Figure 1
Setup in live-end dead-end studio.
(Courtesy Ralph H. Jones Company)

Figure 2
Eliminating unwanted pickup from live end or side walls with a cardioid or unidirectional mierophone.
(Courtesy Ralph H. Jones Company)

Placement and Operation of MICROPHONES IN BROADCAST STUDIOS

Analysis of Fundamental Microphone Arrangements That Can Be Used as a Basis for Complex Placements.

by JOHN B. LEDBETTER

Studio-Transmitter Engineer, WKRC

CORRECT PLACEMENT OF A PARTICULAR MICROPHONE depends on a number of variable factors such as the acoustic characteristics of the studio, type and placement of talent, directive response of the microphone, and the size of the audience. Because these factors are so widely variable no fixed rules or placement diagrams can be depended on to produce the desired effects in every application. Each program arrangement or variation thereof must be treated as an individual case and set up accordingly. Stringed instruments, especially bass viols, for example, are rather susceptible to humidity and temperature changes, and may thus require placement farther away from the microphone on damp, rainy days to maintain setup balance and to prevent predominance of the lower-frequency ranges. There are, however, basic setups and arrangements which have been worked out over a period of years and have proved most satisfactory in their individual applications.

In actual setups it is advisable to use as few microphones as possible for any given pickup, since microphones placed at different points in the same sound field introduce a certain amount of phase distortion. For small groups, orchestras or dance bands one microphone usually is sufficient, and in a number of cases has proven adequate for larger groups and even for complete concert orchestras. Proper overall balance is obtained by selective grouping of instruments and talent and the results checked by actual monitoring tests.

In featuring one or more instruments it is at times desirable to use an extra microphone for each featured instrument or section and fading the microphone in at the mixing panel.

In setups for a soloist with piano accompanyment an RCA 44-BX or similar velocity microphone is usually used. Placing the vocalist at a distance of from four to six feet from the microphone prevents excessive peaking of certain notes and eliminates the sibilant effect usually noticed at lesser distances.

A satisfactory balance between piano and voice is usually obtained by placing the piano, with top raised, about twelve to fifteen feet away with its open side facing the microphone.

In Figure 1 appears a typical setup for a small group in a *live-end dead-end* studio, with the group placed in the dead end, facing the live end and using a 44-BX bidirectional microphone; W. E. *8-Ball* used for sound effects. Sound reenforcement from the live wall may be controlled by tilting the microphone forward or turning slightly to either side. The stand may also be lowered a foot or so below the speakers' lip level and the face of the microphone tilted upward. Some announcers prefer this method in general speaking since it seems to allow a more natural stance. Unwanted pickup from the live end or from side walls of the studio may be eliminated by using a cardioid[1] or unindirectional microphone[2] and arranging the group as shown in Figure 2. Vocalists and announcers are usually instructed to stand at least two, and preferably three feet from the ribbon type of microphone to prevent accumulation and predominance of low frequencies. On the cardioid and unidirectional microphones close-talking may be ac-

Figure 3
Dance orchestra setup; violins 6′ from microphone, saxophones 4′ to 6′ behind violins, brass sections 6′ to 10′ behind saxophones.
(Courtesy WLW)

Figure 3a
Orchestral pickup with suspended cardioid and velocity piano-bass microphone.
(Courtesy WLW)

complished by standing close and speaking into the side of the microphone, that is, in the plane of its ribbon and thus operating only the pressure unit. With dynamic microphones[3] approach may be made to within one foot of the diaphragm without producing undesirable effects.

The arrangement in Figure 3 for dance orchestra is generally satisfactory in studio setups. The violins are placed at a minimum of six feet from the microphone, the saxes about four to six feet behind the violins, and the brass section removed six to ten feet behind the saxes, depending on their loudness. A second microphone may be employed when it is desired to feature muted trumpet or trombone or other special effects. The guitar, ordinarily placed about three or four feet from the microphone, may be placed on the soloist's side opposite the brass or drums if these instruments predominate, or an extra feature microphone may be added. The piano usually is placed at a distance of about twelve feet, with its top raised and the open side facing the microphone. A second piano may be placed at an equal distance and within the same angle of pickup on either side of the microphone, and then moved toward or from the microphone until the proper balance between pianos has been obtained.

For the same orchestra setup in a band-shell or remote pickup where audience and background noise is relatively high a more satisfactory pickup may be obtained by using a cardioid or unidirectional microphone placed in the same pickup position as the 44-BX velocity shown in Figure 3, but with the dead side facing the source of objectionable sound. This type of microphone also allows a higher level to be fed into the audience loudspeakers before a feedback point is reached. The announcer is allowed to assume a *close-talking* position at the side and about a foot away from the microphone when announcements are to be made over background music. It may be found advantageous to place him directly in front of the microphone, or, if the music level cannot be sufficiently controlled during his announcements, it may be necessary to provide the announcer with a separate microphone, placed with its dead side toward the band to maintain the proper levels between band and announcer.

A typical symphony (Figure 4) requires a wide-angle pickup of approximately 140° to 150°, and for this application a directional microphone[4] is most suitable. The cardioid, with its pick-up angle of 120° may be used satisfactorily by placing several feet farther from the orchestra. When background noises and acoustic conditions permit, two bi-directional microphones may be used for pickup, these being placed side by side and separated by at least six feet and turned so that their individual pickup angles of approximately 90° will collectively provide uniform coverage over the required area. By this means a weak section can be compensated for by increasing the gain of that particular microphone. A more perfect balance may often be accomplished by raising the unidirectional microphone to a height of six or seven feet and moving farther away from the group.

[1]W.E. 639-B.
[2]RCA 77.
[3]W.E. 618-A, 633-A (salt-shaker), 630-A (8-ball).
[4]W.E. 77A or 77B.

A similar arrangement employing a 44-BX velocity is used for pickup of the large choral group, (Figure 5); an extra microphone has been provided for the announcer and master of ceremonies.

Microphones as Sound Reenforcement Media

Tangible sound reenforcement is used to give greater depth and *body* to broadcasts and to provide a satisfactory sound level for the audience. It is usually obtained through one of two methods: (*1*) conjunctive, and (*2*) direct. The first is commonly used in remote or portable setups and consists of a bridging coil connected across the remote amplifier output circuit and feeding into the *phono* or second stage of the usual type of public address amplifier. A variable pad or fader is placed across the secondary of the bridging coil to control the reenforcement level. The second method is preferable in studio and similar installations of a permanent nature. The reenforcement in this case is accomplished by the use of separate microphones, usually concealed in the wings of the stage or near the footlights and feeding directly into the sound system, the level being controlled from a mixing panel in the control room.

Microphone Phasing

When two or more microphones are used simultaneously, the proper phasing of each instrument in relation to the other becomes a matter of prime importance. One microphone out of phase will result in a hollow or *boomy* effect and prevent perfect overall balance.

It is assumed that all microphones

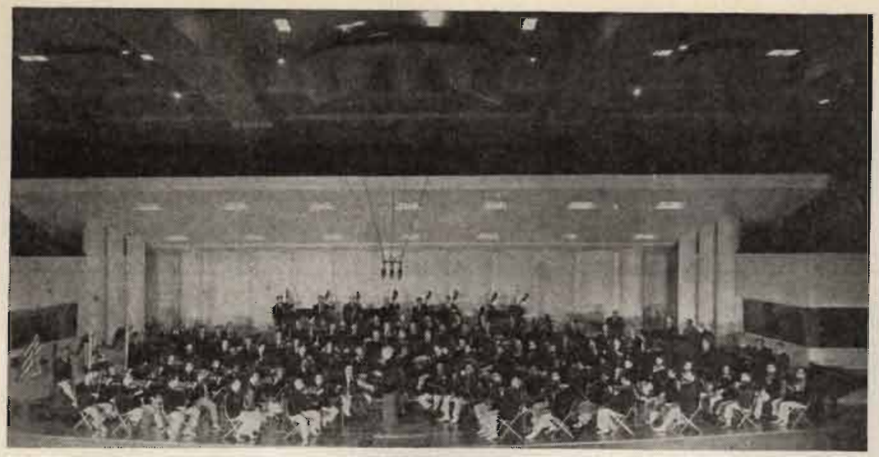

Figure 4
Wide-angle pickup for a symphony.
(*Courtesy WLW*)

in regular use at a particular station are, or have been, properly phased. Certain conditions arise, however, such as in the purchase of a new microphone or the return of a repaired unit from the factory, that may alter this phasing.

Condition of phase may easily be determined by the *comparative-level* method in which two microphones, one the microphone under test and the other known to be correctly phased for its regular operations, are placed side by side, the front of each facing the same direction, and their outputs connected to the regular input channels of the mixer. With the faders of both channels set at the same level, a reading is taken of the output of the first microphone. With the first fader still open, the second microphone is switched into the circuit. An increase of level as noted on the *volume indicating meter* indicates the second microphone is in phase with the first, while a decrease in level denotes the opposite.

Figure 5
Choral group setup with unidirectional microphone 6′ to 7′ from group. Extra microphones are used for announcer and commentator.
(*Courtesy Stockdale*)

Three methods are commonly used to reverse the phase of a velocity microphone: (*1*) reversing the cable leads at the microphone terminal block; (*2*) inserting a patchcord in the circuit in question with one end of the cord inverted, and (*3*) use of a line-reversing switch.

The first method is used when a microphone is to be phased permanently and is accomplished by removing the screws which hold the microphone grille in place and removing the cover to expose the terminal block in the bottom of the case, immediately above the microphone coupling transformer. The two cable leads connected to the transformer primary are reversed and resoldered.

The second method is used when it is necessary to reverse the phase of a particular microphone after a program is on the air. Patchcords (WE type) are simply inserted in any convenient part of the circuit ahead of the mixer, as *Microphone Out* to *Amp In* or *Amp Out* to *Key In* with one end of the cord inverted. With patch cords of the single-circuit type, where two cords are used to patch a given circuit, reversal is made by transposing the leads at one end of the cord. The possibility of a momentary break in the program or an instantaneous circuit *pop* may be avoided in patching by waiting for a convenient pause in the program, then *keycutting* or by closing the fader at the instant patch insertion is made. The same end may be accomplished prior to the air time simply by rotating the microphone through an angle of 180°.

At the transmitter it is often found that when the polarity switch of the modulation monitor is set to read positive peaks, one particular voice peaking *zero* level may register 100%, yet another speaker giving the same audio level may modulate only 60%, or less. However, on reversing the polarity of the program line the second speaker is found to also modulate 100%. This condition, known as *extended positive peak modulation* and due to the peculiar harmonic content of some voices, particularly male, is usually more noticeable when one announcer or speaker follows the other on the same microphone. A line-reversing switch installed at the transmitter end of the program line is used to reverse polarity when necessary and thereby equalize the modulation peaks of each type of voice. Use of such a reversing switch is limited to the transmitter, since the studio engineer usually is provided with no means of checking actual modulation percentages.

Figure 6
Typical setup for a quizz program.
(*Courtesy WKRC*)