OPERATION AND INSTALLATION MANUAL

MODEL 2199 B

DELUXE 12 WATT HIGH FIDELITY

AMPLIFIER FOR CUSTOM SOUND INSTALLATIONS

IMPORTANT

Please Read Carefully Before Installing or Operating Your Amplifier.

BELL SOUND SYSTEMS, INC.
A SUBSIDIARY OF THOMPSON PRODUCTS, INC.
COLUMBUS, OHIO

TYPICAL INSTALLATION *SHOWING* INTERCONNECTING CABLES *FOR* BELL *HIGH FIDELITY* AMPLIFIER

MODEL 2199B

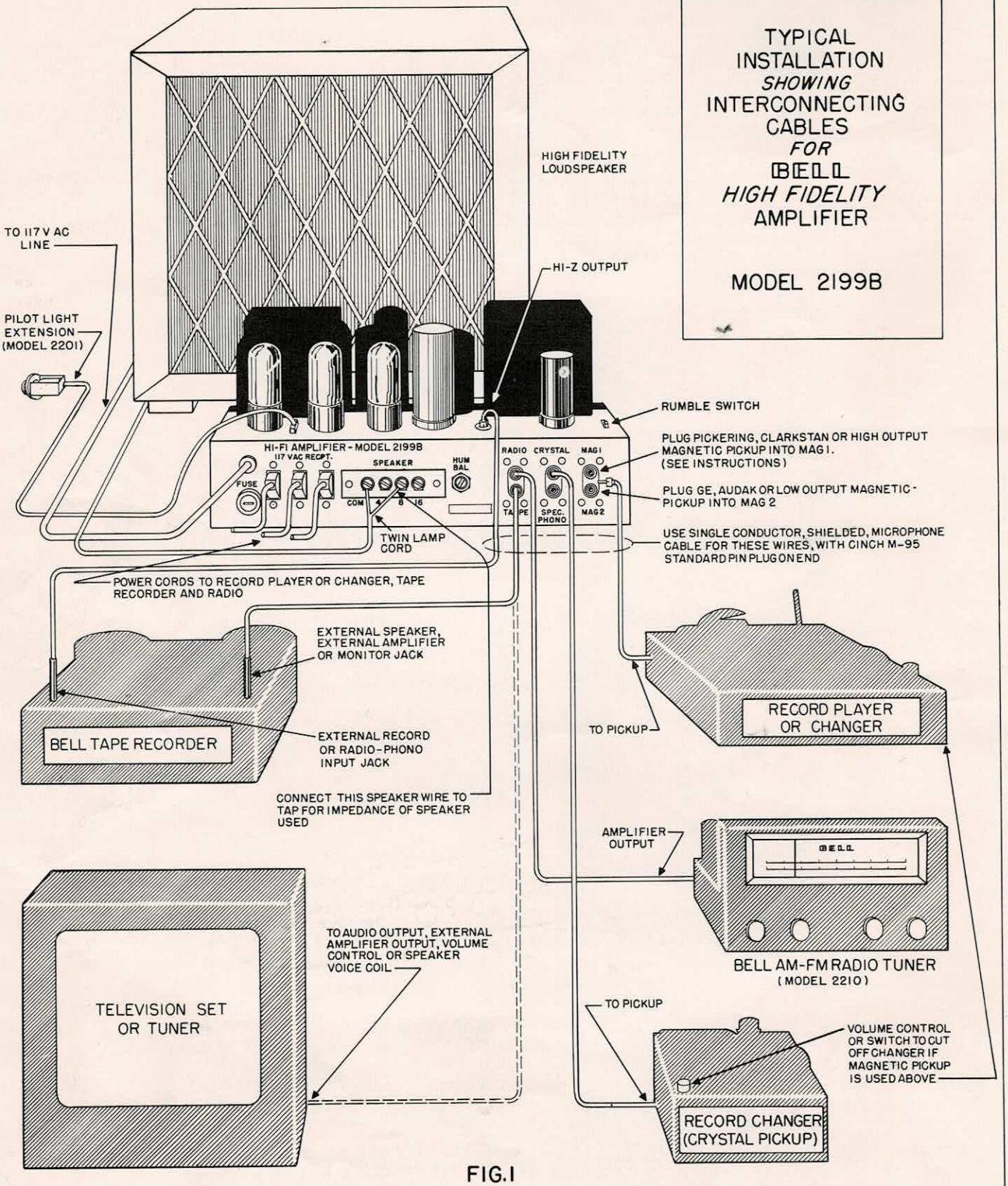


FIG. 1

JUDD 12-53

BELL SOUND SYSTEMS, INC. COLUMBUS 7, OHIO.

I - UNPACKING INSPECTION Unpack carefully and observe condition of packing carton for signs of damage. Check controls for smooth operation. See that tubes are seated securely in their proper sockets. Examine fuse in fuse post, should be 1½ amps. Included in the package: 1 - Model 2199B Amplifier; 1 - Set of five extension shafts and four #4 wood screws contained in plastic bag; 1 - Instruction manual for 2199B; 1 - Dial mounting template; 1 - Warranty card to be filled in and mailed immediately.

A pilot lamp assembly, Model 2201, may be purchased from your dealer if desired. It comes complete with five foot cord, plug, socket, lamp and instructions for mounting.

II - GENERAL DESCRIPTION - Model 2199B is a six tube high fidelity amplifier with a power output of 12 watts at less than one percent distortion.

Six inputs provide for: Tape or T. V., Radio, Special Phono, Crystal and two magnetic pickups. These inputs may be switched at will from front panel by the selector equalizer switch. This switch has seven positions as follow: 1 78 RPM, 2 COL-LP, 3 RCA - AES - NARTB, 4 FFRR, 5 EUROPEAN, 6 RADIO, 7 TAPE.

Other front panel controls include: Loudness control calibrated in db; Gain control; Bass tone control; Treble tone control with AC power switch.

A slide switch near the 6SC7 tube may be used to reduce turntable rumble. This reduces 10 cycle signals about 16 db on crystal, special phono and magnetic pickups when in the "ON" position.

A hum balance control on the rear chassis flange is used to reduce hum. When tube changes are necessary see instructions regarding adjustments.

Three convenience receptacles (for 110-120 volts AC) may be used for record player, radio tuner, changer, tape recorder, etc. These are switched thru main power switch located on treble control but are not fused.

Total drain of three receptacles is 270 watts. This may be used out of one receptacle or divided up in any manner among the three, such as 90 watts each.

A remote pilot lamp socket located between the 6V6 and 5Y3 tubes is used for the Model 2201 pilot lamp accessory kit.

The high impedance auxiliary output (Hi-Z) located near the 6SC7 tube is provided for feeding any input signal to tape or disc recorders or additional amplifiers such as another high fidelity or a P. A. system. This output is ahead of the tone controls and consequently has a flat response, 20-20,000 cps within 2 db. It is, however, controlled by the volume control and the voltage obtainable is from near zero at low volume to about 10 volts at full amplifier output. Distortion at 10 volts is less than one percent from 20 - 20,000 cps.

III - INSTALLATION (See Fig. 1) - Model 2199B is designed to operate on 110-120 volts, 50-60 cycle AC current. A schematic wiring diagram is located in this instruction manual (back page) for reference by servicing technicians.

The unit should be located in a place where the controls will be convenient to operate. Other equipment, radio tuner, record player, changer, tape recorder and TV set should be close by for ease of operation.

The amplifier must be located where adequate ventilation will protect it from over-heating. In a closed cabinet, ventilation louvers or holes must be located in top and bottom of cabinet to allow circulation. If located in a piece of furniture, allow space above the amplifier to protect the wood finish, or tack a piece of tin or aluminum foil on the underneath side of the cabinet to reflect heat.

The amplifier may be mounted with tubes vertical (normal upright position) or with the tubes horizontal provided that the long dimension of the chassis is horizontal or any position in between these two. Other positions may shorten rectifier tube life.

Extension Shafts - To mount the amplifier behind a cabinet front or panel, use the template enclosed to locate the five ½" diameter holes to be drilled in the panel. Remove the knobs from the amplifier by pulling straight off. Remove five hex nuts and remove dial panel. Attach the extension shafts and remount the dial to the cabinet using the four #4 wood screws provided. Longer extension shafts are available from radio supply house if required.

Record Player Location - Since magnetic pickups are sensitive to magnetic fields such as power transformers, they should be located at some distance (more than 12") from the amplifier, tuner, tape recorder or other power transformers and motors, or they must be oriented at some particular angle which is not always practical in installations of several pieces of equipment. The Model 2199B power transformer is located on the right hand end of the chassis, viewed from the front.

Input Connections and Wiring (See Fig. 2) - 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 2199B is high enough so as not to constitute a load on the input device. Make connections to amplifier by attaching a standard phono pin plug such as CINCH M-95 to end of cable. Three units such as: Radio or Tuner; Tape or T.V. and a Phonograph

pickup may be connected to inputs at the same time, then switched to desired input from selector switch on front panel. If more than one pickup is used in the Hi-Fi system, switches to cut out the magnetic, and volume controls to cut out crystal or ceramics may be used. Inputs are as follows:

Mag 1 - Low gain, for any high output magnetic pickup such as the Pickering 120M, Clarkstan and others rated at 30 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.

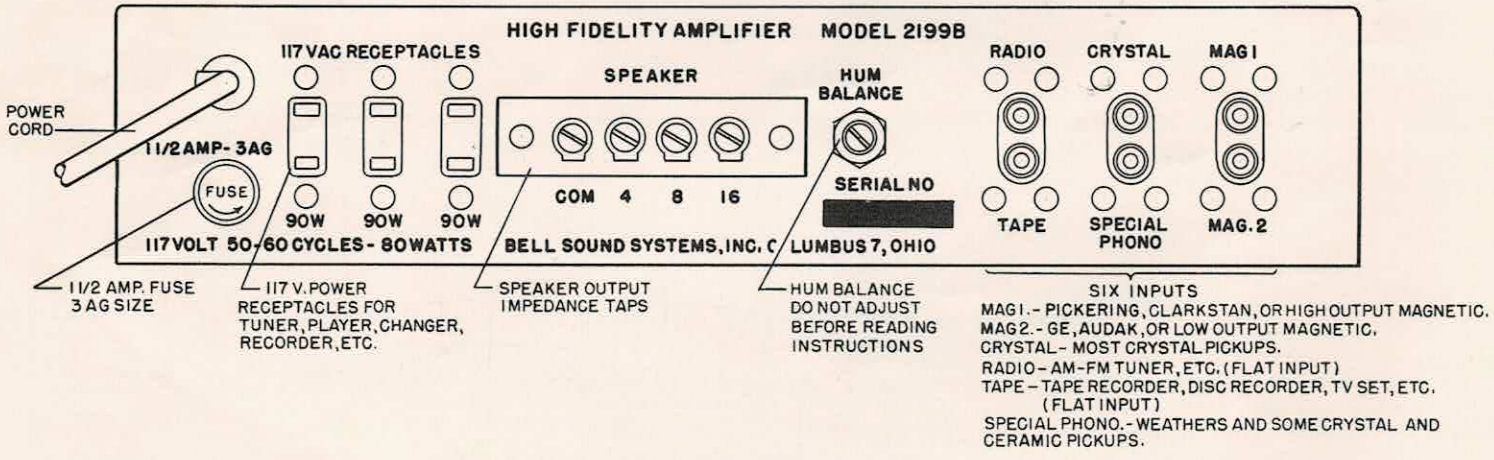
NOTE: The load resistors given above are correct for flat response from the Pickering or G-E pickups and are not to be confused with lower values to be found in published data which are intended to produce high-frequency roll-off. Correct roll-off is obtained in the Model 2199B equalizer, not in the load resistor.

Crystal Pickup - Practically any type of crystal or ceramic 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 45 rpm changer and others) and are recommended. Inquire about these from your dealer. Set the equalizer on "European" for flat response for most wide range crystal or ceramic pickups. For variations, any of the five positions of equalization may be used to suit the individual taste. The rumble filter is effective also and may be switched in or out when using crystal pickup input. Other response changes can be made with the tone controls.

Special Phono - The special phono input is used for such pickups as the Weathers F-M type. It can be used also for crystal or ceramic pickup which are weak in high frequencies, since this input has a rising high frequency response. The equalizer should be set on European for the Weathers type but can be used in any of the five positions for variations in response.

Radio Tuner - A radio tuner such as the Bell 2210 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, pre-amplifier or tone controls since these are incorporated in the Model 2199B. The amplifier output of the Bell tuner should be used. This permits the volume control of the tuner to be set at the same level as the phonograph. If you do not have a tuner with volume control see Fig. 4 for a hook-up to reduce radio volume. If signal voltages from the tuner are higher than 1 volt it may be necessary to install this ahead of the amplifier input. Connection to RADIO can also be made directly to the voice coil but results are at times not as good as from the detector or amplifier output. The impedance of radio input is over 200,000 ohms.

FIG. 2. REAR PANEL DETAIL



Tape Recorder Connections and T. V. Sets - For playing tape (or wire) recordings through the Model 2199B a cable should be connected from the external amplifier jack, monitor jack, output jack or external speaker jack of the tape recorder into the tape input of the Model 2199B. To record from the output of the Model 2199B another plug and shielded cable may be connected from the auxiliary Hi-Z output to the external record or phono-radio input jack of the tape recorder. Be certain that the shield connects to the grounded side of the tape recorder input. Use shortest lead possible.

For connection to T. V. set, have a service man install a shielded cable connected to the T. V. volume control. See Fig. 1 for other possible connections. Input impedance of Tape or T. V. input is over 200,000 ohms.

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".

Loudspeaker Connections - The loudspeaker is connected to the amplifier output using two conductor wire. Stranded wire is preferred over solid wire. Standard plastic covered twin lamp cord is excellent. For running under rug, 300 ohm T. V. 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 the loudspeaker impedance. If the speaker is not exactly one of 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 to 16 ohms. Amplifier performance is not affected by a mismatch of up to 25%.

Powering the System - The record player, changer, radio tuner or tape recorder may be conveniently powered through the Model 2199B ON - OFF switch by plugging the power cords of these units into the power receptacles on the rear panel. When so connected they are controlled by the power switch although not fused. The total wattage drain is 270 maximum. This from any one outlet or divided in any manner among the three, such as 90 watts each.

IV - OPERATION (See Fig. 3) - The operation of the 2199B is simple after the installation has been completed. Turn the unit "ON" with the treble control. Set both the bass and the treble controls at flat to start with.

Select the input desired, Radio, Tape or Phono., with the selector equalizer switch. If Phono, is used set equalization to desired position, that is, RCA - LP - FFRR, etc.

To use loudness control, turn gain control to maximum clockwise position #10. Adjust volume with loudness control to any desired level. You will note that the bass and treble response will increase as the control is turned counter clockwise and the volume will drop. The volume cannot be turned to zero but if too loud at extreme counter clockwise position, turn gain control counter clockwise to correct level.

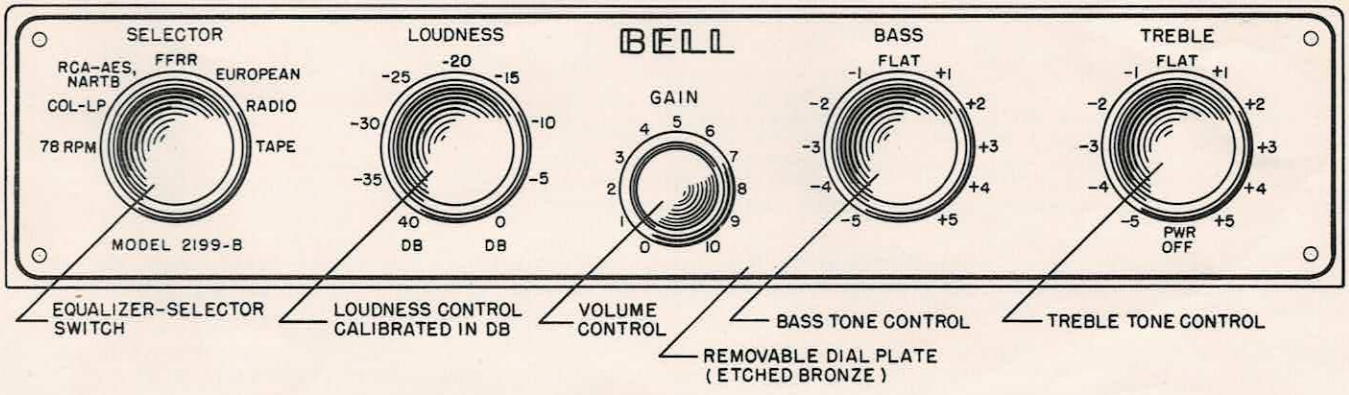
If compensation of loudness control is too great (too much bass and treble), turn loudness control clockwise a little at a time and reduce volume to desired level with gain control. Any degree of loudness compensation can be had by proper adjustment of the continuously variable gain and loudness controls.

The loudness control 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 and treble tones. The compensating circuit boosts the bass and treble at low volume and restores naturalness even though the volume is lower than normal.

The use of the bass and treble tone controls will give further variation to suit the individual tastes.

To use without loudness compensation, turn loudness control to "O" maximum clockwise position, and adjust volume level with gain control only.

FIG.3 FRONT PANEL DETAIL



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. CAUTION - do not use too much bass boost, if loudness compensation is being used. Too much bass at any time means the amplifier is delivering more power to the loudspeaker at low frequencies. Since these frequencies may not sound as loud to the ear it is very easy to have distortion before it is realized. If using a phonograph player or changer the motor rumble and pickup arm resonance will show up quicker when using bass boost. Too much treble boost increases high-frequency output and distortion may result before it is realized. The Model 2199B bass control boosts the bass frequencies 17 db at 40 cycles and cuts them 18 db at 40

cycles. The treble control boosts the high frequencies 15 db at 15,000 cycles and cuts them 19 db at 15,000 cycles. A rumble filter is provided to lessen turntable rumble and arm resonance. When in "ON" position the lower frequencies are attenuated as much as 16 db. The best cure for rumble, however, is to have the motor and drive mechanism of the player or changer checked or replaced with another type having lower inherent rumble. A better pickup and arm may also be worth considering. Increasing the treble control will have the effect of increasing the brilliance and life of the music but will also increase record surface noise and radio background noise. Reducing the treble will have the opposite effect and is useful to subdue noises or for background music.

The hum balance control has been adjusted at the factory and, unless tubes or other parts are replaced, it should not require adjustment except in rare instances. If adjustment is needed proceed as follows: Remove all input connectors leaving only the speaker connected. If a magnetic pickup is used, turn equalizer switch to "NARTB" position. Turn treble control to minimum and bass control to maximum. Turn volume to maximum and adjust hum balance to a minimum of hum. If no magnetic pickup is used, turn selector switch to "RADIO" and proceed as above.

V - HIGH FIDELITY ENJOYMENT - 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 listener's judgement. The table given is a recommendation only and does not mean the manufacturer uses the exact curve shown.

Allegro	COL-LP	Dial	COL-LP	Oceanic	COL-LP
American Recording Society	RCA -etc.	Elektra	RCA-etc.	Oxford	COL-LP
Arizona	RCA - etc.	EMS	RCA-etc.	Period	RCA-etc.
Atlantic	RCA - etc.	Esoteric	RCA-etc.	Philharmonic	RCA-etc.
Audiophile	RCA - etc.	Festival	COL-LP	Polymusic	RCA-etc.
78 RPM	EUROPEAN	Good Time Jazz	RCA-etc.	Rachmaninoff	COL-LP
Bach Guild	COL-LP	Handel-Society	COL-LP	RCA	RCA-etc.
Banner	COL-LP	Hayden-Society	COL-LP	Remington	RCA etc.
Bartok	RCA-etc.	Harvard	COL-LP	Renaissance	COL-LP
Blue Note	RCA-etc.	HMV English	COL-LP	Stradivari	COL-LP
Caedmon	RCA-etc.	American	RCA-etc.	Tempo	RCA etc.
Canyon	RCA-etc.	London FFRR	FFRR	Technichord	RCA-etc.
Capitol	RCA-etc.	Lyrichord	RCA-etc.		EUROPEAN
Capitol-Cetra	RCA-etc.		COL-LP	Telefunken	RCA-etc.
Cetra-Soria	COL-LP	Mercury	RCA-etc.		EUROPEAN
Coliseum	COL-LP		COL-LP	Transradio	COL-LP
Columbia	COL-LP	MGM	RCA-etc.	Urania	COL-LP
Concert Hall	COL-LP		COL-LP		RCA-etc.
Coral	RCA-etc.		RCA-etc.	Vanguard	COL-LP
Cook	RCA-etc.		COL-LP	Vox	COL-LP
Decca	COL-LP		RCA-etc.	Westminster	RCA-etc.
	RCA-etc.		COL-LP		COL-LP

NOTE 1. Binaural records when played monaurally on one band, use outside band and RCA-etc. equalization.

2. When two equalizations are given this indicates curve may be a compromise between the two or both equalizations have been used at some time or other.

Recording Thru Model 2199B - When using the auxiliary output (Hi-Z) to make recordings, do not use loudness compensation, otherwise, the extra bass boost will overload the recording. Turn loudness control to maximum clockwise rotation. Use gain control for volume adjustment. Loudness compensation may be used however when playing recording back thru amplifier. In connecting this output to the recorder use the shortest possible length of low capacity shielded cable in order to maintain high response.

Model 2199B has adequate feedback to give good regulation of the output voltages and may be used safely without a load if desired and may be used to feed recorders, headphones or other amplifiers and PA systems. If used in this way, slightly higher output voltages may be had(at 16 ohm tap) than at the auxiliary output and the tone controls will be in the circuit. The amplifier will be flat from 20 - 20,000 cps within 2 db (radio or tape input with tone controls flat) and the distortion at 10 volts will be less than one percent from 30 to 20,000 cps.

Level Adjustment of Inputs - (See Fig. 4) In the interest of keeping the volume level of all input signals the same and to minimize crosstalk, 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 and other inputs may be adjusted on this basis.

(b) The Radio, and Tape inputs are designed to operate from low output voltages of the order of 1/2 volt. If the signal voltage is high, a potentiometer can be installed as shown (Fig.4) to permit adjustment of the volume. The cable should be as short as practical.

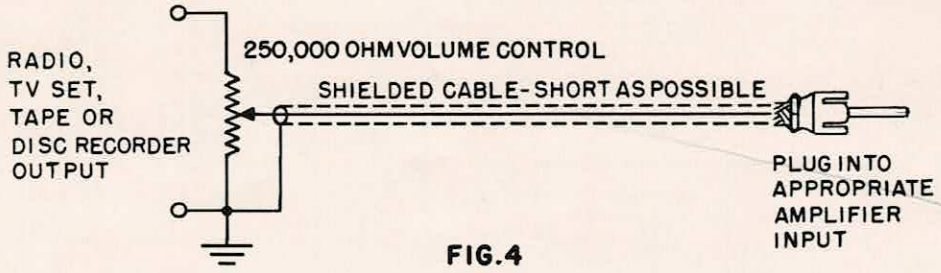


FIG.4

The following table gives the input resistance and the approximate input voltage for 10 watts output.

Selector Position	Input	Input (load) Resistance	Input Volts at 1000 cps
NARTB	Mag 1	27,000 ohms	.040
NARTB	Mag 2	47,000 ohms	.010
EUROPEAN	Crystal	1,200,000 ohms	.350
EUROPEAN	Special		
	Phono	100 MMF capacitor	.350
RADIO	Radio	200,000 ohms	.200
TAPE	Tape	200,000 ohms	.200

Matching Speakers - Occasionally it is desired to operate more than one speaker from the output of the Model 2199B and the following suggestions are offered.

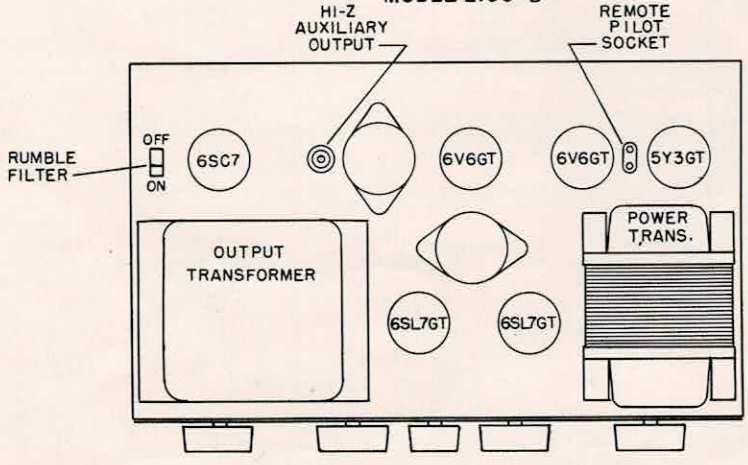
(1) Where speakers are to be operated separately, one at a time, a selector switch can be installed to select the desired speaker. In case the impedances of the speakers are different, the selector switch must have 2 to 3 poles depending upon the number of DIFFERENT impedances. Each pole is wired to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

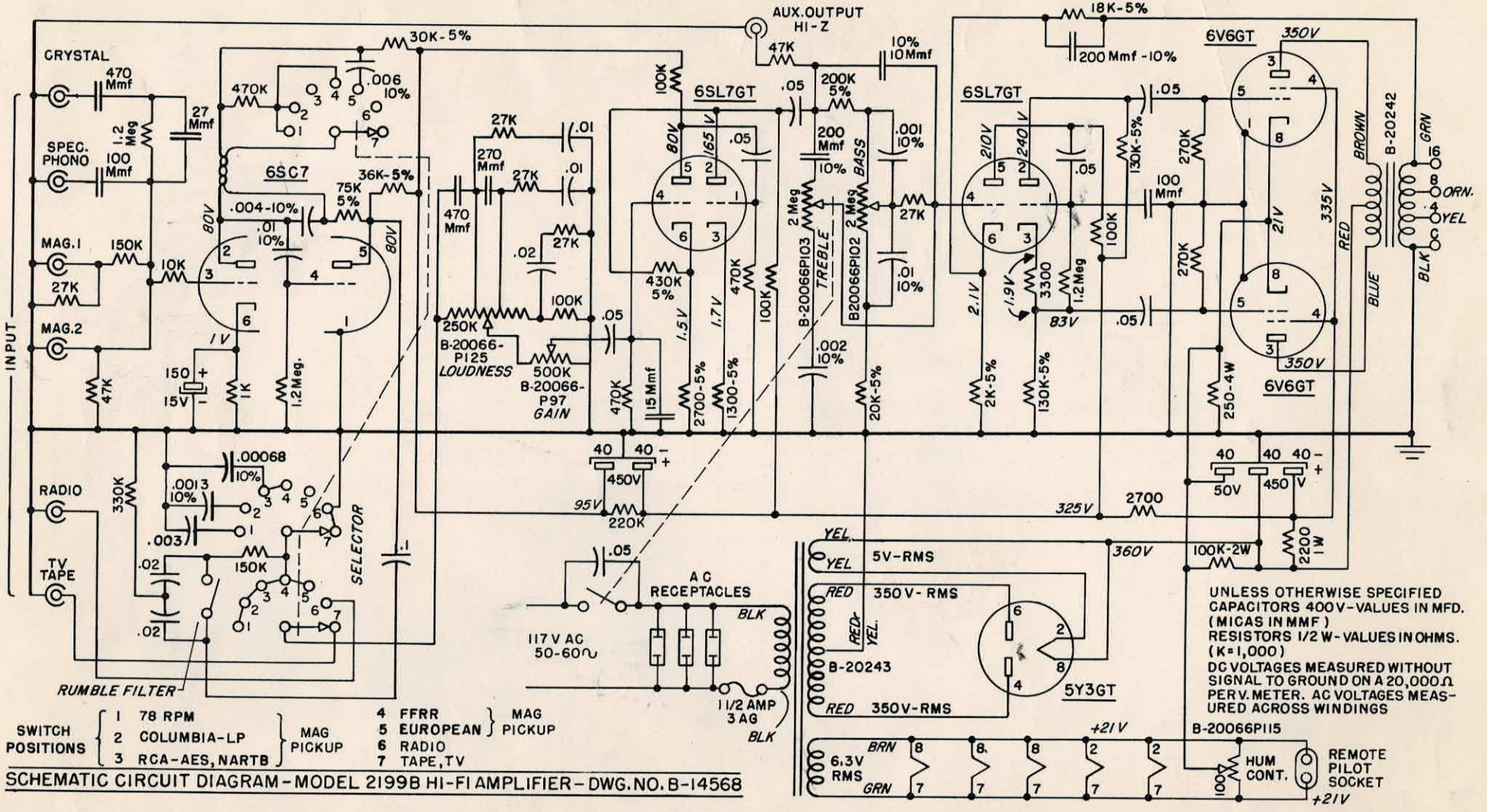
If they are equal, parallel the wires to the amplifier tap having 1/2 the speaker impedance. This will maintain the impedance match.

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.

FIG.5 CHASSIS TOP DETAIL.
MODEL 2199-B



BELL SOUND SYSTEMS, INC.
555 Marion Road
Columbus 7, Ohio



SCHEMATIC CIRCUIT DIAGRAM – MODEL 2199B HI-FI AMPLIFIER – DWG. NO. B-14568