

OPERATION AND INSTALLATION MANUAL

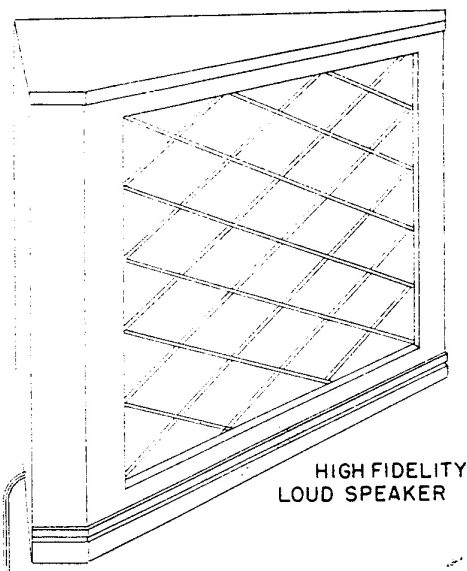
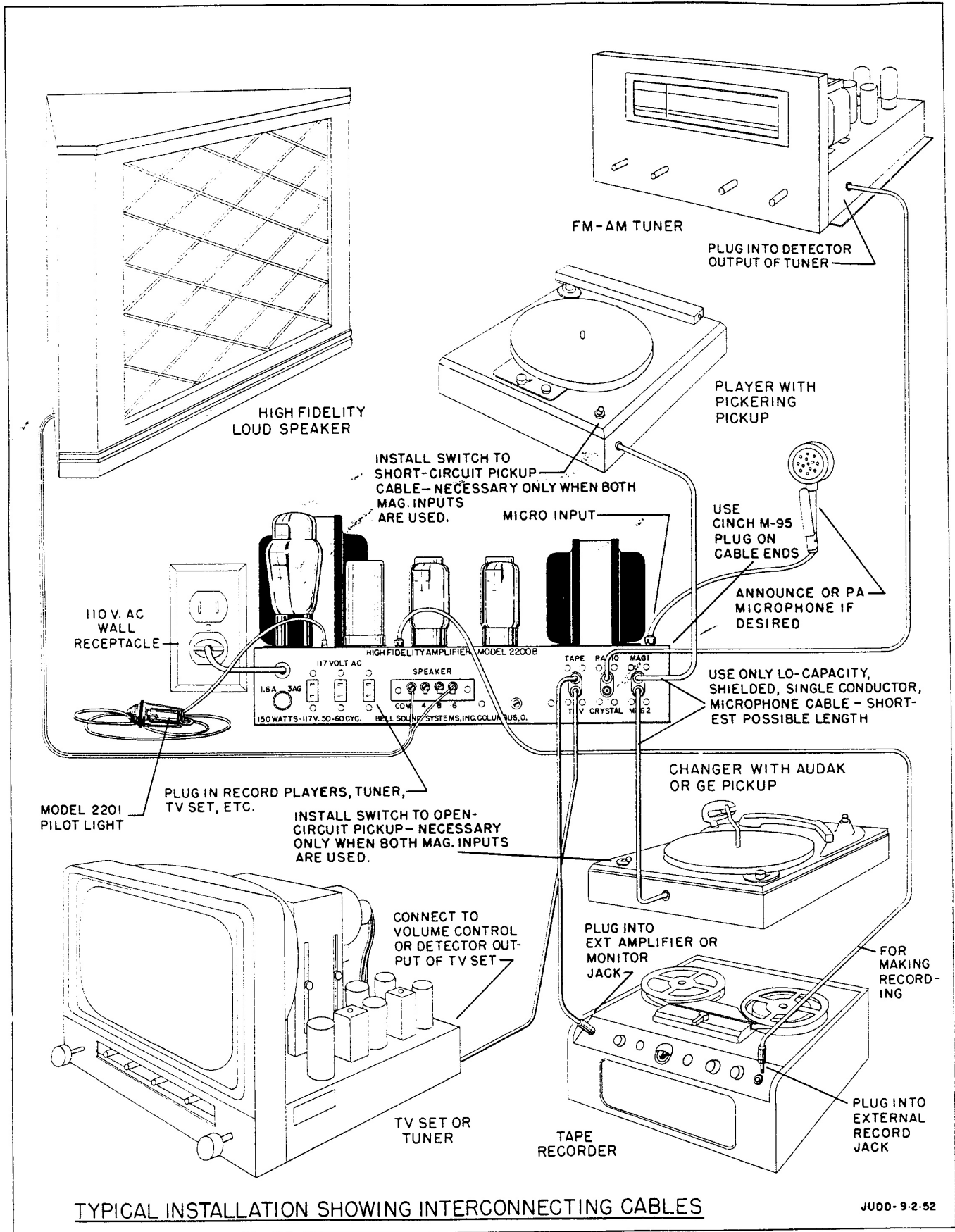
MODEL 2200B

THE AMPLIFIER DESIGNED EXPRESSLY
FOR THE MUSIC-LOVERS CUSTOM SOUND INSTALLATION

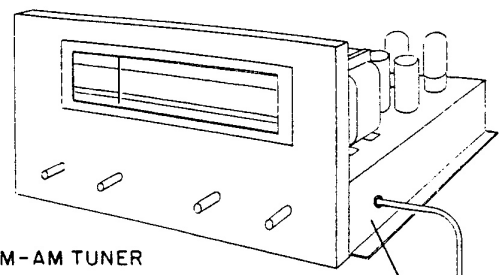
IMPORTANT

*Please Read Carefully Before Installing
or Operating Your Amplifier.*

BELL SOUND SYSTEMS, INC.
COLUMBUS, OHIO

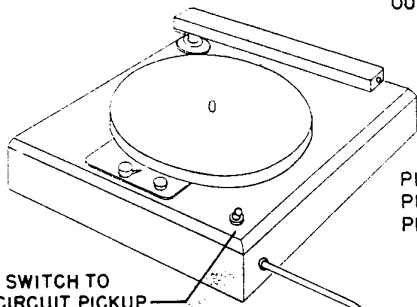


HIGH FIDELITY LOUD SPEAKER



FM-AM TUNER

PLUG INTO DETECTOR OUTPUT OF TUNER



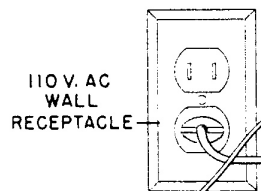
PLAYER WITH PICKERING PICKUP

INSTALL SWITCH TO SHORT-CIRCUIT PICKUP CABLE - NECESSARY ONLY WHEN BOTH MAG. INPUTS ARE USED.

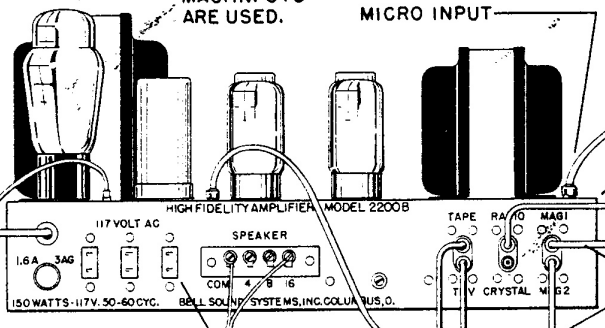


USE CINCH M-95 PLUG ON CABLE ENDS

ANNOUNCE OR PA MICROPHONE IF DESIRED



110 V. AC WALL RECEPTACLE



HIGH FIDELITY AMPLIFIER MODEL 2200B

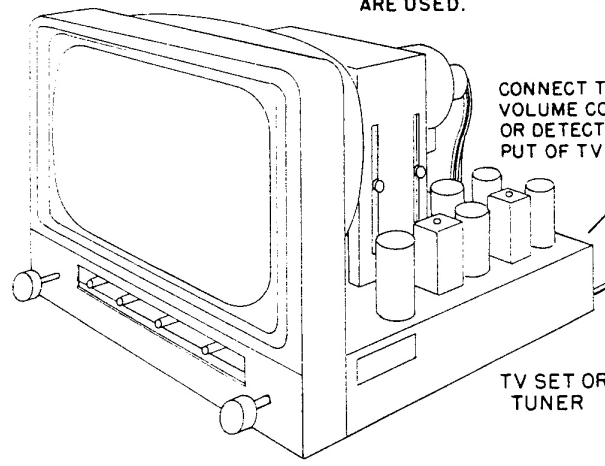
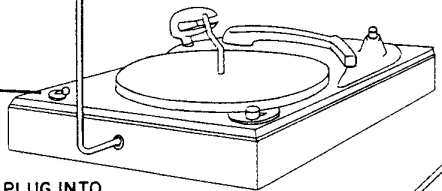
USE ONLY LO-CAPACITY, SHIELDED, SINGLE CONDUCTOR, MICROPHONE CABLE - SHORTEST POSSIBLE LENGTH

MODEL 2201 PILOT LIGHT

PLUG IN RECORD PLAYERS, TUNER, TV SET, ETC.

INSTALL SWITCH TO OPEN-CIRCUIT PICKUP - NECESSARY ONLY WHEN BOTH MAG. INPUTS ARE USED.

CHANGER WITH AUDAK OR GE PICKUP

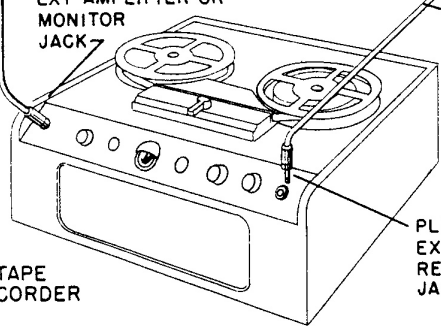


TV SET OR TUNER

CONNECT TO VOLUME CONTROL OR DETECTOR OUTPUT OF TV SET

PLUG INTO EXT AMPLIFIER OR MONITOR JACK

TAPE RECORDER



FOR MAKING RECORDING

PLUG INTO EXTERNAL RECORD JACK

TYPICAL INSTALLATION SHOWING INTERCONNECTING CABLES

INSTRUCTION MANUAL
FOR
MODEL 2200B HIGH FIDELITY AMPLIFIER

- A. UNPACKING - Observe condition of packing carton and amplifier for signs of damage in shipment. Make immediate claim for damage with transportation company. See that all tubes are seated in their correct sockets.

Included are:

- 1 - Model 2200B Amplifier complete with tubes
- 1 - Plastic bag containing six extension shafts and five #4 wood screws
- 1 - Instruction manual
- 1 - Warranty card to be filled in and mailed

The Model 2201 Pilot Light Assembly is available as an accessory which plugs into the amplifier. Pilot Lamp can be mounted at any convenient point.

GENERAL DESCRIPTION - The Model 2200B is particularly designed for the discriminating listener and to operate as the heart of a high-quality music system. It has "flat" inputs for a radio tuner, tape recorder, TV set, microphone and compensated inputs for two different types of magnetic pickups and a crystal pickup. The pre-amplifier, which is built in for G-E, AUDAK, PICKERING, CLARKSTAN, ETC., pickup, has a variable equalizer for compensating practically every type of record characteristic used today.

Signals from all the various sources plug into the Model 2200B Amplifier and are selected by means of a selector switch on the front panel. Individual tone controls for bass and treble provide for either boosting or attenuating the bass or treble tones, independently. A rotary power ON-OFF switch on the panel and three 110 V power receptacles on the rear panel enable all parts of the sound system to be controlled from the Model 2200B.

An important convenience in installing the Model 2200B is the removable dial panel and extension shafts for mounting the amplifier behind a cabinet or other wooden panel with all controls on the front.

- B. INSTALLATION - The Model 2200B is designed to operate ONLY on 105 to 125 volts 50 to 60 cycles AC current. Rated performance is obtained with a line voltage of 117 V.

The circuit diagram of the amplifier is located on the INSIDE OF THE BOTTOM PLATE of the amplifier.

A wiring diagram of a typical installation is shown in Fig. 1. The diagram is self-explanatory and shows the type of wire, connectors, etc., to use.

LOCATION OF AMPLIFIER - The amplifier itself should be centrally located at a point where it is most convenient for the controls. The tuner and, if possible, the TV set and tape recorder should be located nearby in the interest of centralizing the controls.

Due to the heat generated by the power tubes in the amplifier it should not be mounted in a completely closed cabinet space. The rear of the compartment should be completely open, if that is not possible ventilation openings must be provided both high and low in the compartment rear to allow cool air to enter and hot air to exhaust at the top. Place amplifier not more than 2" away from the rear panel containing these openings.

It is well not to place the amplifier directly under a cabinet top since the heat may damage the finish. A piece of bright tin tacked under the cabinet top will alleviate this condition.

USING EXTENSION SHAFTS - To mount the amplifier behind a cabinet front or panel, use the template provided with the amplifier to locate the six 1/2" diameter holes to be drilled in the panel. Remove the knobs from the amplifier by pulling straight off. Remove six hex nuts and the dial panel will come off. Attach the extension shafts and remount the dial to the cabinet using the five #4 wood screws provided. Longer extension shafts are available from radio supply houses if required.

LOCATING RECORD PLAYER - Since magnetic pickups are sensitive to magnetic fields from power transformers they must be located at some distance (more than 12") from the amplifier, tuner, tape recorder or other power transformers. The Model 2200B power transformer is located on the right hand end of the chassis, viewed from the front.

INPUT CONNECTIONS AND WIRING - Shielded, low capacity, single conductor microphone cable or CO-AX should be used for input connections to the amplifier. Cable lengths in excess of six or eight feet may cause some loss of high frequency response (depending upon impedance of

device involved) and increase susceptibility to hum pickup. Locate input cables away from power lines and other wires as much as possible. There is generally no problem of impedance matching to various inputs since the input impedance of the Model 2200B is high enough so as not to constitute a load on the input device.

CONNECTING MAGNETIC PICKUPS - Where two magnetic pickups are to be used, switches must be provided for disconnecting or short-circuiting the pickup cartridge not in use, as shown in Fig. 1. Small rotary or lever type sliding-contact switches are best and they should be enclosed in grounded metal boxes for complete shielding. When two separate pickups use the same input on the Model 2200B, a two position rotary selector switch will be necessary to select the desired pickup. This is not shown on the diagram but can be arranged by a serviceman.

The two magnetic inputs on the amplifier are:

MAG 1 - Low-gain, for any high output magnetic pickup such as the Pickering 120M and others rated at 40 millivolts output or higher. The load resistor is 27,000 ohms.

MAG 2 - High-gain, for any low output magnetic pickup such as the G-E variable reluctance AUDAK and others rated at approximately 10 millivolts output. The load resistor is 47,000 ohms.

NOTE: The load resistors given above are correct for flat response from the Pickering or G-E pickups and are not to be confused with lower values to be found in published data which are intended to produce high-frequency roll-off. Correct roll-off is obtained in the Model 2200B equalizer, not in the load resistor.

Use Cinch M-95 plugs, obtainable at any radio parts supply house, for all input connectors. **MICROPHONE CONNECTIONS** - Any high-impedance microphone may be plugged into the MICRO input on the chassis top. The MICRO-PHONO switch disconnects the MAG phono inputs when the microphone is used.

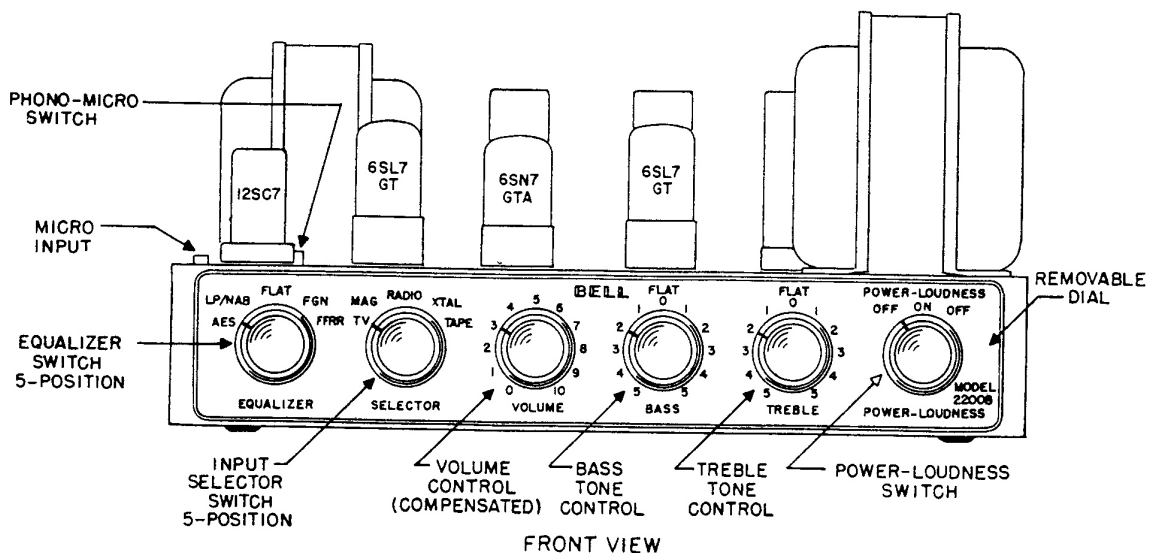
CRYSTAL PICKUP - Practically any type of crystal pickup may be plugged into the crystal input. Since crystal pickups vary in their frequency response more than magnetic pickups, a given record may sound different when played with a crystal pickup. Special wide range crystal cartridges are available (for the RCA 45 r.p.m. changer, and others) and are recommended. Inquire about these from your dealer.

The variable equalizer on the amplifier is not effective when using a crystal pickup, response changes can be made with the tone controls.

RADIO TUNER - A radio tuner with both FM (frequency modulation) and AM (Amplitude modulation - standard broadcast) is recommended. The wide range low noise capabilities of FM are superior to AM. The fidelity and "presence" of a good direct studio pickup on FM is a revealing experience in good listening.

It is not necessary to use a tuner having an audio system, volume control, pre-amplifier or tone controls since these are incorporated in the Model 2200B.

The detector (DET) output of the tuner or TV set should be used. If no detector output is available, one can be installed by a competent service man. The connection should be made



through a .05 mfd series blocking condenser to the volume control.

If signal voltages from the tuner are higher than detector output signals, it may be necessary to install a pad in the amplifier input. See a later paragraph Level Adjustment of Inputs. Connection to RADIO input can be made directly from the voice coil of a radio set but results are not as good as from the DET output.

TAPE RECORDER CONNECTIONS - For playing tape (or wire) recordings through the Model 2200B, a cable should be plugged from the EXTERNAL AMPLIFIER or MONITOR JACK (the OUTPUT jack could also be used) of the tape recorder into the TAPE input of the Model 2200B. See Fig. 1. Although a tape playback head can be plugged directly into MAG 2 input, this input is not designed for this use and optimum playback response will not be obtained.

To record from the output of the Model 2200B, plug into the HI-Z AUX OUTPUT (see rear view below) and into the EXTERNAL RECORD or INPUT jack of the tape recorder. The outside shell of the plug is grounded internally in the amplifier. Be certain that this wire connects to the grounded side of the tape recorder input. The output of the Model 2200B cannot be used to feed a tape recording head direct. See later paragraph for more information about tape recording through the amplifier.

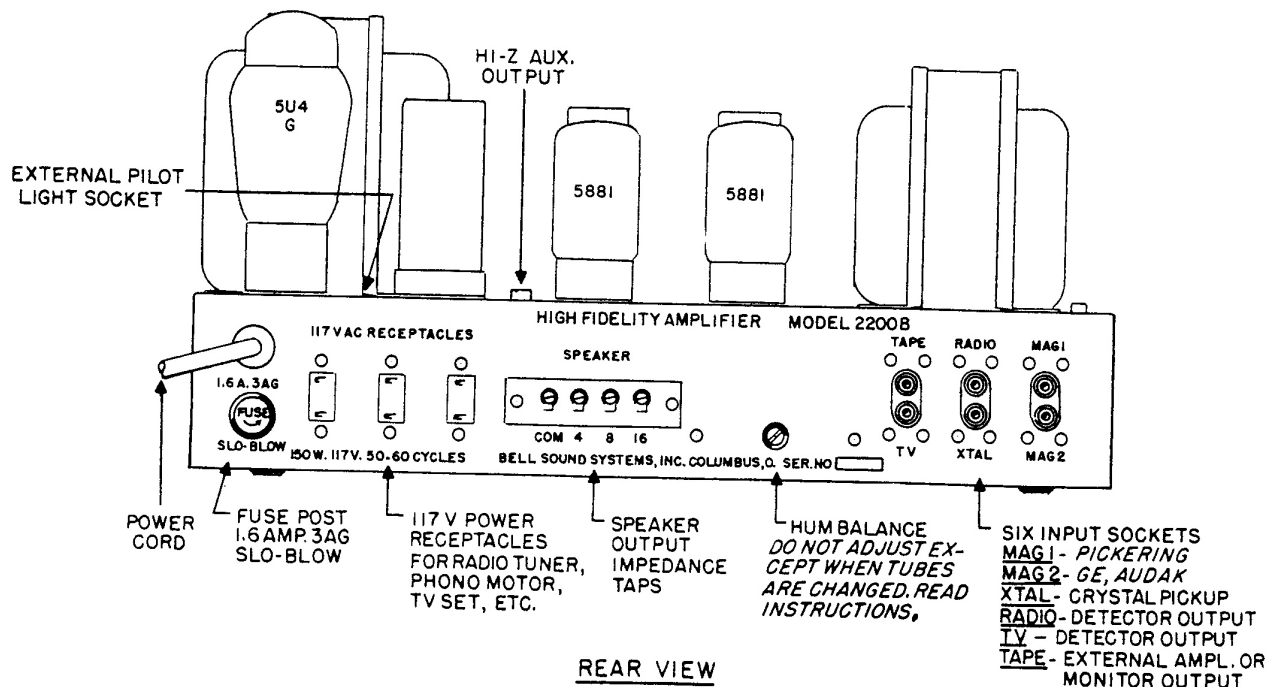
LOUDSPEAKER LOCATION AND MOUNTING - The loudspeaker should be located in a cabinet apart from the immediate record player cabinet whenever possible to eliminate possible feedback coupling. If located within the same compartment, the player should be isolated on rubber mounts from the cabinet frame.

Loudspeakers already mounted in cabinets designed for them are recommended. These cabinets are obtainable as pieces of furniture for floor mounting in room corners or against walls, or as units for "built-ins". More information on loudspeakers is given in a later paragraph.

LOUDSPEAKER CONNECTIONS - The loudspeaker is connected to the amplifier output using two-conductor cable #20 gage copper wire or larger. Stranded wire is preferred over solid wire. Standard rubber covered twin lamp cord is excellent. For running under a rug, 300 ohm TV antenna type flat twin line is good.

Connect one wire to common C terminal and the other wire to 4, 8, or 16 ohm terminal depending upon whether the loudspeaker is rated at 4, 8, or 16 ohm impedance. If the speaker is midway between these values, use the nearest lower valued tap. Speakers rated at 500 ohms can be used by obtaining a transformer from the speaker manufacturer to match 16 ohms. Amplifier performance is not affected by a mismatch of up to 25%.

POWERING THE SYSTEM - The record player, changer and radio tuner may be conveniently powered through the Model 2200B ON-OFF switch by plugging the power cords of these units into the power receptacles on the rear panel of the Model 2200B. When so connected they are controlled by the Model 2200B power switch although not fused by the Model 2200B fuse.



C. OPERATION - The Model 2200B Amplifier is designed for ease and flexibility of operation in a complete home music system. Its' simplicity of control will be apparent after its first usage

RECORD-EQUALIZER	
English Decca	FGN
English Columbia	FGN
HMV	FGN
Telefunken	FLAT
FFRR	FFRR
London 33-1/3 & 45	LP/NAB
London 78	FFRR
Most European	FLAT
Other than Above	FLAT
Early American	FLAT
RCA-All Speeds	LP/NAB
Columbia incl. LP	LP/NAB
Mercury	FGN
Capitol	AES
M-G-M	AES
Artist	AES
Technicord	AES
Most Late American	AES
Other than Above	

THE RECORD EQUALIZER - The following table has been prepared as a guide in the use of the equalizer for different kinds and makes of domestic and foreign records. Since there has been so much variation in the actual equalization used in making the records, even among those of the same label, the final choice of playback equalization will depend upon the listeners judgement.

The switch positions control both the low-frequency turnover and the high-frequency roll-off used in reproduction. Additional variations in response are obtainable from the tone controls, although the tone controls have different turnover points and have different listening effect.

Full frequency range records will show up to best advantage when properly equalized and the equalizer will have maximum listening effect using wide range records. The equalizer is effective when using MAG inputs only

POSITION	RESPONSE	NOTES
AES	400 cycle turnover -12 db roll-off	This is response curve approved by AES (Audio Engineering Society) and is used on many American records
LP/NAB	500 cycle turnover -14 db roll-off	This is a compromise curve within plus or minus 1 db of the LP,NARTB, and RCA curves
FLAT	500 cycle turnover flat high response	For European records shown in table and for maximum brilliance from other records
FGN	250 cycle turnover flat high response	See Table.
FFRR	400 cycle turnover -5 db roll-off	For certain English records (see table) and for brighter reproduction of most American records

THE VOLUME CONTROL on the Model 2200B can be used either as a standard (uncompensated) gain control or as a "loudness" control, using a compensating circuit for low level listening. This circuit actually tends to correct for a listening deficiency of the average human ear at low volume. Music reproduced at a volume lower than the original sounds weak in the bass tones. The compensating circuit boosts the bass at low volume and restores naturalness even though the volume is lower than normal. As the volume control is turned up past 30 percent rotation the compensation gradually drops out.

THE POWER-LOUDNESS switch turns the amplifier on in the ON position. The loudness compensating circuit is also ON in the ON position. Turning the switch to the loudness OFF position will disconnect the loudness compensation and the volume control will operate as a standard gain control.

THE TONE CONTROLS provide considerable range of tonal adjustment to suit the listening conditions and the program material being reproduced. Using a good loudspeaker system, the best program material will normally sound best with tone controls in center FLAT position. In this position, the entire frequency spectrum is amplified uniformly.

The bass control range is -17 db to plus 15 db at 40 cps.

The treble control range is -28 db to plus 18 db at 15,000 cps

Increasing the bass or treble means that the amplifier is delivering more power to the loudspeaker at low or high frequencies respectively. Since the power capability of the amplifier is so high, speaker overload may occur unless the volume is reduced. This is particularly true when record reproduction contains rumble which is a strong low frequency signal causing severe speaker cone displacement, but not much actual sound output. When rumble is increased by bass boost, distortion of the entire frequency range may occur.

The effective cure for rumble is to have the motor and drive mechanism of the record player checked or to replace the record player with another type having lower inherent rumble.

Reducing the treble control will have the effect of reducing the brilliance and "life" of the music and is useful for subdued background music. Increased treble will have the opposite

effect. Also, it will increase record surface noise and radio background noise
RECORD PLAYER - A number of record players and changers available which will provide high quality pickup from all record sizes and speeds. Generally these use either the G-E, Audak, Pickering, Clarkstan or other equally good pickups. The use of a good pickup will be found to be especially important when playing the newer LP records. The motor and drive assembly should be of a type which is free of rumble and vibration. All driving surfaces should disengage in the idle or "OFF" position.

ABOUT RECORD AND STYLUS WEAR - The record itself and the stylus tip are the first two vital links in the high fidelity music system. Modern wide-range and full frequency range records, played through the Model 2200B are a revelation in good listening, they have startling realism. These records deserve the best care and protection from their natural enemies, excessive stylus wear, heat and surface dust. Most critics agree that wear is greater with fine-grooves records. Tests show that measurable wear of a sapphire stylus begins after 15 hours playing time (much less for a metal tip) altho distortion may not be noticeable until some hours later. Unfortunately, stylus wear occurs gradually and often escapes notice until the worn stylus has begun to seriously damage good records. The cure is to install new styli as needed or still better, to install a diamond stylus which has a life of at least 100 times that of a sapphire. Most recent pickups have replaceable styli although these are designed to fit only one type of pickup cartridge.

Equally good reproduction is considered possible at 78 r.p.m. as obtainable at the slower speeds, although surface noise is generally greater at the higher speed. Surface noise and wear can become excessive with the soft-material (plastic) records when surface dust becomes imbedded in the material. Wiping these records with a soft damp cloth is helpful to remove dust and to discharge static electricity from the record.

LOUDSPEAKER - The final link in the hi-fidelity reproducing chain is the loudspeaker and the importance of using a good loudspeaker cannot be overstressed. Speakers having separate low-frequency and high-frequency radiators are necessary to reproduce the full frequency range of which the amplifier is capable. The high-frequency radiator may be attached directly to the low-frequency voice coil or, still better, it may be a separate unit, or tweeter. The tweeter may be located in the center of the low-frequency cone (called co-axial) or it may be mounted alongside (called a two-unit speaker). Three and four unit speakers are also available and a cross-over network must be included.

The design of the housing for the speaker is of greater importance than design for appearance alone. The performance of the speaker system, particularly at low frequencies is dependent upon the acoustic design of the enclosure. The safe procedure is to obtain a housing from the speaker manufacturer which is designed to operate with the chosen speaker. The home constructor should consult the speaker manufacturer about the correct cabinet design. Generally, the volume of air in the enclosure should be at least five cubic feet. The speaker must be mounted flush against the baffle opening without air leaks.

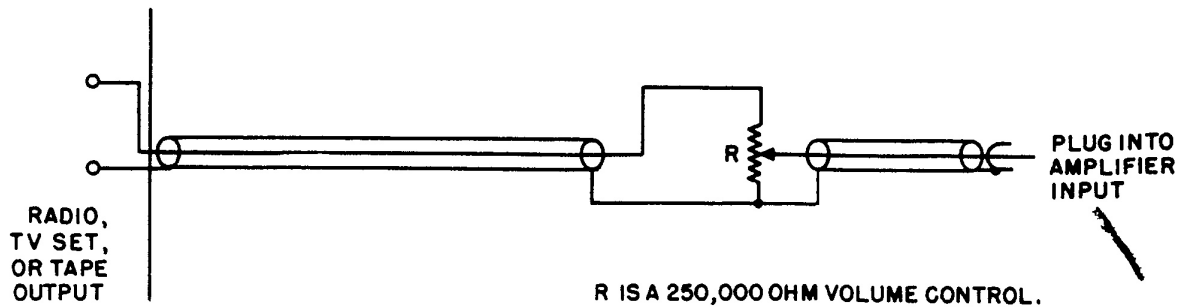
USING MODEL 2200B AMPLIFIER FOR RECORDING - The Model 2200B is ideal for use as a recording amplifier or as part of a music system for copying disc records on tape or recording radio or TV programs on tape or disc. Several precautions are offered to help obtain the best possible results.

- (a) Make test recordings beforehand to check out system for adjusting recording level.
- (b) When recording from a radio, the direct connection to the detector (DET) output will provide best results.
- (c) Always record program "flat", that is, do not introduce additional bass or treble boost or cut unless definite deficiencies exist in the original material. Leave the use of tone controls for playback.
- (d) Monitor recording continuously by listening to loudspeaker or by means of earphones on amplifier output.
- (e) Avoid "riding the gain" during recording. Select a suitable volume level setting which will accept the loud parts and leave the control set essentially at this point.

IMPORTANT - Always turn the power-loudness switch to the loudness - OFF position when recording to remove the loudness compensation from the recorded signal.

LEVEL ADJUSTMENT OF INPUTS - In the interest of keeping the volume level of all input signals the same as the selector switch is rotated, the following is recommended:

- (a) Be certain the correct MAG input is used for the phono pickup being used. This will assure the correct gain for phonograph.
- (b) The RADIO, TV and TAPE inputs are designed to operate from detector output voltages of the order of 1/2 volt. If the signal voltage is high, a potentiometer can be installed as shown below to permit adjusting the volume. The cable should be as short as practical.



MATCHING SEVERAL SPEAKERS - Occasionally it is desired to operate more than one speaker from the output of the Model 2200B and the following suggestions are offered:

(1) Where speakers are to be operated separately, one at a time, a selector switch can be installed to select the desired speaker. In case the impedances of the speakers are different, the selector switch must have 2 or 3 poles depending upon the number of DIFFERENT impedances. Each pole is wired to the correct amplifier output impedance and each position to the correct speaker.

(2) If several speakers are to be operated simultaneously, the problem becomes more difficult if full power output from the amplifier is to be obtained. As a general rule, with two different speakers, connect each speaker to an amplifier tap having $1/2$ the impedance of the speaker. If they are equal, parallel the wires to the amplifier tap having $1/2$ the speaker impedance. The above method will maintain the impedance match.

In general, speakers may be connected to a tap lower than their rated impedance, not higher. The resulting mismatch will result in slightly lower volume and slightly reduced power output to the speaker but response and distortion will not be affected.

D SERVICING

ADJUSTMENT OF THE HUM BALANCING CONTROL - This is a screwdriver adjustment accessible through a hole in the rear panel of the amplifier. This adjustment has been factory set to minimum hum and should not need to be changed unless tubes or other parts are changed. The adjustment should be made as follows:

Set the selector switch on TV, RADIO or TAPE being certain that nothing is plugged into the input selected. Turn the volume, bass and treble controls full on and turn the adjustment until minimum hum is heard in the loudspeaker. The adjustment should be made under quiet listening conditions and with the ear as close to the speaker opening as possible.

A print of the circuit schematic is located on the inside of the bottom plate. When parts are replaced, care must be taken to use the exact equivalent part, notice that the tolerance on some of the resistors is 5% and some of the capacitors is 10%. Replacements for the power transformer No. B-20236 and output transformer No. B-20235 should be obtained direct from the factory since exact equivalents are not available to the servicing trade.

If the amplifier develops trouble, the tubes should be checked first, since they are the most likely cause of trouble. Hum at zero volume is most apt to be caused by the right hand 6SL7GT tube (front view) or the 6SN7GT (A) tube. Hum increasing with volume, tested per previous paragraph heading, is due to first 6SL7GT tube. Hum or noise in MAG position indicates replacement of the 12SC7 tube. Due to wide variations in 12SC7 tube characteristics, several tubes can be tried and the best one used.

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