

OPERATING INSTRUCTIONS

FOR

VELOCITY MICROPHONE

TYPE 44-B

(MI-4026A)

PART I — DESCRIPTION

1. **Introduction.**—The velocity microphone is the result of several years of intensive research and development toward the improvement of the characteristics of microphones as used for broadcasting, and is entirely different in principle and construction from other microphones now in use. This microphone is admirably suited to studio pick-up, public address and sound reinforcement applications.

Instead of a "diaphragm" (in the commonly accepted meaning of the word), the velocity microphone contains a thin metallic ribbon suspended between the poles of a permanent magnet with its length perpendicular to, and its width in the plane of, the magnetic lines of force. The opposite ends of the ribbon are connected to a transformer which matches the impedance of the ribbon to a 250- or 50-ohm line. Sound waves reaching the ribbon vibrate it within the magnetic field set up by the magnet. The vibration of the ribbon is in exact accordance with the sound vibrations and, occurring as it does within the magnetic field, sets up corresponding alternating electric potentials across the primary of its associated transformer. These minute voltages are subsequently amplified to the power level required for broadcasting. The microphone amplifier may be located remotely from the microphone unit when necessary or desirable.

2. **Description.**—The velocity microphone shown in Figure 1 consists of a microphone unit mounted on a swivel at the top of a program stand. The swivel mount permits the "aiming" of the transmitter in any desired direction. The transmitter is enclosed within a perforated metal casing which serves to protect it from mechanical injury and adverse wind effects.

The line coupling transformer is contained in a metal case as a part of the microphone unit.

The Type 44-B microphone unit is furnished with screw-mounting collar (program stand flange) to fit a standard Type AZ-4090 microphone stand. A suspension mounting (Type UP-4212-A) is also supplied with the microphone to permit the unit to be suspended overhead when desired. See Figure 3.

The microphone program stand (Type AZ-4090) is of the adjustable single vertical column type with a three point base. The height of the transmitter may be adjusted to maximum and minimum heights of 81 inches and 50 inches respectively.

3. **Sensitivity.**—With an input sound pressure of 10 dynes per square centimeter perpendicular to the plane of the ribbon, the ribbon microphone unit will deliver 800 microvolts across a 250-ohm load, which is equivalent to an output level of -67 db. as compared with a zero level of 12.5 milliwatts, or -64 db. as compared with a zero level of 6 milliwatts.

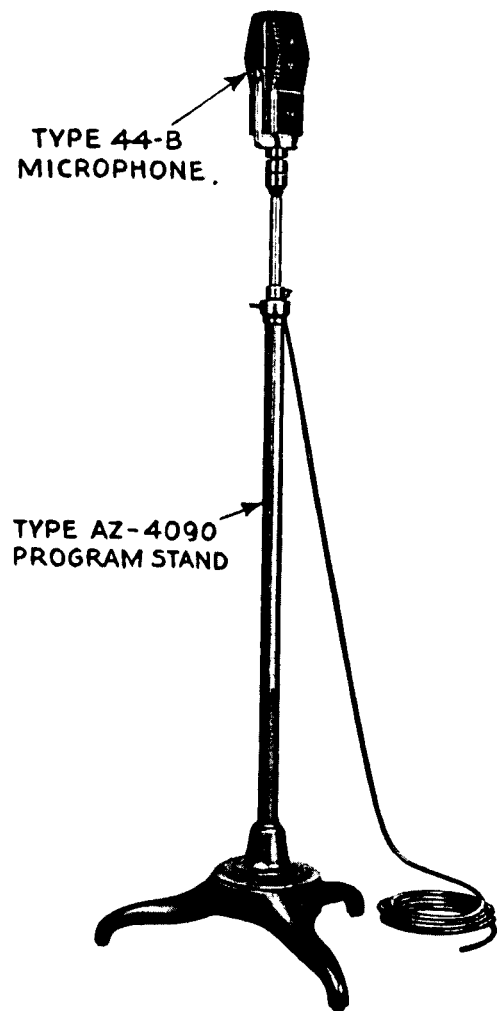


Figure 1—Microphone on Program Stand

On an open circuit basis of measurement, *i. e.*, with an input of 1 dyne per square centimeter (1 bar) perpendicular to the ribbon, the output of the microphone across an open circuit is the equivalent of -81 db. with reference to a zero level of 12.5 milliwatts.

4. **Quality of Response.**—The operating range of the microphone extends from 30 cycles to 15,000 cycles.

When a velocity microphone is placed close to a source of sound the low frequency response is accentuated. In view of this fact, provision is made in the Type 44-B microphone to enable the user to alter its frequency response in such a manner as to suit best the particular purpose desired; *viz.*, the pick-up of voice (*i. e.*, within 2 feet of the microphone), or the pick-up of music (which takes place at greater distances from the microphone). Emphasis is here placed on the fact that this feature of the Type 44-B microphone is not provided with the intention that such alterations in frequency response be made at will; *i. e.*, between selections on a broadcast program; but is furnished for the sole purpose of supplying a microphone with the best possible characteristics for vocal pick-up or for musical pick-up. It is recommended that the frequency response be adapted to either of these types of pick-up and the use of the microphone be restricted to that type of pick-up only.

To alter the frequency response proceed as follows:

A small circular hole will be found in the cover plate of the transformer casing. Through this hole will be visible the letter "V" (voice) or the letter "M" (music), depending on whether the microphone is at the time adapted for vocal pick-up or for musical pick-up.

Vocal pick-up requires the use of a jumper (upon which appears the letter "V"), which is to be placed across the two terminals marked "M" (music), located

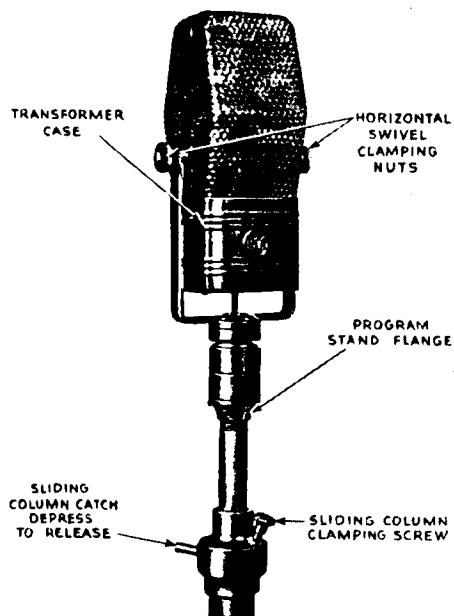


Figure 2—Close-up of Microphone on Program Stand

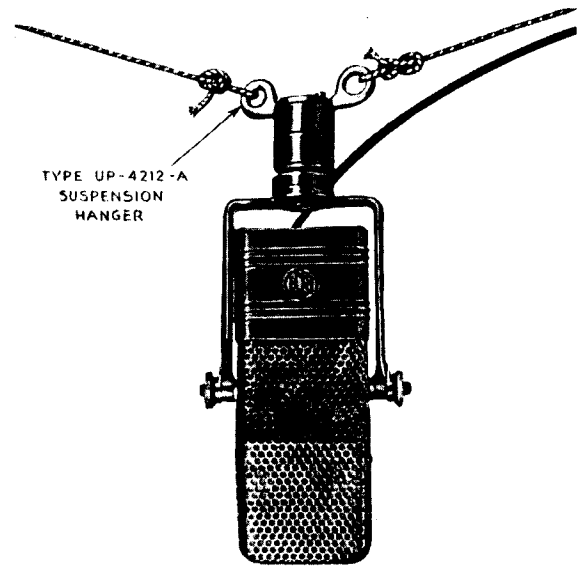


Figure 3—Microphone Suspended

on the terminal block within the transformer housing. Access to this terminal block is obtained by removing the cover plate of the transformer housing.

When the jumper "V" is used, it connects a reactor in parallel with a part of the transformer winding (when the 250-ohm output connections are used), or with all the transformer winding (when the 50-ohm output connections are used). See the schematic diagram, Figure 6.

A response curve taken with and without the "V" jumper is shown in Figure 5. As will be observed from examination of this curve, there is a sharp decline at the low frequency end of the curve when the "V" jumper is used. It is to be noted that this curve was taken in a plane wave field, and that the curve is flat when the speaker is located at a distance of 1 foot from the microphone.

5. **Directional Characteristics.**—One of the most important characteristics of the velocity microphone is its directional property. Since the ribbon is suspended in free space, sound waves approaching the microphone from a direction in the same plane as the ribbon have no effect upon it. Sound waves *from either direction* along an axis perpendicular to the plane of the ribbon have the maximum effect. For equal distances from the transmitter, the relative response to sound originating at various angles to the axis perpendicular to the ribbon is shown in Figure 4.

It is at once apparent that this characteristic is of considerable value in the solution of some of the difficulties usually encountered in reverberant locations by the reduction of the effect of undesired sound reflections, and in the increased possibilities of obtaining better balance, clarity, naturalness, and selectivity in sound pick-up. Extraneous direct or reflected sounds approaching the microphone from side directions will have little effect, and therefore background noises and

TYPE 44-B VELOCITY MICROPHONE

ρ = LOSS IN DB BELOW RESPONSE OBTAINED ALONG
AXIS NORMAL TO PLANE OF RIBBON.

σ = ANGULAR POSITION IN DEGREES OF SOURCE OF
SOUND WITH RESPECT TO AXIS NORMAL TO
PLANE OF RIBBON.

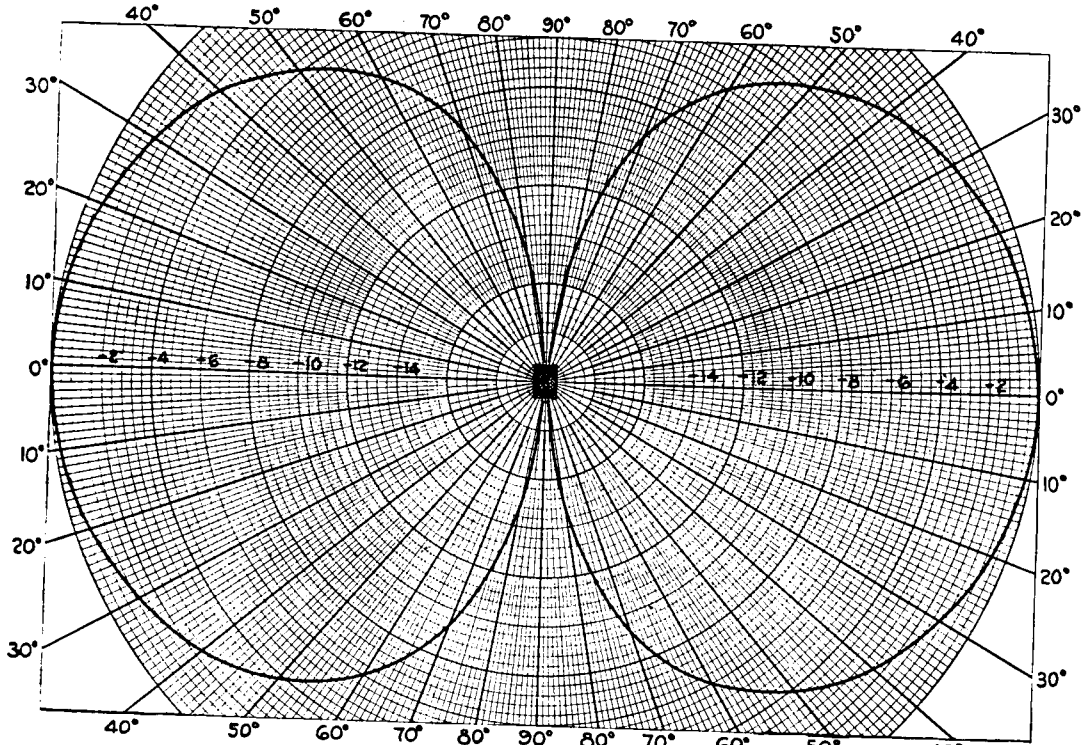


Figure 4—Directional characteristics of velocity microphone

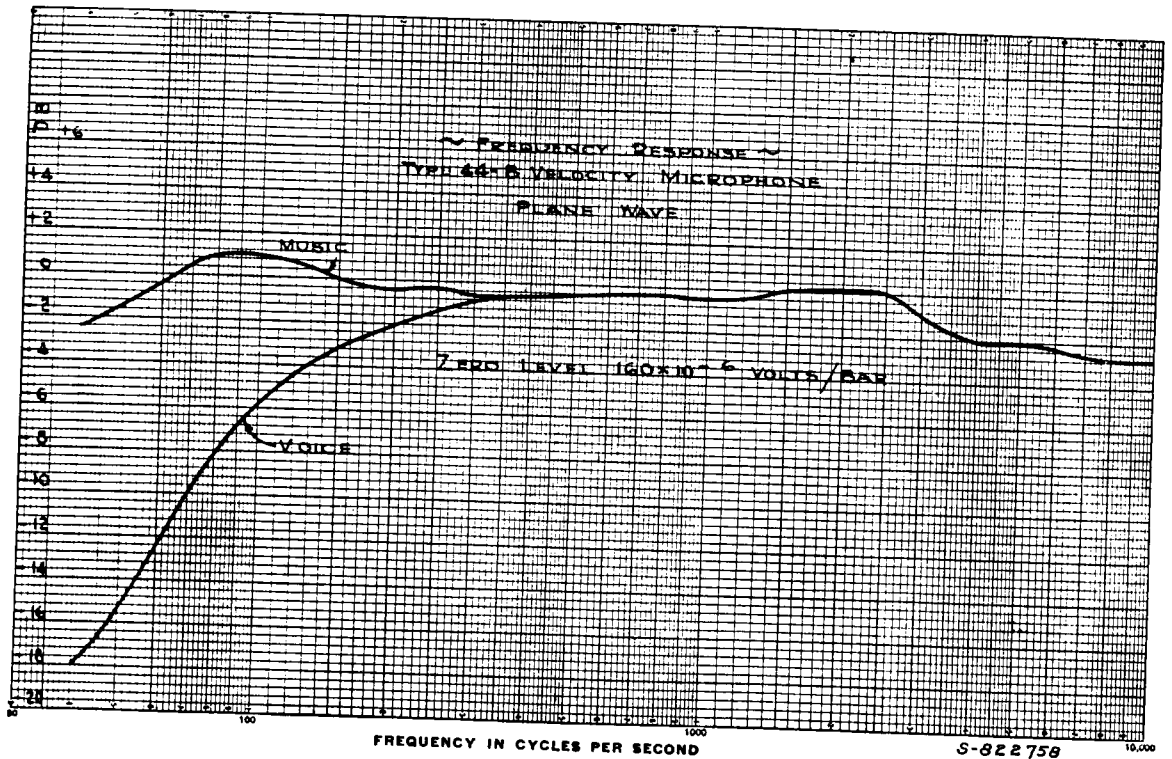


Figure 5—Frequency Response of Type 44-B Microphone

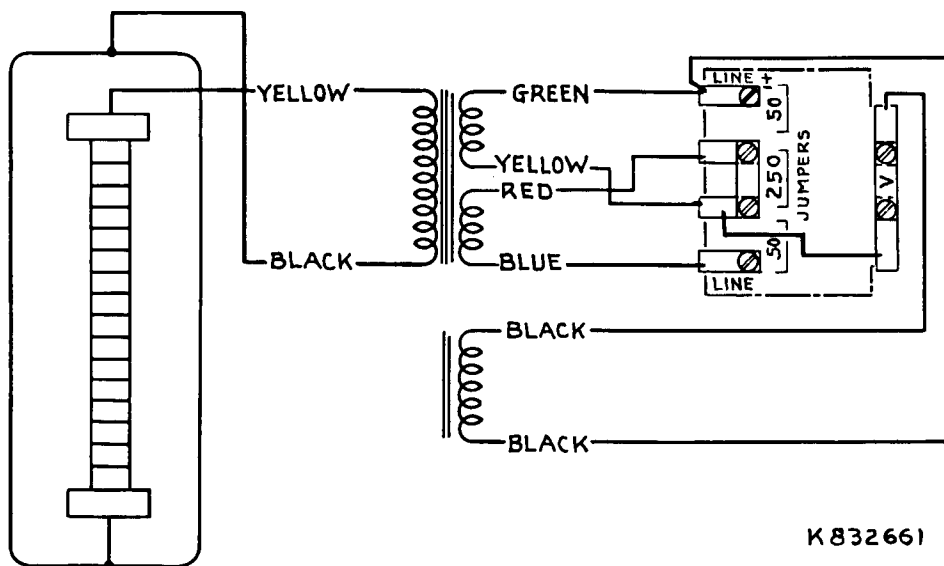


Figure 6—Schematic Wiring Diagram of Microphone

reflected sounds in the broadcast are considerably reduced, which increases, by comparison, the quality of the direct sounds reproduced. The degree of sound-proofing necessary for sound originating within the "dead zone" is, of course, dependent upon the reflecting surfaces present which may return the undesired sound to the microphone from such directions that response may be obtained.

For the same allowable reverberation pick-up the operating range of the velocity microphone is approximately 1.7 times greater than a non-directional microphone having the same sensitivity.

When used for public address and sound reinforcement purposes the directional characteristic is of considerable value in reducing feed-back effects between the microphone and loudspeaker.

Sound concentrators and baffles used with condenser microphones are unnecessary with and inapplicable to the velocity microphone because of the fundamental difference in the principle of its operation. The transmitter must be used in free space where the flow of air particles is unimpeded. However, "pick-up" from the rear direction of the microphone may be eliminated by placing a baffle or shield of heavy sound absorbing material, such as heavy felt, at a distance of not less than three feet from the transmitter and so confine the "pick-up" to the area in front of the microphone.

PART II — OPERATION

6. Microphone Assembly.—Packed in the box with the microphone unit proper is an envelope containing three (3) machine screws, three (3) lockwashers, one (1) program stand flange, and one (1) Type UP-4212-A suspension hanger. The machine screws

and lockwashers are used for attaching either the flange or the hanger to the microphone unit.

(a) *Stand Mounting.*—If it is desired to mount the microphone unit on a program stand, the flange, which contains a threaded socket for attaching to the program stand, must be securely fastened to the base of the microphone cushion assembly by means of the three (3) machine screws and lockwashers furnished. See Figure 2.

(b) *Suspension Mounting.*—If it is desired to suspend the microphone overhead, the suspension hanger, which contains the eyelets for cord attachment, must be securely fastened to the base of the microphone cushion assembly by means of the three (3) screws and lockwashers furnished. See Figure 3.

NOTE.—When the microphone is suspended see that its weight is carried by the hanger with no strain on the cable.

(c) *Cable Connections.*—Remove the cover plate of the transformer housing.

Loosen the two screws in the cable clamp and pass the end of the cable through the clamp.

At one side of the terminal block are mounted four terminals. Of these four terminals, the two outside are output terminals. Between the two terminals nearer the center is engraved the number 250 (*i. e.*, 250 ohms). Between each outside terminal and the nearer of each centrally located terminal is engraved the number 50 (*i. e.*, 50 ohms).

If the microphone is to feed a 250-ohm line, the two small jumpers should be placed, one over the other, across the two centrally located (250-ohm) terminals.

If the microphone is to feed a 50-ohm line, one of the two small jumpers is to be placed across each pair of terminals marked 50.

No change is necessary in microphone cable terminal connections.

Solder the ground lead from the cable shield to the cable clamp.

The cable is to pass through the slot in the cover plate of the transformer housing.

Figure 10 shows the location of the various numbered contacts of both plugs and receptacles, and, in conjunction with the schematic wiring diagram, will serve to indicate the proper connections of the various leads when testing, repairing, or replacing any electrical part.

(d) *Phasing.*—When more than one microphone is used in a single pick-up, it is possible that the output of the various microphone circuits may not be in phase when fed into a common circuit. The microphone circuits include the microphones themselves, microphone pre-amplifiers, microphone attenuators (mixers) and the necessary connecting lines. The output of the microphone attenuators (mixers) when fed into the overall attenuator (mixer) must be in phase, or varying degrees of distortion will result, depending upon the relative placement of the microphones. If two microphones are placed close together, the result will be practically zero output if their circuits are out of phase at the overall mixer.

For this reason each unit of all RCA speech input equipment is carefully wired in accordance with a definite wiring color scheme in order that they will always be in phase when the inter-unit connections have been made according to a uniform plan; *i. e.*,

where the “±” connection of *one* microphone is connected to a certain input terminal of its pre-amplifier, then the “±” connection of *all* microphones must be connected to a corresponding terminal of their respective pre-amplifiers, and so on through the system up to the overall mixing control.

In set-ups in which velocity microphones are used, it is possible to phase them by turning those out of phase through 180 degrees. This is not possible with any pressure operated microphone.

It is particularly important that the phasing problem be borne in mind when inspecting, testing, repairing or replacing any unit or component thereof, and care be taken to see that the internal connections of the various units are made strictly in accordance with their wiring diagrams.

7. Technique of Velocity Microphone Placement.—The proper placement of the microphone is essential in order to realize fully its inherent advantages. For this reason, the following instructions should be carefully studied, and close attention be given to the results of any special placement with a view towards future improvement of the technique. These instructions can of course only serve as a guide, and a study should be made to determine the best microphone placement for each condition.

(a) *General.*—The source of sound, speaker, announcer or musical instrument, should not be placed closer to the microphone than 2 feet and a distance of 3 to 4 feet is to be preferred. At shorter distances there is a tendency toward accentuation of low fre-

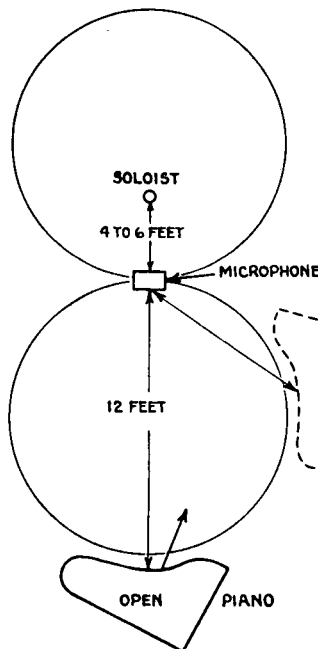


Figure 7—Soloist with piano

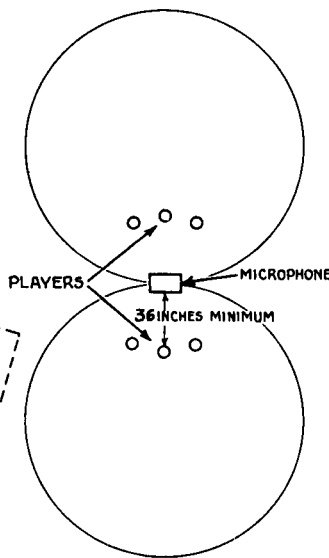


Figure 8—Plays

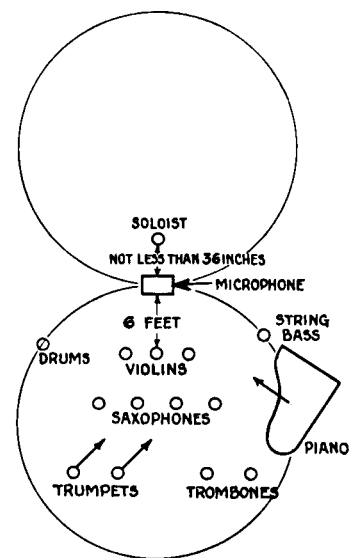


Figure 9—Dance orchestra

VARIOUS MICROPHONE ARRANGEMENTS

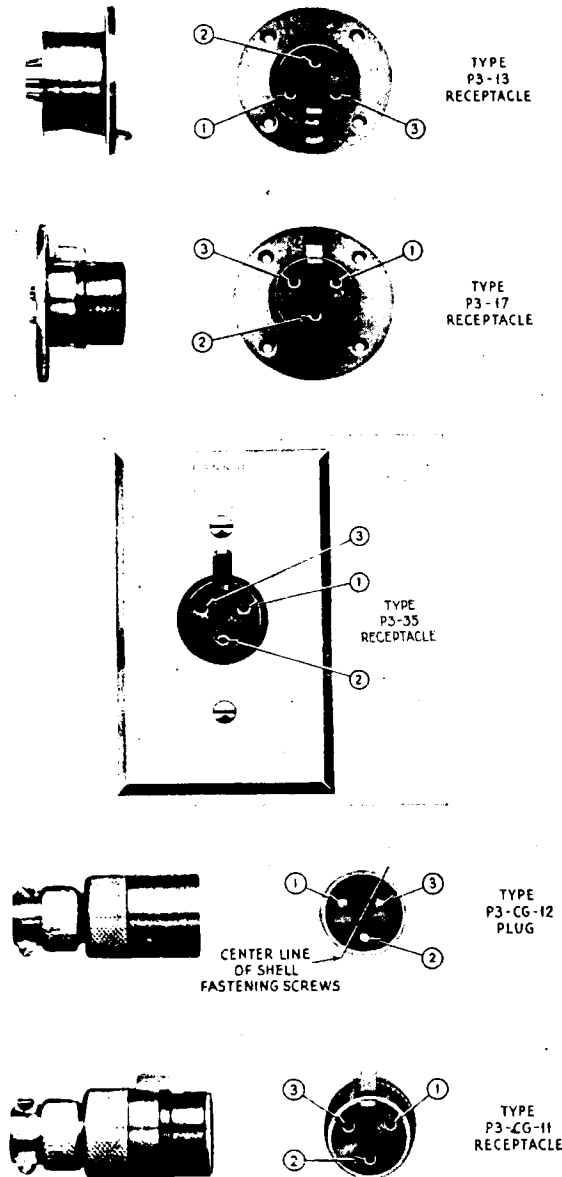


Figure 10—Plugs and Receptacles

quencies, which may result in making voices sound "boomy." In this respect, the use of the velocity microphone differs greatly from that of the condenser microphone with which the speaker or soloist has usually worked at a distance of 4 to 6 inches.

The placement of a speaker or musical instrument off from the center line of the microphone will in no way affect the quality of pick-up, but will merely attenuate the direct sound pick-up, thereby raising the ratio of reverberation to direct pick-up.

The microphone is bi-directional. Speakers, instruments, or players may be placed on either or both sides of the microphone with equal effect. The dia-

grams (Figures 7, 8 and 9) will serve as examples of the advantages which arise from the bi-directional characteristic.

For the most satisfactory results, the microphone should not be placed closer than 3 feet to any solid reflecting surface. This statement is, of course, general and specific conditions may require otherwise, such as in footlight mounting.

The diagrams referred to in the subsequent paragraphs and the discussion concerning them can only serve to indicate some of the possible placements under particular conditions. The final decision as to what constitutes the proper placement must rest with someone who is competent to judge the quality of the results as reproduced by the monitor speaker.

(b) *Soloist with Piano*.—Interesting effects may be obtained by changing the angle of the microphone with respect to the piano, thus changing the ratio of reverberation to direct pick-up. The distance between the soloist and microphone should be determined by the strength of his (or her) voice, and the piano should be placed accordingly. The general arrangement is shown in Figure 7. Under no conditions should the soloist be less than 2 feet from the microphone.

(c) *Plays*.—The bi-directional characteristic of the microphone may be used to its fullest advantage in broadcasting by grouping the players about the microphone at such positions that their voice levels match to form the desired composite. See Figure 8. With such an arrangement, considerable if not all of the moving and dodging back and forth of the characters seeking positions advantageous to the presentation may be avoided.

When the microphone is used by a speaker located at a table or desk, the microphone should be so placed that it picks up direct sound from the speaker rather than reflected sound from the surface of the table, desk or manuscript.

(d) *Dance Orchestra*.—The diagram (Figure 9) is self-explanatory, the only precaution necessary being to keep the soloist at least 2 feet, and preferably 3 feet, from the microphone.

Due to the fact that artists and announcers cannot work close to the microphone, some difficulty may be experienced in obtaining the proper balance between the artist or announcer and the orchestra. This difficulty can be overcome quite satisfactorily by using two microphones, one to pick up the orchestra and the other to pick up the artist or announcer. The artist's microphone should be located so that its "dead zone" is toward the orchestra. By properly setting the mixing controls, the level of the orchestra can be controlled so that a satisfactory back-ground accompaniment of music is obtained.

In locating the microphone with respect to an orchestra, care should be taken to avoid reflected pick-up from hard surfaced floors. Such reflections can be avoided by the use of carpets or similar material on the floor.

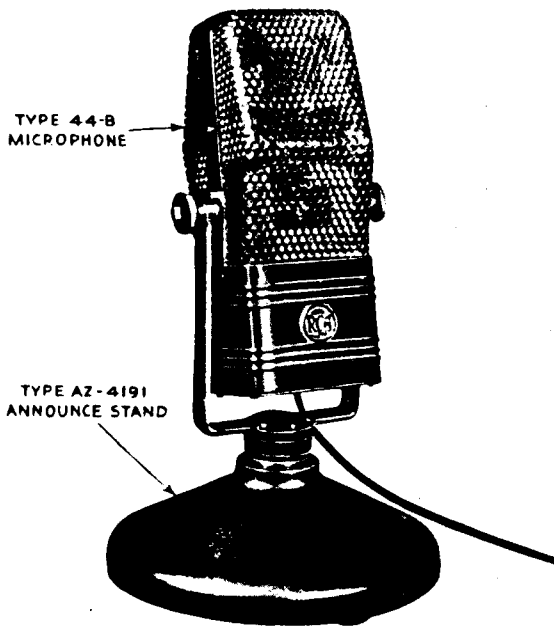


Figure 11—Microphone on Announce Stand

(e) *Public Address.*—For public address use the microphone can usually be placed near the speaker (within 3 or 4 feet). It is important to see that the direction of minimum pick-up is toward the loud-speaker system to prevent acoustic feed-back. If the speaker must have latitude of movement on the stage, it may be necessary to have a microphone installed at each side to obtain satisfactory pick-up.

(f) *Sound Reenforcing.*—Microphones used for this purpose must generally be concealed and may be placed and successfully operated in the wings, footlights, flies, etc., of the stage. When the microphone is placed in a footlight trough, heavy sound absorbing felt should be placed behind the microphone to prevent undesirable reflection effects. Such a system usually requires a number of microphones and the detailed location of these microphones is largely determined by the exact use of the microphone, constructional details of the stage and other conditions so numerous as to preclude any definite statement of rules or methods of applica-

9. List of Parts and Accessories.—

Description	Type	Type MI-4026-A Stock No.	Type MI-4027-A Stock No.
Velocity Microphone (Black finish—MI-4026-A; Chromium trimmed—MI-4027-A)	44-B	MI-4026-A	MI-4027-A
Program Stand	AZ-4090	MI-4056	—
Announce (Desk Type) Stand	AZ-4191	MI-4058-A	—
Suspension Fitting	UP-4212-A	MI-4071-A	MI-4071-B
Microphone Transformer	RT-435	16828	16828
Cushion Mounting Assembly		16987	17433
Microphone Screen		16825	—
Swivel Clamping Nut		16826	17435
Washer (used under Swivel Clamping Nut)		16827	17436
Microphone Cable		MI-62*	MI-62*

* Length of cable must be specified when ordering.

tion. The plane of zero sound may be utilized to great advantage in eliminating undesirable resonance, reflection and diffraction effects usually encountered when a microphone is located in a cavity. This fact accounts for the highly successful application of this microphone to footlight trough mounting. Detailed information as to the method of installation for a particular condition may be obtained on request.

8. *Operation.*—In general, the microphone will operate satisfactorily and require very little attention. It should give the normal output listed in section 3.

The microphone may be mounted in several ways. The most common mounting is the program or floor stand. This stand is adjustable as to height. The center of the velocity microphone may be located at any height from 56 to 81 inches above the floor. In order to raise or lower the stand, the vertical column clamping screw should first be loosened. If it is desired to raise the microphone, all that is necessary is to lift it to the desired point and there it will lock itself automatically. Usually, it will remain fixed at this position unless there is vibration or the microphone and stand are moved around. This moving may cause the stand to slowly slide downward. The clamping screw is provided in order to prevent this. However, if the microphone does not tend to creep, then it is not necessary to use the clamping screw. When it is desired to lower the microphone stand, the clamping screw should first be loosened, then the inner tube of the microphone stand should be raised slightly while pressing the sliding column latch which projects at the side of the locking device. This will release the lock and allow the microphone to be lowered to the desired position, at which point the latch should be released and the stand will automatically lock itself. Then the clamping screw may be tightened if desired.

It is not recommended that the customer attempt to repair the microphone, but, rather, that it be returned to the RCA Manufacturing Company, Inc., for repair. This may be done by writing to the RCA Manufacturing Company, Inc., for a "RETURNED APPARATUS" tag and "REPORT BLANK." Before doing this, however, make absolutely certain that the trouble is in the microphone and not elsewhere in the circuit.

TYPE 44-B VELOCITY MICROPHONE

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		<i>MI-4026-A</i>	<i>MI-4027-A</i>
		<i>Stock No.</i>	<i>Stock No.</i>
Microphone Plug.....	Cannon		
	Type P3-CG-12	MI-4630	MI-4630
Front and Rear Microphone Guards.....		————	17434
Cushion Thumb Nut.....		————	17439
Cushion Spacer.....		————	17438
Locking Washer.....		————	17437
Female Cord Connector.....	Cannon		
	Type P3-CG-11	MI-4620	MI-4620
Flush Type Wall Receptacle.....	Cannon		
	Type P3-13	MI-4622	MI-4622
Surface Type Wall Receptacle.....	Cannon		
	Type P3-17	MI-4621	MI-4621
Flush Type Wall Receptacle.....	Cannon		
	Type P3-35	MI-4625	MI-4625