

*Western Electric*

**109-TYPE  
REPRODUCER  
GROUP**



**Instruction Bulletin No. 1166, Issue 1**

The Equipment Described in This Bulletin  
Was Designed and Developed for the  
*Western Electric Company*  
By  
BELL TELEPHONE LABORATORIES

*Western Electric*

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# *Western Electric*

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## **109-TYPE REPRODUCER GROUP**

### **1. General Description**

The 109-Type Reproducer Group is for use in electrical transcription systems for radio broadcasting and similar applications and consists of a 9-Type Reproducer with its supporting arm and arm rest and the necessary equalizing equipment. Each reproducer group is so constructed that it can be used for reproducing from either vertical or lateral cut disc-type records through the selection of the proper electrical connections by means of a switch supplied as a part of the equalizing equipment.

The 109-Type Reproducer Group is available in two combinations or codes, namely the 109AA and 109B Reproducers, which consist of the following components:

#### **109AA Reproducer Group**

- 1—9A Reproducer
- 1—5A Reproducer Arm
- 1—711A Bracket
- 1—171A Repeating Coil
- 1—KS-13386 Equalizer

#### **109B Reproducer Group**

- 1—9B Reproducer
- 1—5A Reproducer Arm
- 1—711A Bracket
- 1—171A Repeating Coil
- 1—KS-13386 Equalizer

The 109AA and 109B Reproducer Groups are similar except for the component 9-Type Reproducers which differ only in the material and tip radius of the stylus. Both, the 9A and 9B, are mechanically and electrically interchangeable on the 5A Arm and function

equally well with the other components of the 109-Type Reproducers.

### **2. 9A & 9B Reproducers**

The 9A Reproducer has a 2-mil radius diamond-tip stylus and is intended primarily for use on transcription-type records made of non-abrasive material, with narrow or medium groove cross-section, whereas the 9B Reproducer has a 2.5 mil radius sapphire-tip stylus which is designed for optimum performance when used with records having a wider groove cross-section.

The 9A and 9B Reproducers are permanent magnet, moving coil type reproducers consisting essentially of two coils assembled on a yoke which is attached through a driving rod to a stylus. A flat suspension spring suspends the coils from a point at the center of the yoke and the coils are free to vibrate, under the influence of the stylus motion, in the field of a permanent magnet, in either a vertical motion through the magnetic field or in an oscillatory angular motion having its apex at the junction between the yoke and suspension spring. The magnetic field is so arranged that when the coils vibrate vertically, voltages of like polarity and equal amplitude are generated in each coil. When the coils are subjected to an oscillatory angular motion having its apex at the suspension spring junction, the magnetic field configuration causes voltages of opposite polarity, but equal amplitude, to be generated in each coil. Vertical cut recordings result in vertical coil motion and the two coils are connected by means of the switch so that the voltages are series aiding. Lateral cut recordings result in

the oscillatory angular motion of the coils which are also connected by the proper operation of the switch so that the voltages are again series aiding. When the coils are connected by means of the switch for vertical reproduction, voltages generated by unwanted lateral modulation in the record are suppressed and when the coils are connected for lateral reproduction, voltages generated by unwanted vertical modulation are effectively suppressed.

The approximate over-all dimensions of each reproducer are 3" long, by 1 $\frac{3}{4}$ " high by  $\frac{3}{4}$ " wide. It weighs approximately 4 ounces.

### **3. 5A Reproducer Arm**

The 5A Reproducer Arm was developed as a companion piece for the 9-Type Reproducer and permits the reproducer to be quickly connected, both mechanically and electrically, to the arm. Best results from the 9-Type Reproducer will be realized when used with the 5A Reproducer Arm inasmuch as they were designed for use with each other in order to provide optimum tracking conditions.

The balance of the arm allows a stylus pressure of 35 grams, contributing to long record life. The weight of the arm is approximately 3 $\frac{1}{2}$  pounds and offers a sufficient mass to stabilize tracking over the useful frequency range.

The 5A Reproducer Arm is equipped with a four-prong type jack for engaging the four-pin type plug of the reproducer and a thumb screw on the reproducer is used for locking the reproducer in place in the arm jack. One end of four connecting wires are soldered to the terminals of the arm jack and the other end of the connecting wires, which project from the arm, are provided with spade type cord tips for making connections to the terminals of the equalizing equipment.

The over-all length of the arm and repro-

ducer is 18 $\frac{1}{2}$ " and the distance between the stylus and pivot is 13 $\frac{1}{8}$ ". The height of the arm is adjustable to accommodate different heights of turntable platters. Mounting information is given in detail under the section on "INSTALLATION."

### **4. 711A and 712A Brackets**

The 711A Bracket, which is supplied as a part of the 109-Type Reproducers, is a T-shaped arm rest designed to support the reproducer end of the arm and reproducer when it is not resting on a record.

The 712A Bracket is available for use with the 109-Type Reproducers on cabinet type transcription turntables which lack sufficient area on the table top to accommodate the base of the reproducer arm at the proper distance from the center of the turntable platter. The 712A Bracket, however, is not furnished as a part of the 109-Type Reproducer and must be ordered separately. When the 712A Bracket is used, the 711A Bracket which serves as an arm rest is not required inasmuch as an arm rest is incorporated as an integral part of the 712A Bracket.

### **5. KS-13386 Equalizer and 171A Repeating Coil**

The KS-13386 Equalizer and the 171A Repeating Coil form the equalizing, switching, and impedance matching portion of the 109-Type Reproducing Groups.

The equalizer switch has seven reproducing positions, two for vertical and five for lateral. The seven reproducing characteristics are based on two fundamental frequency response characteristics, Curve A and Curve B. These curves are based upon a survey of the recording field and match those which are currently used for record production.

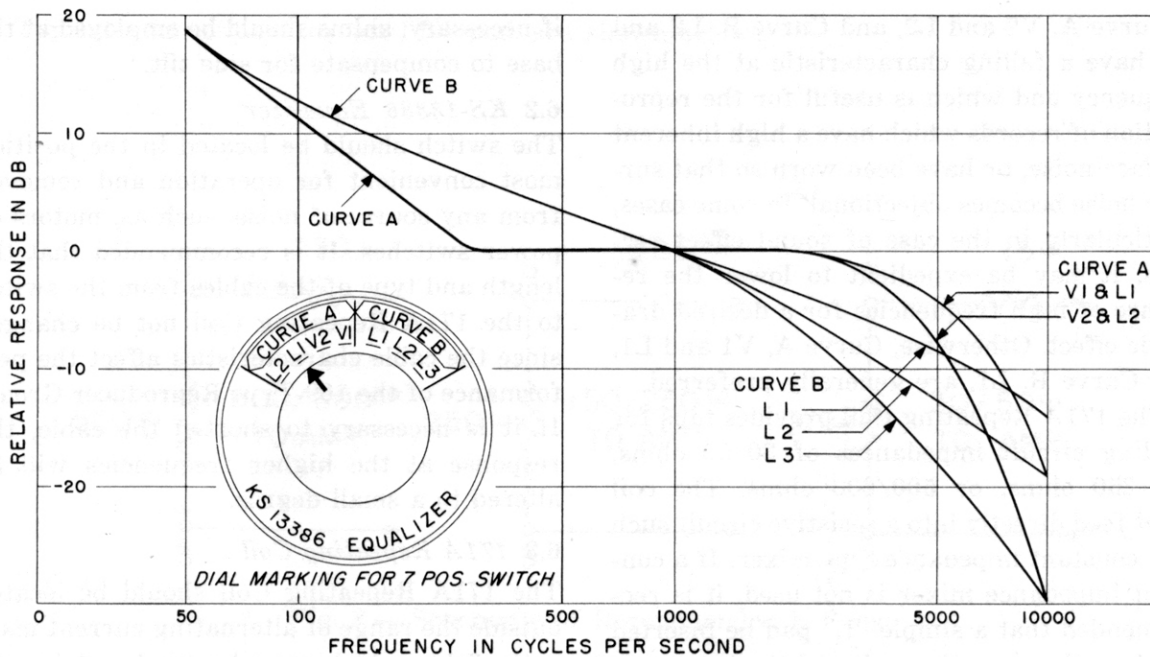


Fig. 1 — Typical Equalizer Curves

Curve A is the conjugate of the frequency response curve in general use in recording vertical transcriptions, some early lateral transcriptions and some “instantaneous type” lateral transcriptions.

Curve B is the conjugate of the frequency response curve in general use in recording lateral transcriptions (NAB Standard and Orthocoustic) and phonograph records. For information on specific curves used in making recordings, recording studios should be

consulted.

The switch positions having the characteristic according to Curve A should be chosen for the reproduction of records made with the characteristic which is the conjugate of this curve. Similarly, the switch positions indicated for Curve B should be chosen for the reproduction of records made with the conjugate of Curve B. On Table 1 is indicated the frequency response which will be obtained for the various switch positions.

Table 1

Equalizer Switch Position	Recording Type	Over-all System Response	
Curve A	V1	Vertical	Uniform 50—10,000 cycles
	V2	Vertical	Uniform 50—2,500 cycles with roll off to 15 db down at 10,000 cycles
	L1	Lateral	Uniform 50—10,000 cycles
	L2	Lateral	Uniform 50—2,500 cycles with roll off to 15 db down at 10,000 cycles
Curve B	L1	Lateral	Uniform 50—10,000 cycles
	L2	Lateral	Uniform 50—1,000 cycles with roll off to 5 db down at 10,000 cycles
	L3	Lateral	Uniform 50—1,000 cycles with roll off to 17 db down at 10,000 cycles

Curve A, V2 and L2, and Curve B, L2 and L3, have a falling characteristic at the high frequency end which is useful for the reproduction of records which have a high inherent surface noise, or have been worn so that surface noise becomes objectional. In some cases, particularly in the case of sound effect records, it may be expedient to lower the response of high frequencies for a desired dramatic effect. Otherwise, Curve A, V1 and L1, and Curve B, L1, are generally preferred.

The 171A Repeating Coil provides taps for feeding circuit impedances of 30/50 ohms, 150/250 ohms, or 500/600 ohms. The coil must feed directly into a resistive circuit such as a constant impedance type mixer. If a constant impedance mixer is not used, it is recommended that a simple "L" pad be inserted between the repeating coil and the input terminals of a pre-amplifier (unless the amplifier input presents a pure resistance to match the coil impedances). Schematic drawings of suggested L pads are shown in the section on "Installation."

## 6. Installation

### 6.1 5A Reproducer Arm

The center of the pivot base of the 5A Arm should be located on the turntable top at a distance of 13-9/16 inches from the center of the turntable platter as shown on A of Figure 4. The pivot base should be mounted using B of Figure 4\* as a template and oriented so that the arm covers freely the arc from the center of the turntable to well beyond the periphery of the platter on the side toward the 711A Bracket. The pivot base should be in a plane parallel to the plane of the turntable platter, and the height of the arm should be adjusted by means of the set screw located in the pivot base so that the stylus is at right angles to the plane of the record. The stylus must set at right angles for all positions, and

if necessary, shims should be employed at the base to compensate for side tilt.

### 6.2 KS-13386 Equalizer

The switch should be located in the position most convenient for operation and removed from any source of noise, such as, motors or power switches. It is recommended that the length and type of the cables from the switch to the 171A Repeating Coil not be changed since the cable characteristics affect the performance of the 109-Type Reproducer Group. If it is necessary to shorten the cable, the response at the higher frequencies will be altered to a small degree.

### 6.3 171A Repeating Coil

The 171A Repeating Coil should be located outside the range of alternating current magnetic fields which may be produced by the turntable drive motor or amplifier power transformers. Mounting dimensions, color coding and terminal designations are shown on Figure 3.

The input circuits with which this reproducer group is connected should be operated unbalanced with respect to ground and should be connected to the 171A Repeating Coil as follows:

1. For 30/50 ohms — use terminals 3 (ground side) and 4.
2. For 150/250 ohms — use terminals 3 (ground side) and 5.
3. For 500/600 ohms — use terminals 3 (ground side) and 6.

The 171A Repeating Coil must be terminated in a resistance. Amplifier input circuits presenting a reactive load will alter the frequency response characteristics of the equalizer, so that it is necessary to use either a constant impedance mixer circuit or a fixed resistive pad between the 171A Repeating Coil and the amplifier to stabilize impedance conditions.

\*Perforated page following Figure 4B can be torn out and used as template.



Typical connections for an "L" pad are shown below:

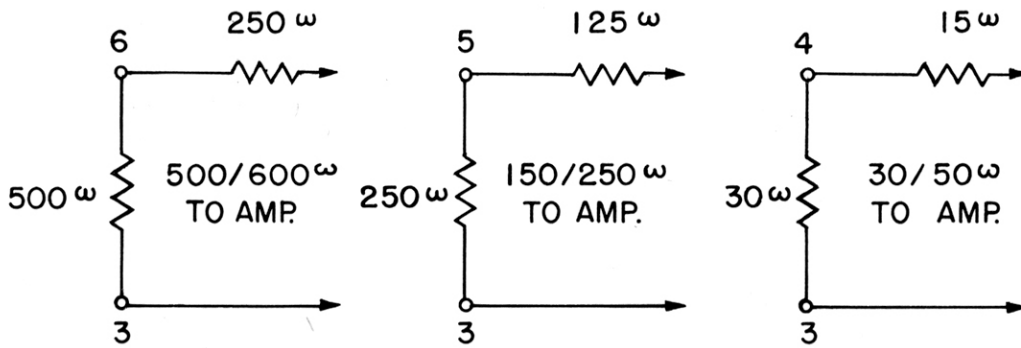


Fig. 2 — Schematic of Recommended L Pads

In all cases the ground should be connected to terminal 3.

### Reproducer Group Wiring Connections

4-Wire Cable  
from Switch

RD  
GR  
BLK  
WH

9-Type Reproducer

BLK-OR  
OR-GRAY  
BLK-GRAY  
OR-BLK

3-Wire Cable  
from Switch

RD  
WH  
BLK

171A Repeating Coil

Term 8  
Term 10  
Term 11

5-Wire Cable  
from Switch

BLK  
BL  
RD  
GR  
WH

171A Repeating Coil

Term 2  
Terms 1 and 3  
Term 7  
Term 12  
Term 13

## 7. Maintenance

The component parts of the 9-Type Repro-

ducer are necessarily very light in weight and should be handled with the care usually taken with any comparable delicate apparatus. Under normal use the reproducer will have a long useful life, but if it is accidentally dropped on the record, or allowed to skip across the record, the stylus point may be damaged. In this event, the reproducer should be returned for repair to the dealer from whom it was purchased. Occasionally dirt and dust from the record grooves will accumulate on the stylus, and this should be removed before it can interfere with tracking.

Contacts on the KS-13386 Equalizer switch should occasionally be cleaned with a cloth moistened with a small amount of unmedicated vaseline. A slight film should be left to provide lubrication.

Precautions should be taken to maintain good electrical contact between the thumb screw of the 9-Type Reproducer and the 5A Reproducer Arm. If paint or dirt breaks the electrical connection, the case of the 9-Type Reproducer is not grounded and serious noise conditions may result.

## **Additional Information**

If additional information is required regarding the Western Electric 109-Type Reproducer Group or other broadcasting or sound

distribution equipment, inquiries should be directed to the nearest distributor listed on the back cover of this bulletin.

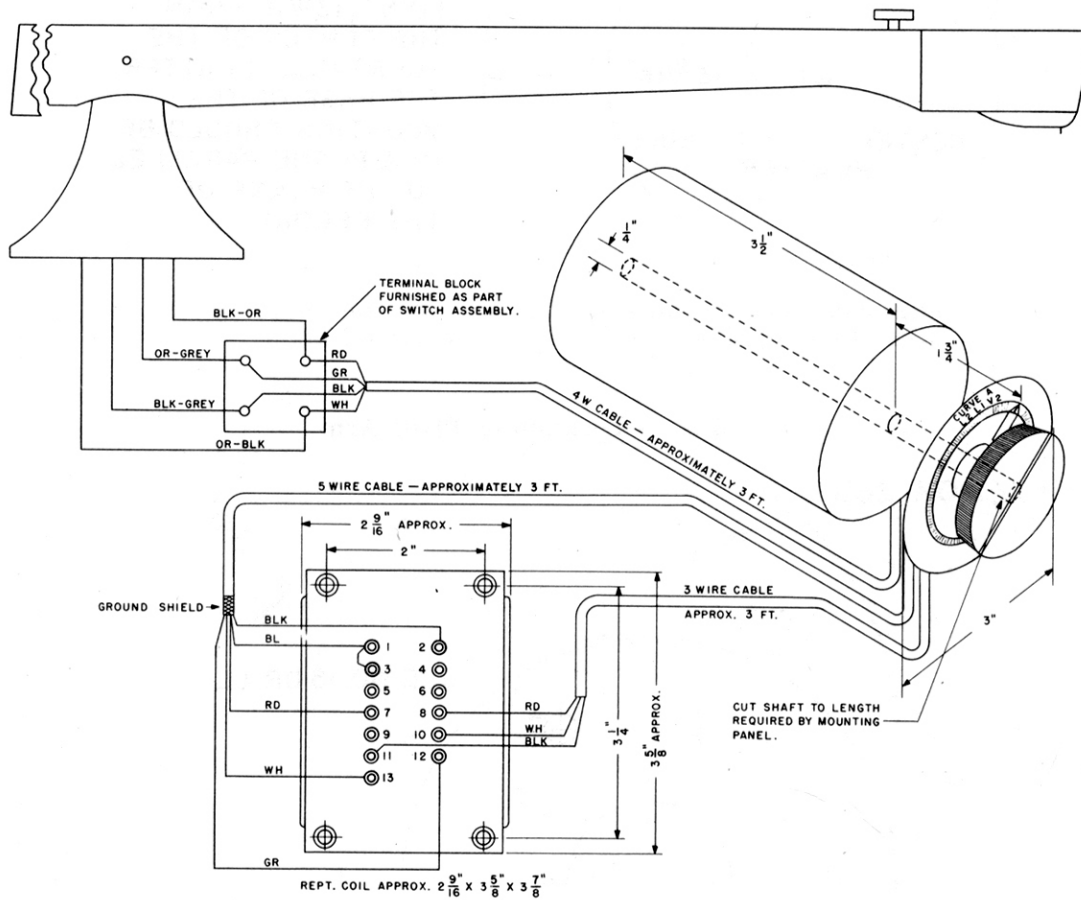
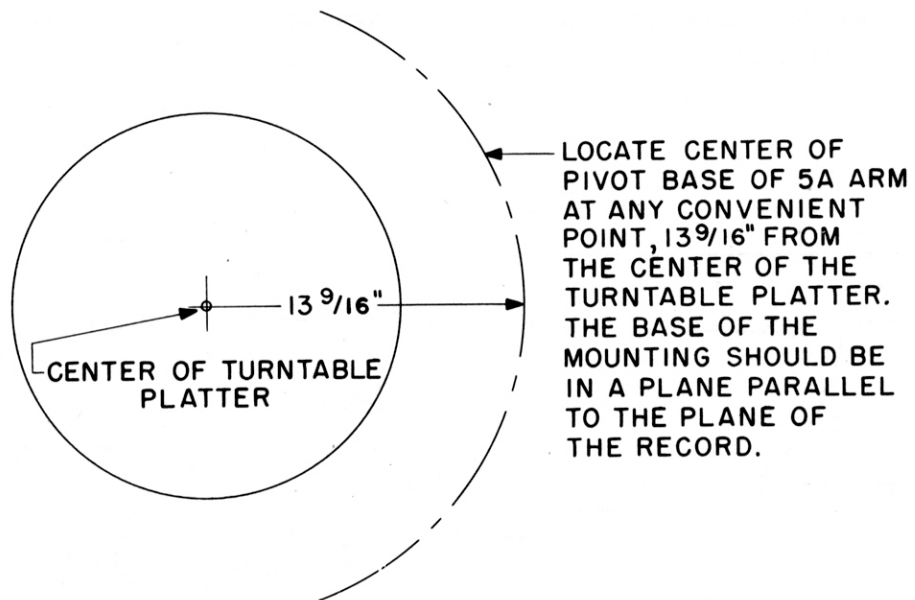
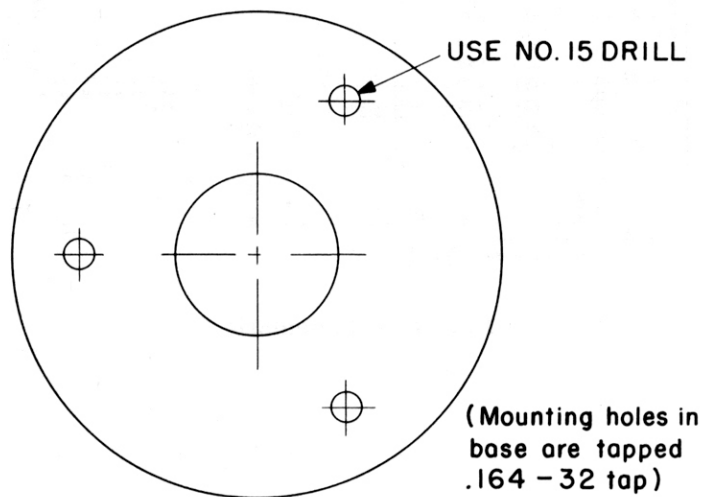


Fig. 3 — Schematic

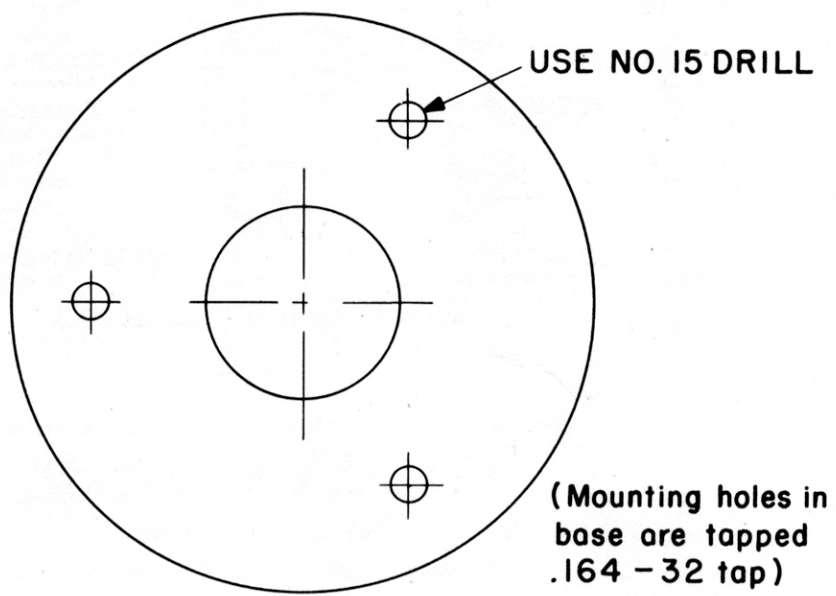


*Fig. 4-A* — Location of Pivot Arm



*Fig. 4-B* — Pivot Arm Drilling Templet

Tear out and use this drawing to mark mounting holes for the Western Electric 5A Reproducer Arm.



Drilling Templet

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