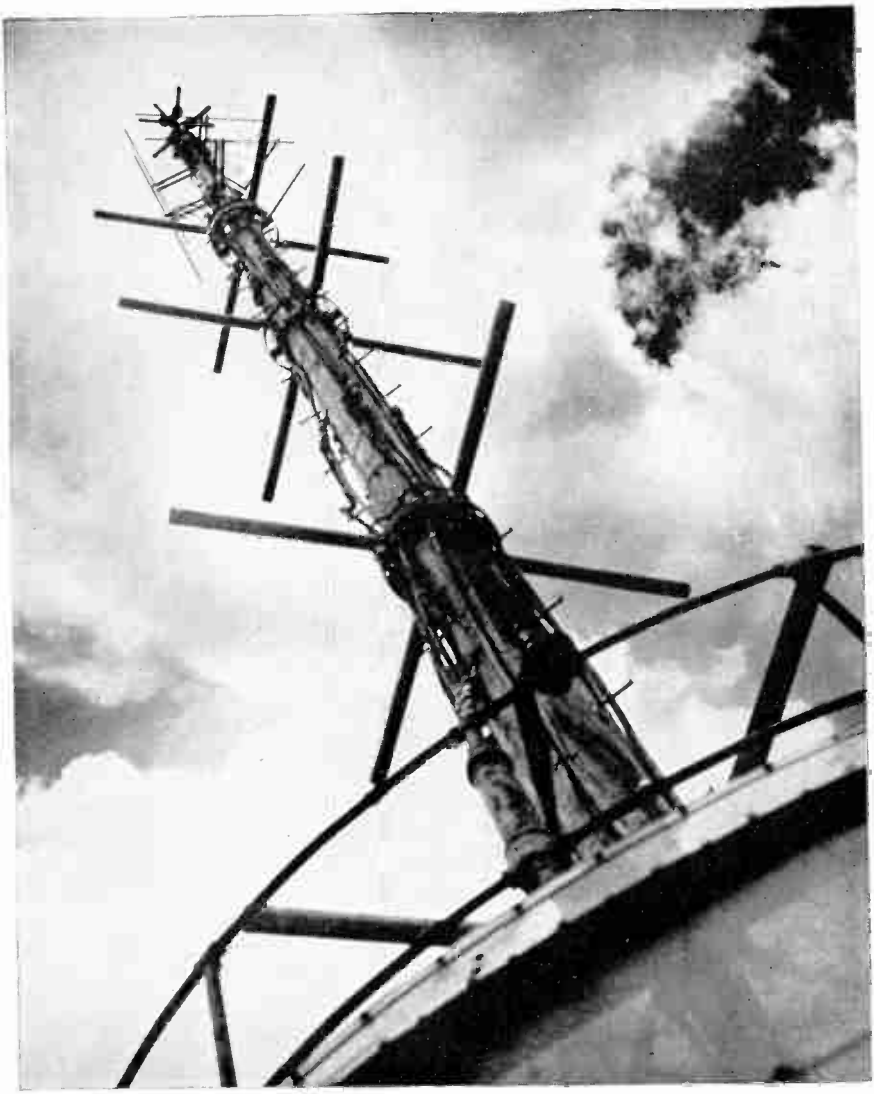
1. Comparative freedom from static.

2. A wider audio-frequency band, owing to the fact that the channels assigned to FM stations are much wider (200 kilocycles) than the 10-kilocycle channels of standard-wave stations.

To the music-loving listener FM means clearer reception and more faithful reproduction of the frequency range of sound. If he is fortunate enough to obtain a loud-speaker of the requisite efficiency FM will be able to bring him every pitch that his ear can perceive, from the lowest bass of the pipe organ to the highest harmonics of orchestral instruments. Some day it may even bring him stereophonic sound, since FM channels are wide enough to permit the transmission of two separate signals, each with a frequency range wider than that of standard-wave broadcasting.

FM broadcasting, first developed by Major Edwin H. Armstrong, was inaugurated in 1934 over station W2XF, an experimental transmitter of the National Broadcasting Company in the Empire State Building in New York. By 1942 there were twenty-five commercial FM stations in operation in the United States, and some 350,000 receivers had been sold to the public. The war put a stop to the construction of transmitters and the manufacture of receivers, but not to the laying of plans for postwar FM expansion. Before hostilities ceased many applications had been filed with the Federal Communications Commission for permission to build and operate new FM stations as soon as the necessary materials and personnel should become available.

In June, 1945, the FCC decided to move FM broadcasting from its original position in the 43–50 megacycle band to new channels lying between 88 and 108 megacycles. As no existing FM receivers were designed to tune in the new frequencies, the change meant that FM stations, except those which asked and received permission to continue using their



Transmitting antennas of the NBC television and FM stations on the tower of the Empire State Building in New York.

A television studio set. Note clusters of high-powered lights and boom microphone (right).

old frequencies for a time in addition to the new ones, would be without an audience from January 1, 1946, when the new allocations became effective, until new receiving equipment could be made available to the public.

In spite of all setbacks, the future of FM broadcasting appeared reasonably bright at the end of 1946. FM licensees continued to operate their stations, notwithstanding the temporary lack of listeners, and new receivers were beginning to appear in the market.

Leaders in the broadcasting industry continued to express confidence in FM's destiny. Dr. Frank Stanton, President of the Columbia Broadcasting System, stated at a hearing before the Federal Communications Commission on April 24, 1946,[2] that "The fundamental advantages of FM over AM make it inevitable that FM will replace AM as the preferred service of the great majority of listeners. . . ." William S. Hedges, Vice-President in Charge of Planning and Development, National Broadcasting Company, testifying before the FCC at Chicago on June 6, 1946,[3] discussed FM at some length. The following excerpts from his testimony indicate his attitude toward the subject:

. . . FM has certain advantages not possessed by AM, principally the advantage of being noiseless. It is able to ignore not only natural static, but a great deal of man-made static. . . . The virtue of being noise free would indicate that it would have very wide acceptance in areas which are subject to a great deal of static. . . . FM would likewise be, it seems to me, a very popular type of receiver in metropolitan areas, where there is a great deal of electrical interference caused by factories, and other uses of electrical power in those areas. Therefore, I would visualize a rather rapid growth of the FM audience through the sale of receivers to the public in the metropolitan areas, in the southern parts of the United States, and with less rapid growth of the FM

[2] FCC Docket No. 6741, p. 1579.
[3] FCC Docket No. 7146, pp. 740–742.

audience in the other parts of the nation. . . . FM may supplant, probably will supplant a great many of the local stations, and many of the regional stations. In supplanting those stations, there will be a period of transition, which the public itself will decide through its purchase of FM receivers. . . .

"HIGH FIDELITY"

For some years there has been talk of high-fidelity transmission and reproduction. Particularly since the introduction of FM, the term has been reiterated, its desirability stressed, and the implication conveyed that FM is synonymous with it.

Whether FM is actually capable of achieving high fidelity depends upon the construction placed upon the term. If it refers merely to reproduction of the full audio-frequency band there is some justification for the claim, since, as we have seen, the wide FM channels make it possible to transmit sound frequencies up to 15,000 cycles; but if it is construed as meaning absolutely faithful reproduction of all characteristics of the original sound, high fidelity is still beyond the capacity of FM or any other monaural system.

In a discussion of the subject by three members of the NBC Engineering Department[4] the conditions essential to true fidelity are defined as follows:

1. The system must not discriminate in any of its component parts against any frequency within the range under consideration.
2. No component part of the entire system must introduce false harmonics.
3. There must be no amplitude limitation of any portion of the spectrum in either transmission or reception.
4. The system must be free from phase distortion.
5. The system must be free from extraneous noise.

[4] G. M. Nixon, Assistant Development Engineer, C. A. Rackey, Audio-Video Facilities Engineer, and O. B. Hanson, Vice-President and Chief Engineer, *Down to Earth on High Fidelity* (New York: National Broadcasting Co., Inc., 1944).

6. The loudspeaker and its driving amplifiers must be capable of reproducing without distortion the full frequency range at loudness levels suitable for all listeners.

7. The acoustics of both the pickup and listening spaces must be suitable.

8. The spatial relationships of the sources of sound must be transmitted and reproduced.[5]

If these are the requirements for true fidelity it is obvious that no existing system approaches it very closely. Whether any system will attain it in the near future seems to be a question for the listening public to decide. The NBC engineers quoted above believe that it is attainable. "A system as described above," they remark, "with the exception of binaural or stereophonic transmission, is not too difficult of realization from a transmitting standpoint. It might be closely approached in a receiver reproducing system, but the cost would probably be beyond the value which would be placed upon it by the purchasing public, particularly if the receiver were required to reproduce frequencies from 30 to 15,000 cycles."

The public's attitude toward improved fidelity is not yet clearly evident. There is reason to believe that the demand for FM receivers prior to the war was partly if not chiefly due to the purchasers' desire for more faithful reproduction of the higher sound frequencies; but, on the other hand, studies of listener preferences made within the past few years seem to indicate that the public not only does not feel the need of full-range reproduction but, in some cases, finds the range provided by current types of standard-wave receiver too wide for its taste. For example, a survey made by Samuel A. Gill[6] in 1940 indicated that a majority of the owners of radio sets equipped with a tone control kept that control ad-

[5] That is, stereophonic sound transmission and reproduction are essential.
[6] *Gill's Index*, Vol. II, No. 5, August 22, 1940.

justed to exclude a part of the limited high-frequency band which the receiver was designed to reproduce.

Another test, more comprehensive in scope, was conducted by CBS engineers in 1945.[7] The results of this study tended to confirm the impression that wide-band reproduction is not desired by the majority of listeners. However, despite the care with which this test was planned and carried out, one factor was omitted: the effect of the monaural characteristic on the quality of sound. May it not be that the distortion inherent in monaural reproduction is more apparent in the higher frequencies than in the lower, and that the listener's aversion to wide-band reproduction is due to this abnormality rather than to a dislike of high-frequency sound as such?

It is difficult to believe that listeners who know how music sounds when heard directly would prefer an admittedly inadequate imitation to the real thing, even though they have been conditioned to monaural reproduction for many years. It is to be hoped that tests will soon be made of high frequency acceptability in stereophonic reproduction.

PULSE-TIME AND VELOCITY MODULATION

Information concerning these methods of modulation is insufficient at the present moment to indicate their utility as media for the broadcasting of music. Presumably, they are not inferior to FM in their ability to transmit the full range of audio frequencies, and they may enjoy even greater freedom from noise, since they operate at radio frequencies far higher than any produced by natural static. One aspect of pulse-time modulation seems promising as an aid to higher fidelity—i.e., its capacity for multiplex transmission, which

[7] Howard A. Chinn and Philip Eisenberg, "Tonal Range and Sound Intensity Preferences of Listeners," *Proceedings of the I.R.E.*, September, 1945, pp. 571–581.

should help to remove one barrier to stereophonic transmission. However, accurate appraisal of the value of both devices from the musical point of view must await further experiment, or at least further revelation of the facts concerning them.

RECORDING

Phonographic recording today utilizes techniques similar to those of broadcasting, with the exception of radio transmission and reception. The studios, production techniques, microphones, amplifiers, and loudspeakers are substantially the same as those used in broadcasting—in fact, many recordings and transcriptions are made in broadcasting studios, and many home record players are built into broadcast receivers and make use of the radio loudspeakers. It is natural, therefore, that the recording art should keep pace with the advances in broadcasting.

Progress in the making of records during the past twenty years has been considerable, as anyone will grant who has compared a modern example with one of the old acoustical recordings. The largest orchestras can now be picked up effectively, whereas scarcely half their complement could get within range of the horns formerly used instead of microphones. Fidelity has improved, surface noise has been reduced, and the slow-speed (33⅓ r.p.m.) transcription has made it possible to record fifteen minutes of music on one side of a sixteen-inch disk, as compared with the four to four-and-a-half minutes provided by the twelve-inch disk at 78 r.p.m. Improvements have also been made in reproducers and in the methods and materials used in the manufacture of records. RCA Victor, for instance, has recently placed on sale a new type of plastic record that has superior tonal qualities and is exceptionally durable.

Further refinements are in the offing, and the near future

may bring some radical departures from the established methods of recording. During the war the techniques of magnetic recording, first applied some years earlier, underwent extensive development and were widely used for military purposes by both sides. In the United States a magnetic recorder was produced that transcribes a full hour's program on a small spool of wire.[8] This should prove very useful for certain purposes, such as providing a reference recording of a broadcast program, a business meeting, or a public address, but it seems unlikely to compete with the conventional type of recording for home use unless some method of duplication can be devised that will be as speedy and economical as the duplication of disk records by stamping out copies in a press.

Another magnetic recorder is the Magnetophon, a German invention which records on plastic tape impregnated with iron oxide. One type of Magnetophon, known as the K7, has recently been improved by American engineers and is said to have a frequency range from 25 to 15,000 cycles and a volume range of 80 decibels. Each reel of tape has a capacity of about twenty minutes of continuous high-fidelity recording, and the tape can be readily cut or spliced. Information concerning the several types of Magnetophon is available in reports issued since the war by the United States government.[9]

Always a possibility, though not, apparently, very imminent, is the stereophonic phonograph recording.[10] It has been

[8] See Alex. E. Javitts, "An Appraisal of Design Trends in Magnetic Sound Recorders," *Electrical Manufacturing*, June, 1946.

[9] See *High-Fidelity Magnetophon, Magnetic Sound Recorder*, Final Report, No. 705, prepared by Capt. James Z. Menard, War Department; also Photostats Nos. PB-12659, PB-1027, PB-1346, and PB-3586, Office of Technical Services, Department of Commerce, Washington, D. C.

[10] Stereophonic recording on film was used in the Walt Disney motion picture *Fantasia*, produced in 1940, but its realism was somewhat obscured by the location of loudspeakers in various parts of the theater, which caused the sound to approach the listener not only from the direction of the screen but from several other directions as well.

produced in the laboratory, but it seems unlikely to progress much farther until there is some demand for it on the part of the public. Stereophonic recording, like stereophonic broadcasting, is caught in a vicious circle: it cannot be justified economically until the public wants it, and the public cannot be expected to want it until it has had a chance to try it.

TELEVISION

The crystal ball is not very communicative on the subject of music in television. "Video" is still so young, as compared with radio, and its use of music has been on such a limited scale that future relationships between the two arts are exceptionally difficult to foresee.

Prior to 1945 some experience had been gained in the televising of certain types of live musical program. Recitals, concerts, and musical variety shows had been presented, and studio performances of operas and musical comedies had been given, but the televising of opera in opera houses and concerts in public auditoriums was not yet practical because of lighting requirements. The supersensitive *image orthicon* tube, which enables the television camera to "see" by candlelight, promises to solve the lighting problem, but there has been no chance to test it in the opera house or concert hall since its development in the autumn of 1945.

The suitability of opera to television is obvious. It is essentially a dramatic performance, with action and pictorial effects that appeal strongly to the eye. Operas vary, of course, in their ability to hold the observer's interest. Some are rather slow-moving and their star performers are not always visually convincing in their parts; but there is probably no opera that is not more enjoyable when it is seen as well as heard. Concerts, on the other hand, have no great eye appeal —or, at most, a limited variety of visual interest. Some con-

certgoers like to watch the conductor or the soloist or the kettledrummer, but whether a typical symphony concert or solo recital will prove diverting enough to the televiewer to hold his eye for an hour or more is a moot question. If not—if the television fan gets tired of watching and merely listens—it will not be good television. It will, in fact, be nothing more than radio broadcasting.

Perhaps television concerts will be shorter than radio concerts. Half an hour may prove to be the maximum length of time that viewers can be expected to devote to a symphony concert, and ten or fifteen minutes may be the limit of attention to a recital; or it may be that some means will be devised of increasing the visual appeal of such programs. Some indication of what can be done along those lines has been given by motion-picture presentations of concert performances. By using several cameras and a reasonable amount of imagination an orchestra at work can be made a vital and fascinating thing to watch, at least for a quarter of an hour or so. The orchestra can be viewed from various angles, the conductor can be shown in close-ups from the front, giving the audience a musician's-eye view of his gestures and facial expressions such as it never sees in the concert hall, and intimate "shots" of the various instruments can be timed to coincide with their playing of prominent passages.

Television may develop a new art, already adumbrated in Disney's *Fantasia,* in which the musical performance will be accompanied by a visual representation not of the performers but of some scene or dramatic subject related to the music. One can imagine effective and appropriate treatment of programmatic pieces, such, for example, as Smetana's *Moldau,* without resort to Mr. Disney's whimsical approach. With the aid of motion-picture techniques television may some day achieve a visually convincing presentation of the *Ride of the Valkyries.*

Where popular music is concerned the outlook is less obscure. Dance bands, with their snappy uniforms, photogenic leaders, and ecstatic drummers, provide a fascinating spectacle for their adherents. Television will not have to worry too much about their eye appeal. Vocal solos, duets, and quartets, however, will probably require special treatment. It will not be enough for the singers to have good voices; they will have to have good looks, and probably also the ability to act. There is already a tendency to dramatize songs in television, sometimes merely by providing an appropriate setting, but occasionally by translating the text of the song into dramatic action. This practice is somewhat restricted because of the fact that it involves dramatic performance rights, which are not controlled as a rule by the agencies that license music for nondramatic performance. It is so obviously suited to television, however, that some way of facilitating the clearance of dramatic rights will probably be found before long.

Some years ago broadcasters experimented with several types of program in which the radio listener was invited to participate by singing or playing his part in music performed by a studio chorus or orchestra. These programs proved quite popular, attracting participants by the thousand from coast to coast, but their effectiveness was somewhat hampered by the inability of the participant to see the conductor. It was difficult for the widely scattered participants not only to keep together but even to begin together, since none of them could see the first beat of the baton. One program used a metronome to indicate the tempo at which each piece was to be played and the precise instant at which it was to begin, but the method was never entirely satisfactory, owing largely to the failure of the average receiver to reproduce adequately the high-frequency click of the metronome. Television, by making the beat visible, may possibly bring

about a revival of this type of audience-participation program.

The potentialities of visual broadcasting are so great that years may elapse before it is possible to determine fully the place of music in television or the value of television to music. As yet the crystal ball shows only dim and ghostly shapes, and the would-be seer is unable to perceive the effects that the addition of sight to sound will have on the broadcasting of music, or the types of musical presentation, as yet unknown, that video may evolve.

CLOSING SIGNATURE: Music broadcasting has come far and will go farther. Those who have accompanied it on the early stages of its journey have been richly repaid, if not in cash, at least in the satisfaction that comes of sharing in an unprecedented adventure and of helping, however humbly, to explore unmapped areas.

Those who join the expedition now or later may expect no lesser rewards. They will witness, and perhaps contribute to, discoveries that will rival those of the past. They will often find the trail rugged and the going hard. They will know fatigue and frustration and discouragement; but they are to be envied, for they will also know the triumph of achievement. And they will never be bored.

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