

Western Electric

**22B, 22C
AND 22D
SPEECH INPUT
EQUIPMENT**



**Instruction Bulletin No. 903
Including Supplements A and B**

SPEECH INPUT EQUIPMENT

22B, 22C and 22D

INSTRUCTIONS FOR USE

The Western Electric 22B and 22C Speech Input Equipments are compact, light in weight, portable, and designed to provide complete pick-up facilities for remote broadcast programs. The equipment consists of a combination amplifier and control unit with a carrying case, and either a rectifier unit for a-c. operation or a battery holder, or both, as specified, with a carrying case and power supply cord. Ample space is provided in both the amplifier and power supply carrying cases for accessory equipment. Where it is desired to operate from batteries the power supply carrying case is equipped with a battery cord and plug and a rack for holding filament and plate batteries. Where the equipment is to be operated from commercial alternating current, an a-c. power unit is installed in the power-supply carrying case in place of the battery rack. The space available in the power-supply carrying case is sufficient so that both the battery and the a-c. power supplies can be carried simultaneously if desired.

The equipment has a net gain of approximately 92 db. It requires a filament supply of approximately 1.4 amperes at 6 volts and a plate supply of approximately 21 milliamperes at 180 volts when operated from batteries. The a-c. power unit is designed to operate from a 50- or 60-cycle commercial lighting circuit of 115 volts nominal voltage. The power consumption is 28 watts at 115 volts.

The following commercial receiver-type metal vacuum tubes are required for the operation of this equipment.

2—Type 6J7 Vacuum Tubes

1—Type 6F6 Vacuum Tube

For battery operation the following light weight batteries are recommended:

1—Exide No. 3-AC-7 Battery per
DB-22334XA

4—Eveready No. 738 or Burgess No. Z30PX
Batteries

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For a-c. operation the following equipment is required:

1—A-C. Power Supply Unit per ESR-610199
for 22 Type Speech Input Equipment

1—Type 80 Vacuum Tube

Batteries and vacuum tubes are not supplied

with the equipment and must be ordered separately.

Where a 22B or 22C Speech Input Equipment has been obtained with one type of power supply and it is desired to order the complementary type, the order should so state, giving the serial number of the equipment involved.

DESCRIPTION

The 22B and 22C Speech Input Equipments are identical except for the volume-indicator meters. The meter in the 22B has a "General Purpose" movement and a db scale calibrated from -10 to $+6$ db with "0 db" at mid-scale. The meter in the 22C has a faster movement with a higher damping factor and a db scale calibrated from -20 to $+3$ with "0 db" at approximately $2/3$ full scale. It also has an auxiliary scale calibrated from 0 to 100 with 100 corresponding to "0" on the db scale.

The 22B and 22C Speech Input Equipments include a four-channel parallel mixing circuit designed to work with 30-ohm dynamic microphones or other 30-ohm sources of comparable level. The output circuit includes a line isolation pad and is designed to work into an impedance of either 150 or 600 ohms. The output impedance may be readily changed by means of a screw-driver-operated switch. Binding posts are provided for two program lines, jacks are provided for two monitoring headsets and both binding posts and a jack are provided for an order wire telephone set.

The mixing potentiometers, amplifier, and volume indicator of the 22B and 22C Speech Input Equipments are assembled in a metal cabinet approximately nine inches high, fifteen inches long, and five inches deep, and weigh approximately fifteen pounds. The schematic circuit diagram of this unit is shown in Figure 1 and the wiring diagram in Figure 2. Controls and volume indicator are located on the front panel of the unit. Microphone input receptacles are at the left end and the output line terminals, monitoring headset jacks, order wire telephone set connections, and power receptacle are at the right end of the unit. The

four mixing controls and master gain control are mounted in a row along the bottom of the panel with the master gain control at the right. Two toggle switches are provided, one for the lamp which illuminates the volume indicator meter and the other for the filament circuit. The volume indicator switch mounted on the upper left side of the panel provides for changing the sensitivity of the volume indicator for measuring output levels from 4 db below to 6 db above 6 milliwatts. It also switches the meter to indicate filament and plate voltages. The two output keys mounted above the master gain control provide for switching the output of the amplifier or the order wire telephone set to either of two telephone lines.

The microphone input circuits are connected through the associated mixing potentiometers to the input of the amplifier. Each mixing potentiometer has twenty steps with a total of 45 db of attenuation and an "Off" position. The first twelve steps from minimum attenuation have $1\frac{1}{2}$ db attenuation each, with gradually increasing attenuation on the last eight steps to cut-off. The output of the mixing circuits is amplified through a single stage terminating in the master gain control which is followed by two additional stages of amplification. The master gain control has twenty steps of attenuation and an "Off" position. The first seventeen steps from minimum attenuation have 2 db attenuation each with increasing attenuation on the last three steps to cut-off.

The amplifier and power-supply carrying cases are approximately $13\frac{3}{4}$ inches high, $16\frac{1}{2}$ inches long and $7\frac{1}{2}$ inches deep. They are made of ply-wood covered with black fabricoid and are extremely rugged in construc-

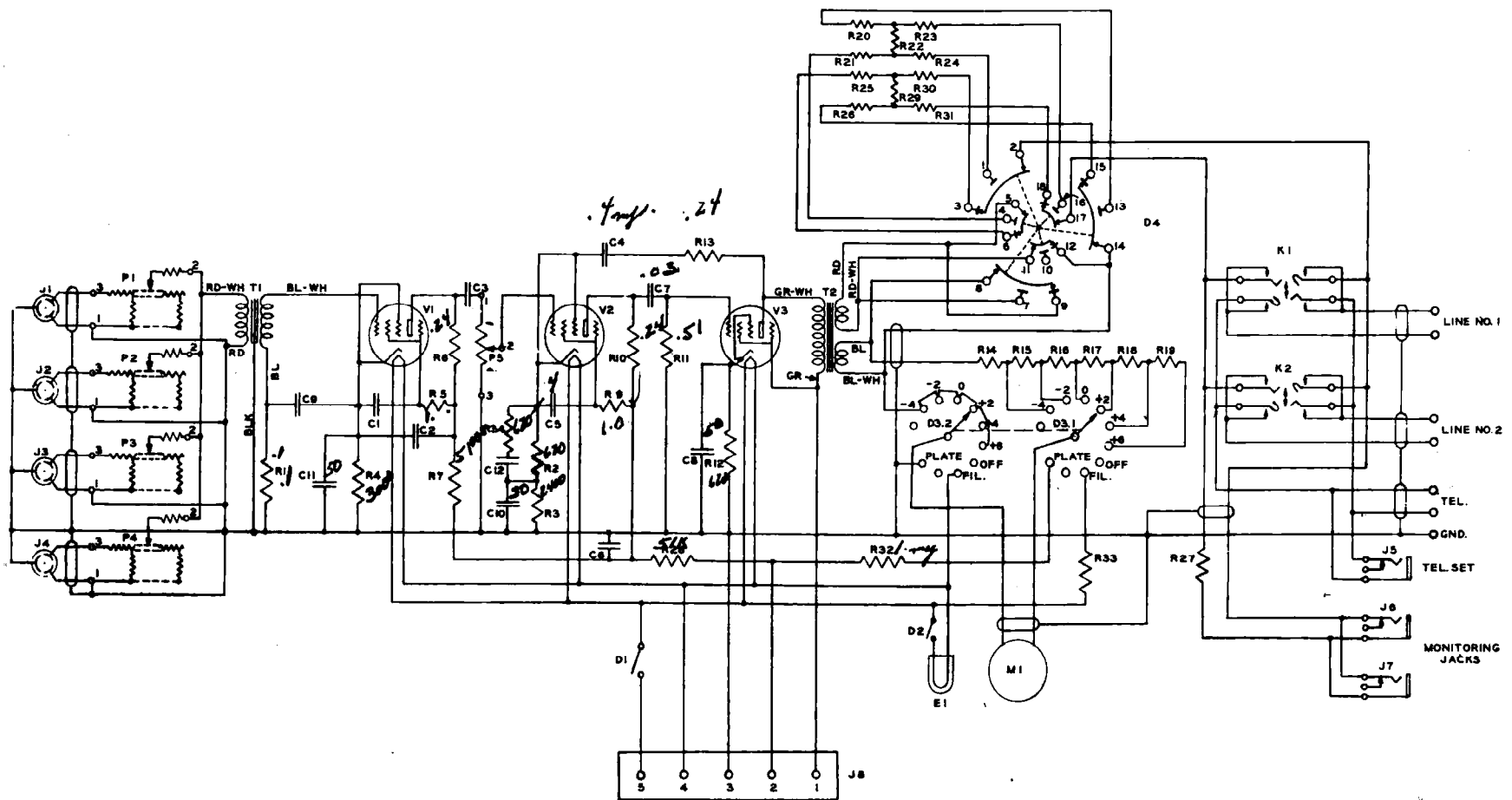


FIGURE 1-22B and 22C Speech Input Equipment—Schematic

tion. Each case is divided into two compartments, the lower one for housing the equipment and the upper one for accessories such as

microphones, monitoring headsets, spare vacuum tubes, etc.

INSTALLATION

The rear cover of the amplifier unit of the 22B and 22C Speech Input Equipments can be removed by loosening the four thumb screws located at the corners on the front panel, and pulling the panel forward. Insert Type 6J7 Vacuum Tubes in the cushioned and center sockets and a Type 6F6 Vacuum Tube in the remaining socket. With a screw-driver set the output impedance switch D4 to "150" or "600" to correspond with the desired output impedance of the amplifier. Replace the rear cover of the unit and fasten by turning the thumb screws in a clockwise direction.

The microphones should be connected through the associated cables to the desired twist lock receptacle at the left end of the unit by means of a Hubbell No. 23005 Plug Cap. Each microphone receptacle is numbered to correspond with the associated mixing potentiometer. The shield of the microphone cable should be connected to the ground terminal of the plug. The plate on which the microphone receptacles are mounted is removable so that if it is desired to use receptacles other than the ones supplied a new plate equipped with the desired receptacles may be substituted in the equipment. Information for the blank plate is given in Figure 5. The program line and the order wire or spare program line should be connected to the terminals marked "Line 1" and "Line 2" at the right end of the unit. The order wire telephone set can be connected either to the terminals marked "Tel" or plugged into the jack marked "Tel." One or two pairs of Western Electric 1002F Headsets or the equivalent equipped with Western Electric 47A (or equivalent) Plugs should be

plugged into the jacks marked "Monitor." Where loudspeaker monitoring is desired or where it is desirable to feed a local public address system from the 22 Type Speech Input Equipment a Western Electric 94 Type Amplifier may be connected to one of the monitor jacks or bridged across the line. The plug of the power supply cable should be inserted in the power supply receptacle on the right end of the unit. A good ground should be connected to the "Gnd" terminal.

When the equipment is operated from batteries, four Eveready No. 738 Batteries and one Exide No. 3-AC-7 Battery per DB-22334XA should be installed in the battery rack and connected as shown in Figure 3. The Exide Battery is a non-spillable type battery. Care should be exercised to keep the height of the electrolyte not more than $\frac{1}{4}$ inch above the top of the separators to preserve the non-spillable feature.

When the equipment is operated from the a-c. supply unit the battery rack may be removed from the power supply carrying case by removing the two screws in the bottom of the case and the a-c. unit installed in its place. A Type 80 Rectifier Tube should be inserted in the vacuum tube socket of the a-c. unit. A power cord of desired length should be connected to the power plug supplied with the unit. The schematic circuit and wiring diagram of the a-c. power unit are shown in Figure 4.

When both the a-c. unit and batteries are carried, the a-c. unit should be turned on its side and inserted in the upper compartment of the power carrying case.

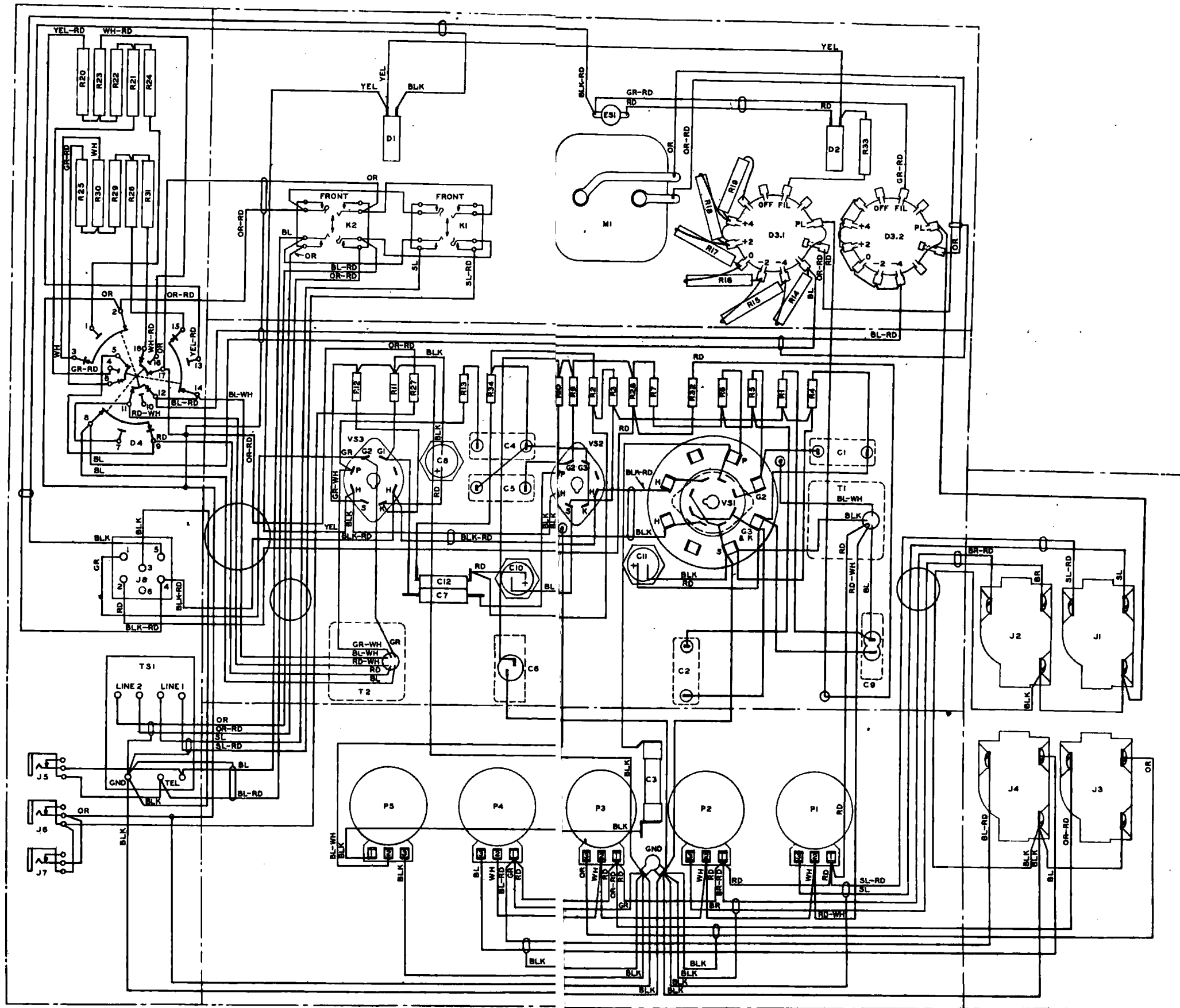


FIGURE 2-22B and 22C Speech Input Equipment Amplifier—Wiring Diagram

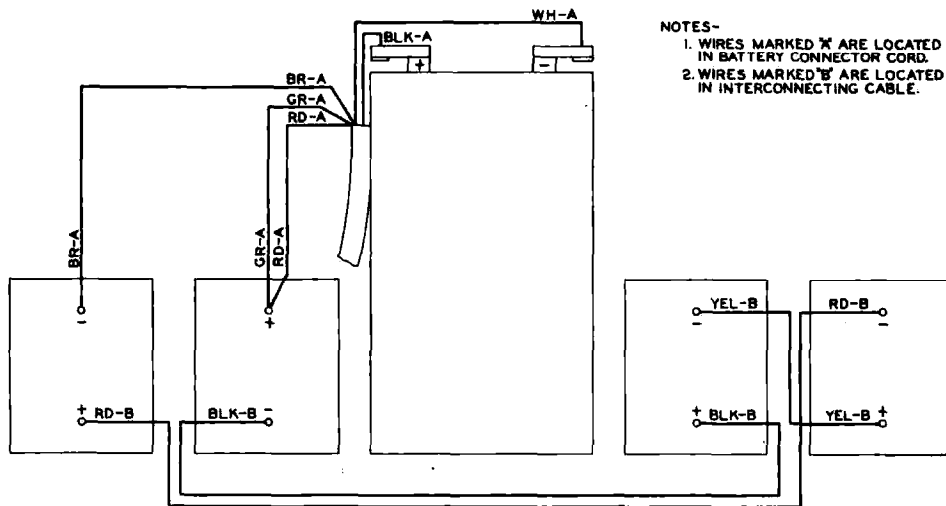


FIGURE 3-22 Type Speech Input Equipment Battery Supply—
Wiring Diagram

USE OF DRY CELL FILAMENT BATTERIES WITH 22 TYPE SPEECH INPUT EQUIPMENT

Under some conditions it may be desirable to operate the 22 Type Speech Input Equipment with dry cell batteries instead of a storage battery as the filament supply. To accomplish this it will be necessary to substitute low filament current type tubes for the standard tubes in order to obtain satisfactory battery life. The following vacuum tubes are recommended for this purpose.

6W7G in place of 6J7

6G6G in place of 6F6

Since the 6W7G Vacuum Tubes are longer than the 6J7 Vacuum Tubes it may be necessary to increase the length of the grid leads in the first and second stages of the amplifier.

With the above tube complement two Burgess 4F2H Batteries connected in series to obtain 6 volts may be used for the filament supply. These batteries will mount in the storage battery compartment of the battery rack.

The number of hours of service which may

be obtained from a set of batteries is dependent upon the number of hours of continuous operation. For continuous operation approximately 12 hours of service may be expected. For six hours of continuous operation per day approximately 24 hours of service may be expected. For operating periods of shorter duration longer service may be expected. It is recommended that the volume indicator lamp switch be left in the "OFF" position when dry cells are used. The use of the volume indicator lamp will decrease the battery life by approximately 30 per cent. Batteries should be discarded when their terminal voltage drops below 5.2 volts. With the volume indicator switch in the "FIL" position this voltage will correspond to a reading of approximately "0 db" on the meter scale. The above voltage limit applies only when vacuum tubes in first class condition are used. For vacuum tubes which have had sufficient use to cause impaired emission higher values of voltage, depending upon the conditions of the tubes, are required for satisfactory operation.

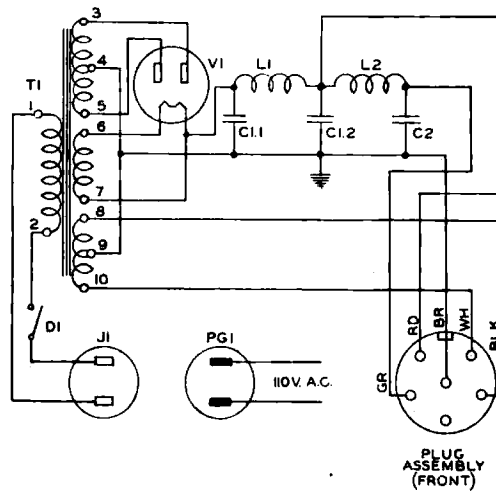
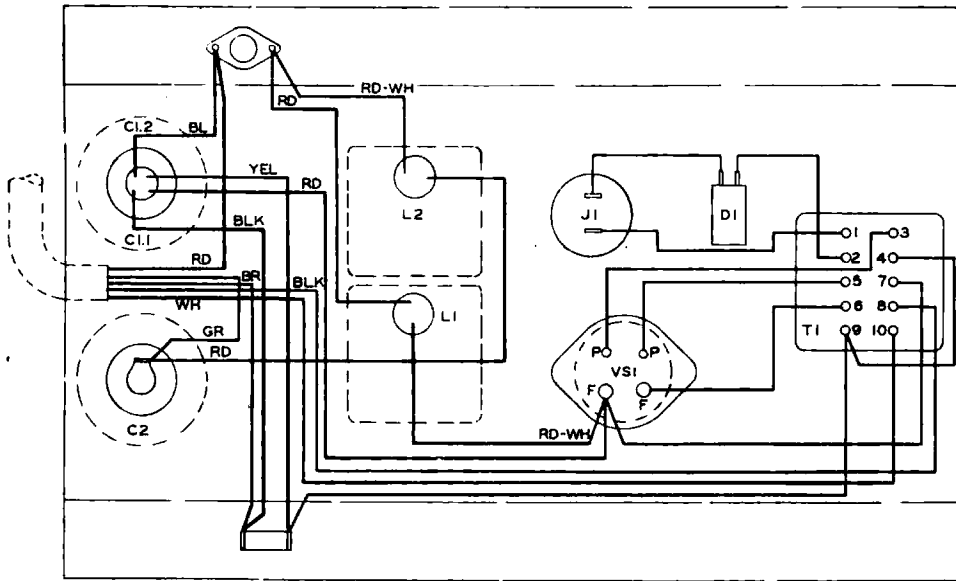


FIGURE 4-22 Type Speech Input Equipment Wiring Diagram and Schematic of Power Supply

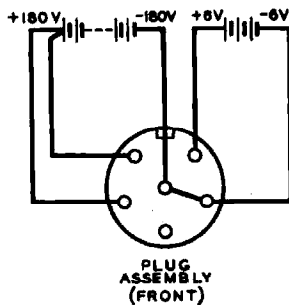
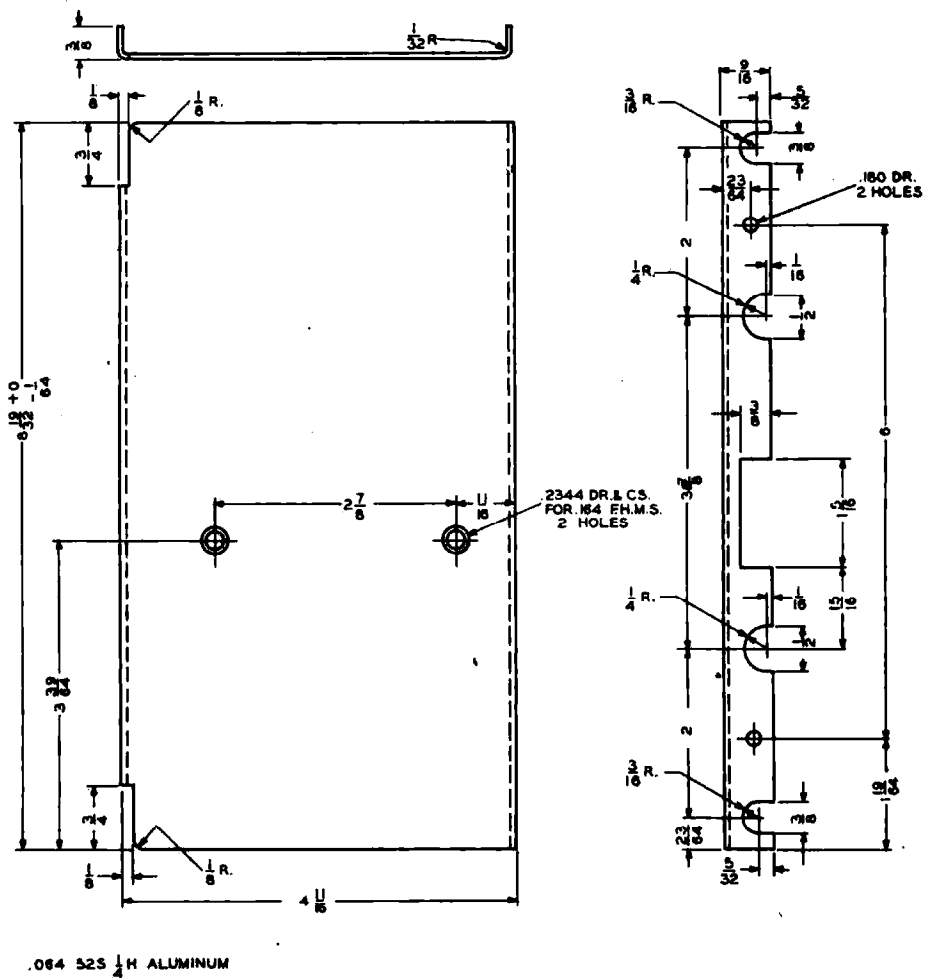


FIGURE 5—Microphone Receptacle Mounting Plate

When the 22 Type Speech Input Equipment is operated with 6W7G and 6G6G Vacuum Tubes slightly lower values of undistorted output power may be obtained than when oper-

ated with 6J7 and 6F6 Vacuum Tubes. When dry cell tubes are used the equipment should not be operated to deliver higher program output levels than 2 db above 6 milliwatts.

OPERATION

The filament switch should be operated to the "On" position to place the 22B or 22C Speech Input Equipment in operation when battery power supply is used. When an a-c. operated power supply is used, the filament switch should be in the "On" position before the power equipment is energized.

The capacity of the filament battery recommended for use with this equipment is sufficient to operate the amplifier for approximately 8½ hours.

The capacity of the plate batteries is sufficient to operate the amplifier for approximately 12 hours.

The volume-indicator switch is connected so that both filament and plate voltage indications may be obtained on the volume-indicator meter. The lower limit of filament and

plate voltages for satisfactory operation are indicated at the "0 db" reading on the scale. When the voltages fall below this point new batteries should be installed. The lamp switch controls the lamp for illuminating the volume indicator meter. This lamp may be on or off as the operator desires but when on it adds an additional 0.150-ampere drain on the filament battery supply.

The amplifier output can be connected to either one of the two program lines by operating the associated line key to the "Amp" position. The line not used for the program circuit may be used as an order wire by operating the associated line key to the "Tel" position. Without a special impedance-matching network the amplifier should not be connected to deliver a program to two lines at the same time.

MAINTENANCE

The 22B and 22C Speech Input Equipments have been designed to require very little maintenance. However, such parts as vacuum tubes and electrolytic condensers will necessarily have a limited life.

It is recommended that a complete spare set of vacuum tubes be kept as follows:

2—Type 6J7 Vacuum Tubes

1—Type 6F6 Vacuum Tube

1—Type 80 Vacuum Tube (required only when a-c. power unit is used).

Some tubes have higher hum or microphonic noise levels than others. Therefore, it may be desirable to select tubes for the first amplifier stage, although the cushioned socket greatly reduces the trouble from microphonic noise.

While this equipment is rugged in construction, it should be afforded the degree of main-

tenance and inspection that any high quality equipment would normally require. Cleanliness is essential for the best operation and therefore the equipment should be kept free from dust and dirt. Compressed air is recommended for cleaning the apparatus. Potentiometer contacts should be cleaned with carbon tetrachloride and then covered with a thin coating of pure petroleum jelly or vaseline.

Electrolytic condensers used in the a-c. power unit also have a limited life. Deterioration is indicated by a gradual increase in the hum level when the amplifier is operated from this unit. If this reaches an unsatisfactorily high value, it is suggested that the entire set of electrolytic condensers be replaced.

The gray crinkle finish of the amplifier cabinet may be cleaned by wiping with a clean cloth moistened with carbon tetrachloride.

Scratches and chips in the finish may be repaired by the application of gray enamel per D-97106 to the injured areas. This enamel may be obtained from the nearest equipment distributor listed in the back of this bulletin. It is supplied with an aluminum powder that is not required for this application.

Recommended Accessory Equipment

The following accessories are recommended

for use with the 22B and 22C Speech Input Equipments. *These are not supplied with the equipment and must be ordered separately:*

- 2—Western Electric 1002F Headsets
Western Electric 630A or 633A (Dynamic) Microphones with Stands and Cords, number as required.
- 1—Western Electric 301A Portable Telephone Set

The equipment described in this Bulletin
was designed and developed for the

Western Electric Company

By
BELL TELEPHONE LABORATORIES

22D SPEECH INPUT EQUIPMENT

Supplement A to Instruction Bulletin No. 903

The Western Electric 22D Speech Input Equipment provides for the use of either a KS-8208 or a KS-8218 Volume Indicator Meter, and includes output line keys equipped with contacts for short-circuiting the inputs of the outgoing lines in the center or normal positions of the keys. With these exceptions the 22D Speech Input Equipment is similar in design and performance to the 22B and 22C Speech Input Equipments, operating instructions for which are given in Instruction Bulletin No. 903.

The schematic circuit of the 22D Speech Input Equipment is shown in Figure A and the wiring diagram in Figure B.

The KS-8208 and KS-8218 Volume Indicator Meters are illuminated scale meters of an improved type which has been standardized for the measurement of volume levels in program circuits and transmission systems. These meters are available with either of two scales, the KS-8208 Meter having the A scale which is marked from -20 to $+3$ vu* above the arc of the meter pointer, with an arbitrary voltage scale 0-100 in small letters below the line of the meter arc. The KS-8218 Volume Indicator Meter includes the B scale in which the 0-100 scale markings are furnished in large letters above the line of the meter arc with the corresponding -20 to $+3$ vu indications below the line. The 100 (0 vu) reference point of the meter in each case is so located on the scale that approximately two-thirds of the available scale length is utilized.

Scale illumination of the meters is provided by two Mazda 6-8 volt, 0.150-ampere lamps mounted inside the meter front cover. Termi-

nals for the external power supply are available at the back of the meter. The lamps of the KS-8208 Meter are normally connected in series, but should be connected in parallel for operation in the 22D Speech Input Equipment by rearrangement of the wiring inside the meter cover which is held in place by two screws at the front of the meter case.

IN ORDERING 22D SPEECH INPUT EQUIPMENTS EITHER TYPE OF VOLUME INDICATOR METER AS DESCRIBED MAY BE OBTAINED. SINCE THE AMPLIFIER IS STOCKED WITHOUT THE VOLUME INDICATOR, THE TYPE OF METER DESIRED SHOULD BE SPECIFIED IN THE ORDER.

Associated with the volume indicator meter as above is a switch marked "D3" and a resistance network for adjusting the sensitivity of the instrument over a range from $+4$ vu to $+14$ vu when the meter deflects to the 100 or 0 vu mark. The readings thus obtained indicate the level at the output terminals of the 22D Speech Input Equipment. Normally a level of $+8$ vu or $+10$ vu will be required to supply program material to a program line.

The current and voltage requirements of the 22D Speech Input Equipment are the same as those of the 22B and 22C Speech Input Equipments as stated in Instruction Bulletin No. 903 except that an additional 150 mils current at 6 volts is required for the illuminating lamps of the volume indicator meter in the 22D Speech Input Equipment.

*Numerically equal to the number of db above or below the new standard reference volume level which is based on calibration with 1 milliwatt of single frequency in 600 ohms using a meter having defined dynamic characteristics such as the KS-8208 or KS-8218 Meter.

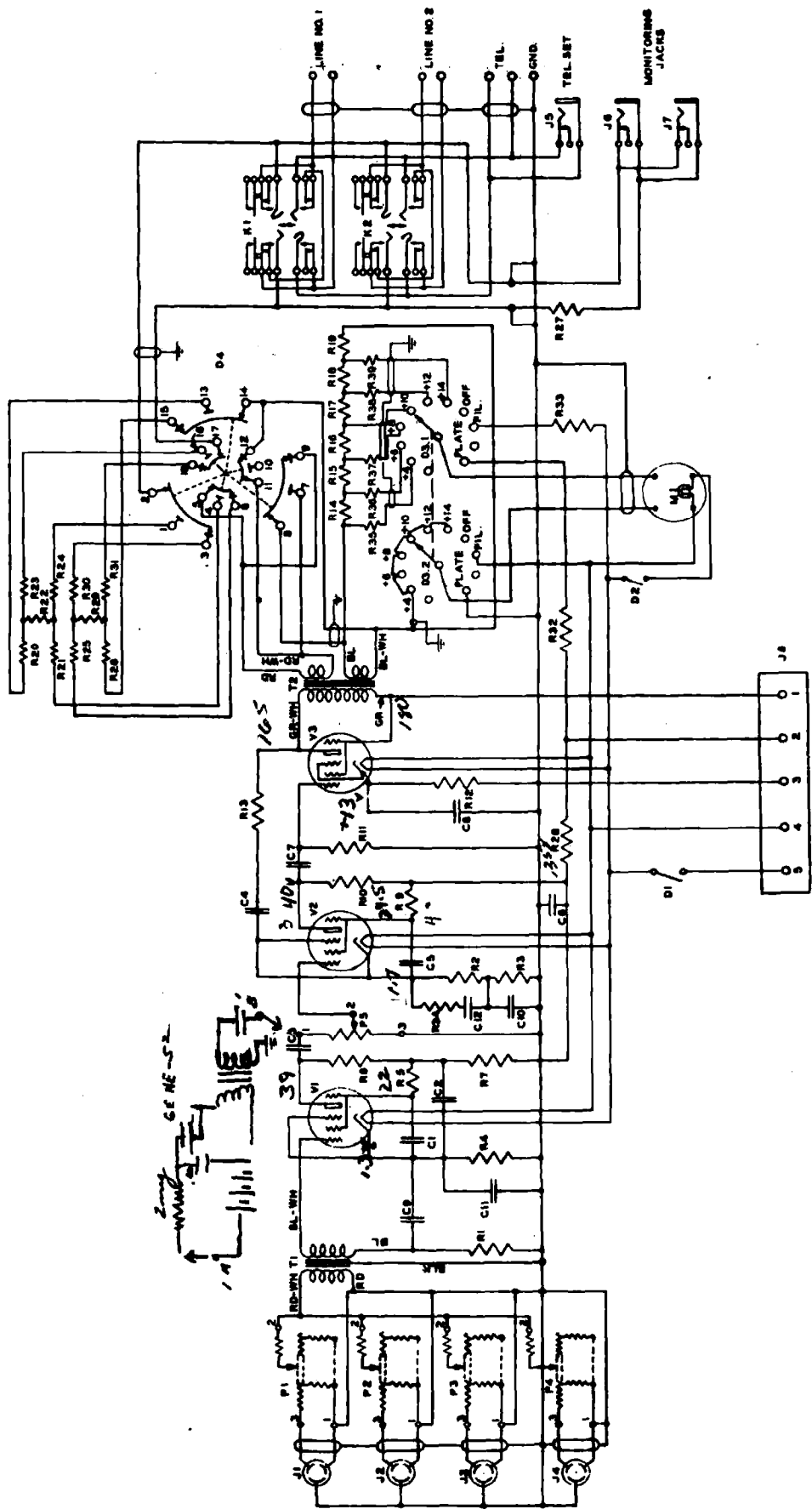


FIGURE A—Schematic

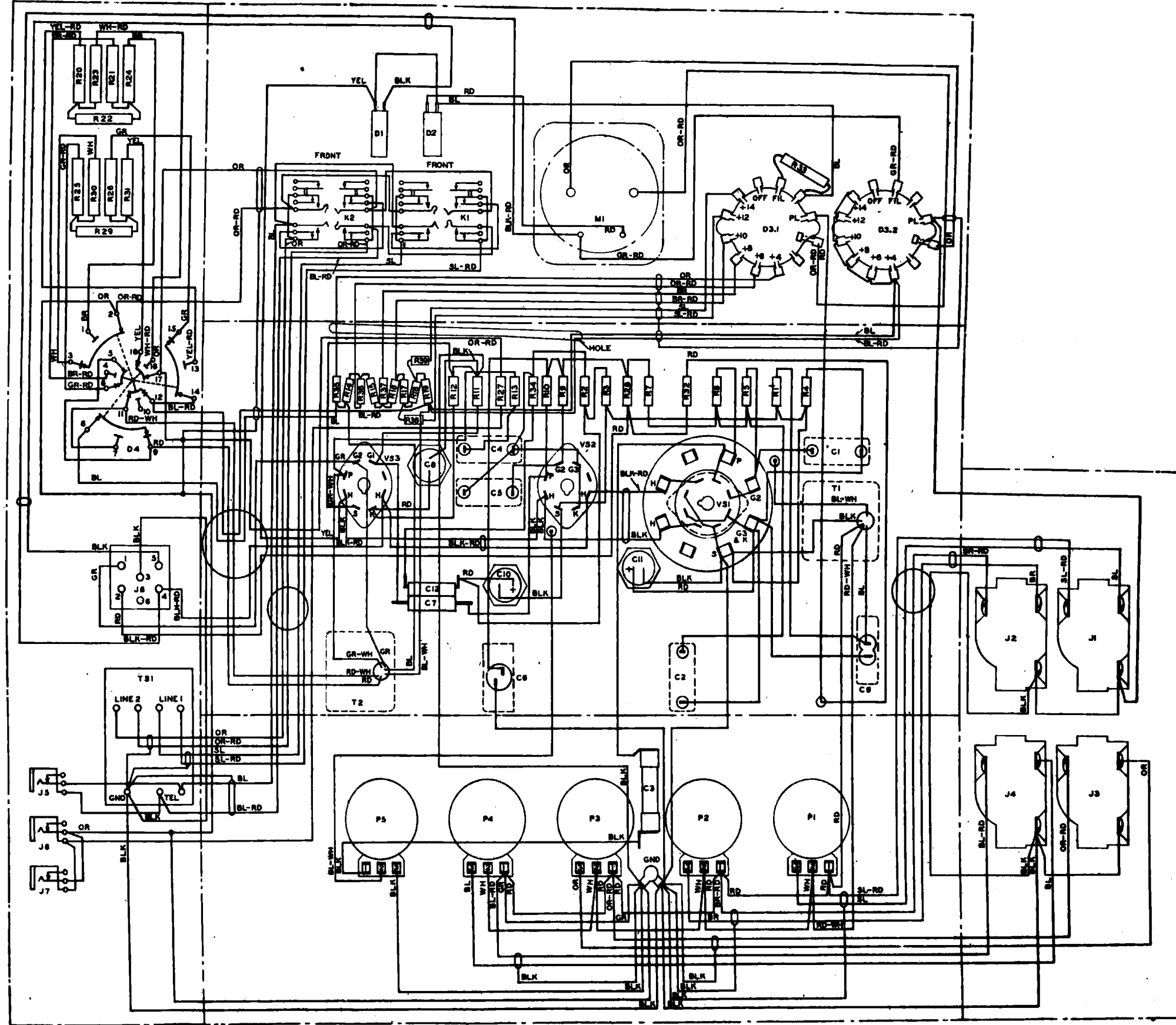


FIGURE B—Wiring Diagram

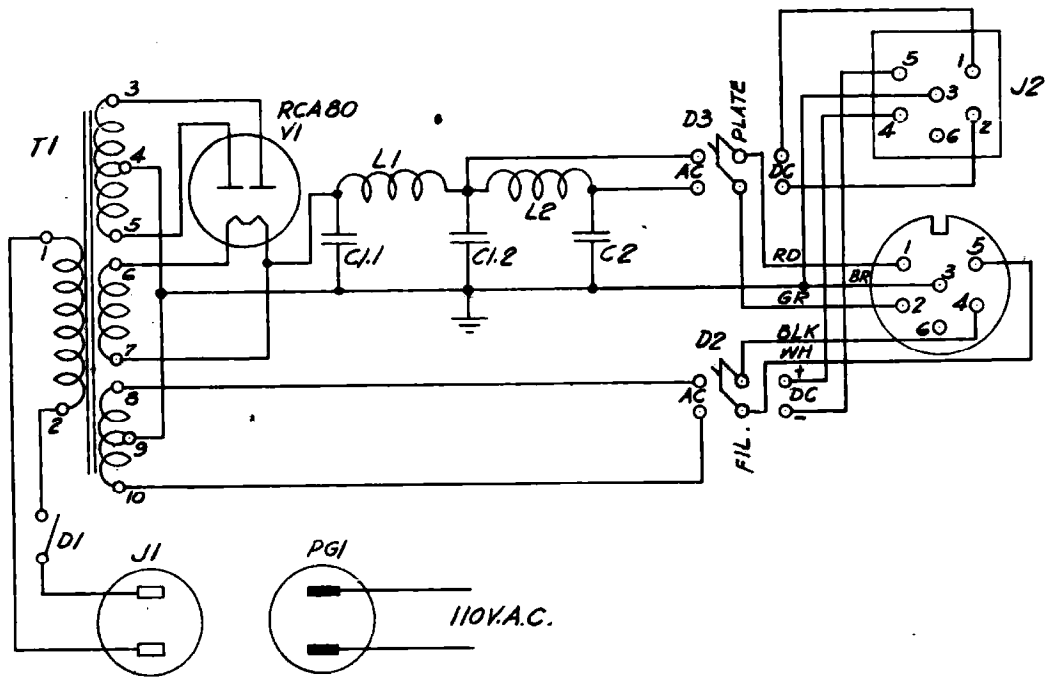


FIGURE 1—Power Supply per ESR-610199-1, Issue 5—Schematic

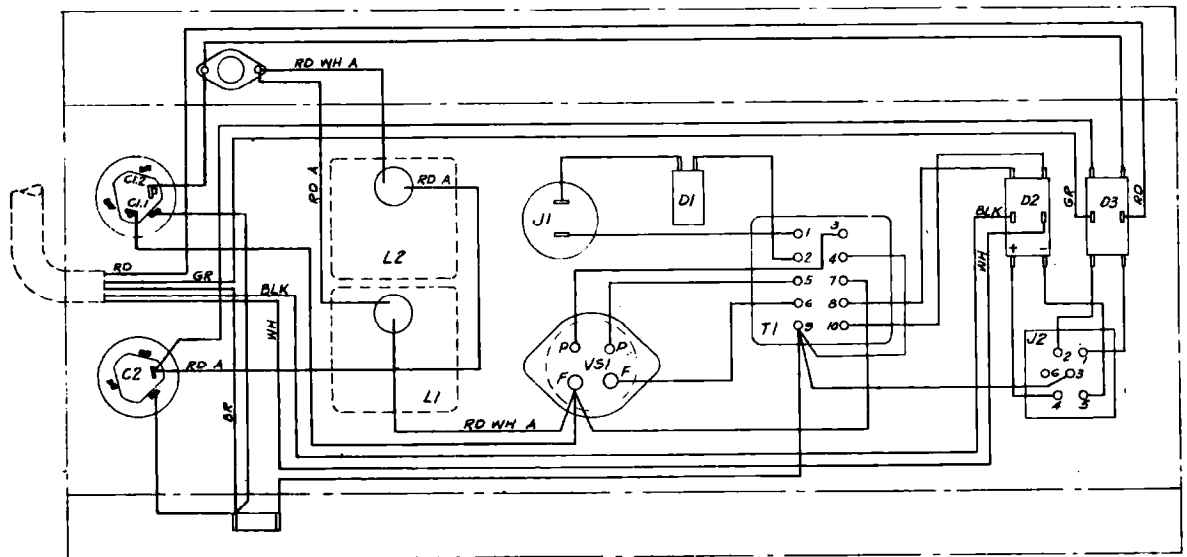


FIGURE 2—Power Supply per ESR-610199-1, Issue 5—Wiring Diagram

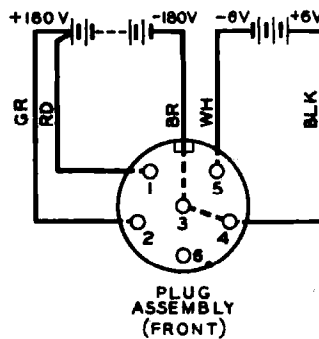


FIGURE 3—22-Type Speech Input Equipment—Battery Supply Schematic

22D SPEECH INPUT EQUIPMENT

Supplement B to Instruction Bulletin No. 903

This supplement to Instruction Bulletin No. 903 covers information and instructions for the use of a new a-c power supply unit with the 22D Speech Input Equipment. This new unit is labeled "Power Supply Per ESR-610199-1, Issue 5" and is similar to the old unit except for the addition of two switches, D2 and D3, and a jack J2 which provide for operation of the amplifier either from the rectifier contained in this unit or from an associated d-c supply unit when the plug from the d-c unit has been inserted in J2. The schematic diagram of this a-c unit is shown in Figure 1 and the wiring diagram in Figure 2 replacing Figure 4 in the Instruction Bulletin No. 903 which shows the corresponding drawings for the prior unit.

The weight of this unit is approximately 8½ pounds. Its dimensions are 13 inches long, by 4⅛ inches wide, by 5½ inches high and it can be mounted in either the top or bottom compartment of the power-supply carrying case. Two elastic stop nuts clinched in the chassis flange together with two No. 8-32 machine screws and two washers furnished with the unit provide for bolting the unit to the bottom of the lower compartment or to the side wall of the upper compartment. It will be necessary to drill two holes in the carrying case for the mounting screws. A No. 18 drill will provide clearance for the No. 8 screws. The position of the holes may conveniently be de-

termined by locating the unit centrally in either compartment and spotting the holes through the elastic nuts with a sharp pointed instrument.

The upper part of the power-supply carrying case may be equipped with this a-c unit and the lower part with a battery rack and batteries to insure against power failures or when it is not certain that a-c power supply is available. When so used the plug on the cord from the battery rack should be plugged into receptacle J2 on the rectifier unit and the plug on the cord from the rectifier should be inserted into the receptacle on the amplifier. Switch D3 may then be used to connect the plate circuits, and switch D2 to connect the filament circuits of the amplifier to either the a-c or d-c power supplies. Each switch functions independently of the other and satisfactory performance is obtained with any combination of a-c and d-c on the filaments and plate circuits. When the rectifier unit is used alone, switches D2 and D3 are left in the a-c position.

The numbering on the plugs of the cords for both the a-c and d-c units has been changed to agree with the terminal numbers shown on the amplifier schematic. Figure 3 shows the corrected schematic for the battery supply unit and replaces the corresponding portion of the drawing shown on Figure 5 of Instruction Bulletin No. 903.

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