

STEREO STEREO 1959

● TECHNICAL ARTICLES

Stereo Discs • Cartridges • Needles
Stereocasting • FM/AM • Multiplex
Speakers • Changers • Turntables
Tape Recorders • Master Control
Converting to Stereo • Glossary

● PRODUCT CATALOG

Photographs of Equipment • Prices
Technical Specifications

● DIRECTORY OF MANUFACTURERS

Names • Addresses • Products

REK-O-KUT TABLETALK

The latest high fidelity developments from Rek-O-Kut Co., Inc., 38-19 108th St., Corona 68, N. Y.

TURNTABLE NEED IN STEREO MET BY NEW RONDINES!

Expanded Rek-O-Kut Line Covers All Levels of Consumer Demand — New Low Prices Start at \$39.95.

Single-Speed in Kit Form—\$39.95



SPECIFICATIONS Model K-33

Assembly Time: Approximately 30 minutes with simple tools. Mounting template supplied

Noise Level: 47 db.

Motor: Induction—4-pole—built to Rek-O-Kut specifications.

Speed: 33 $\frac{1}{3}$ rpm.

Belt: Special endless woven fabric with thickness held to $\pm .001$. Adjustment for belt tension.

Built-In Strobe Disc: For checking speed.

Minimum Dimensions For Cabinet Installation With Rek-O-Kut S-120 Arm: 17 $\frac{3}{4}$ x 16 $\frac{3}{8}$.

Turntable: Tapered for easy disc handling. Solid cast aluminum lathe-turned.

3-speed Hysteresis Synchronous Motor—\$99.95



SPECIFICATIONS Model B-12GH

Noise Level: 53 db.

Motor: New design, self-lubricating, Hysteresis Synchronous.

Speeds: 33 $\frac{1}{3}$, 45 and 78 rpm.

Speed Selection: Single selector knob. Idler is disengaged in "off" position.

Built-In Strobe Disc: For checking speeds.

45 RPM Hub: Built-in retractable.

Pilot Light: Jewelled neon light acts as "on/off" indicator.

Chassis Deck: Cross-ribbed cast aluminum. Designed for flush-mounting in rectangular cut-out.

Minimum Dimensions For Cabinet Installation With Rek-O-Kut S-120 Arm: Left to Right 17 $\frac{3}{4}$; Front to Back 16"; Height above Deck 3"; Height below Deck 6 $\frac{1}{2}$ ".

Turntable: Solid cast aluminum—lathe-turned. Tapered for easy disc handling.

Single-Speed Hysteresis Synchronous Motor—\$69.95



SPECIFICATIONS Model N-33H

Noise Level: 53 db.

Motor: New design, self-lubricating, Hysteresis Synchronous with special breaking for reduction of coasting.

Speed: 33 $\frac{1}{3}$ rpm.

Belt: Special endless woven fabric with thickness held to $\pm .001$. Adjustment for belt tension.

Built-In Strobe Disc: For checking speed.

Chassis Deck: 15 $\frac{7}{8}$ x 15 Aluminum

Minimum Dimensions For Cabinet Installation With Rek-O-Kut S-120 Arm: 17 $\frac{3}{4}$ x 16 $\frac{3}{8}$.

Turntable: Solid Cast Aluminum lathe-turned. Tapered for easy disc handling.

All-New Rondines Offer Matchless Performance — Fashion-Keyed Styling!

With the new advanced Rondines, Rek-O-Kut has again set performance standards far beyond any consistent attainment by other brands! In addition to great new operational performance and convenience, Rek-O-Kut has added fashion-keyed styling with striking designs created by *George Nelson, noted industrial designer*. The lathe-turned cast-aluminum tables are now tapered for easy disc handling and the compact, modern over-all turntable decor is highlighted by the attractive finish in black and aluminum.

The K-33 belt-drive Rondine in kit form answers the tremendous demand by the budget-conscious "teenage," and college groups, as well as the "do-it-yourself" fans. Even with a Rek-O-Kut or Audax Tonearm Kit, the K-33 matches or betters the price of "High Fidelity" changers! Simple assembly with ordinary tools can be accomplished in less than thirty minutes!

Owners and buyers of more elaborate stereo component systems will welcome the advent of the *single speed and 3-speed Rondines with hysteresis*

synchronous motors at unprecedented low prices. This broad selection is further widened by the continued availability of the famous Rondine Deluxe (B-12H) with custom hysteresis motor and the ever-popular 2-speed Rondine Juniors (L-34 and L-37).

Ask About the New Rek-O-Kut Stereo Tonearms — also Stereo Conversion Kits for converting A-120 and A-160 Arms to Stereo.

WRITE FOR LATEST CATALOG



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STEREO 1959

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ALBERT J. FORMAN
Editor

ROBERT CORNELL
Technical Editor

NORMAN CROWHURST
Stereo Consultant

B. V. SPINETTA
Directory Editor

CHARLES DREYER
Art Director

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HOWARD A. REED, *President*

STEP-UP TO STEREO...ON A BUDGET



with **Stereo's Standard**

STEREO STANDARD

IF THIS IS YOUR PRESENT OR PROPOSED APPEARER SYSTEM

costing between **\$60-\$90**

Includes an 8" coaxial speaker such as:
E-V CORONET* (with SP8B), Net \$65
E-V BARONET* (with SP8B), Net \$74.50
 SP8B: Wide range, economical, super-efficient coaxial speaker. Small high-frequency propagator insures fine dispersion.

costing between **\$90-\$120**

Includes a two-way separate system such as:
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E-V BARONET III, Net \$111.50
E-V REGAL IA, Net \$103

costing between **\$120-\$140**

Includes a 12" coaxial speaker such as:
E-V MARQUIS* (with SP12B), Net \$98
E-V ARISTOCRAT* (with SP12B), Net \$107
 SP12B: Added efficiency will insure superior tone. Extends fundamental low range. Full-range dispersion for widest stereo effect.

costing between **\$140-\$200**

Includes a 15" three-way speaker such as:
E-V EMPIRE* (with 15TRXB), Net \$178
REGAL Super-compact, specially designed system with tailored components to give enhanced range and purity of tone with least loss of efficiency. Does not require high powered amplifier. Net \$147.50

Includes a 15" three-way speaker such as:
EMPIRE* 15TRXB, but with added bass efficiency from large cone, and delivering lower bass response.

*E-V systems will only be surrounded with E-V finishing blocks whenever your budget permits.

NOTE: All E-V enclosures also available in limed oak or walnut finishes.

STEP ONE

You need the totally compatible E-V STEREO CARTRIDGE

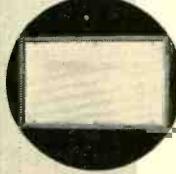
- * The first stereo cartridge
- * The only field tested stereo cartridge
- Thousands already in use prove it**
- * Plays ALL RECORDS BETTER
- * Unexcelled for stereo, superior even to your present cartridge for monoaural
- * Highest vertical and horizontal compliance
- * For superior tracking, longest record wear
- * Best channel separation
- * over 20 db between channels
- * Flattest response
- * Flat beyond audibility to RIAA curve
- * Hum and rumble far below any magnetic cartridge
- * Two ceramic elements deliver precise RIAA curve with no hum!
- * Exclusive E-V Built-In Vertical Rumble Suppressor allows record changer use for stereo
- * 7-mil replaceable (diamond or sapphire) stylus is the ideal size... gives you better reproduction, longer record wear

Then choose a second amplifier and pre-amplifier. If this is your initial high fidelity system, start with any stereophonic amplifier. If you already have a pre-amplifier, buy one with it. If you add a second speaker for stereo,



The E-V Totally Compatible Stereo Cartridge is the industry's standard. Choose the model to fit your needs:
 MODEL 21D—Stereo with 7-mil Diamond Stylus, Net \$19.50
 MODEL 24DST—Dual Stylus Turnover from 7-mil Diamond Stereo to 3-mil Sapphire Monoaural, Net \$77.50
 or the E-V Velocity Stereo Cartridge
 MODEL 21MD—Stereo with 7-mil Diamond Stylus, Net \$19.50
 MODEL 24MDST—Dual Stylus Turnover from 7-mil Diamond Stereo to 3-mil Sapphire Monoaural, Net \$72.50

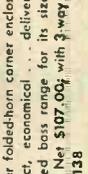
STEP TWO



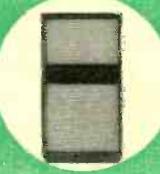
Add-on E-V BARONET*... smallest folded-horn corner enclosure for best musical balance and response range; phenomenal bass range; extended two full octaves. Matches the Coronet and other comparable speaker systems. With SP8B, Net \$74.50, or BARONET III with SP8B and T35B VHF driver, Net \$111.50



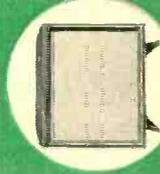
Add-on E-V ARISTOCRAT*... popular folded-horn corner enclosure... compact, economical... delivers most extended bass range for its size. With SP12B, Net \$107.00; with 3-way 12TRXB, Net \$138



Add-on E-V MARQUIS*... matching along-the-wall counterpart of the popular Aristocrat. Response down to 40 cps. With SP12B, Net \$98.00; with 3-way 12TRXB, Net \$122



Add-on E-V REGAL III... super-compact, specially designed system with tailored components to give enhanced range and purity of tone with least loss of efficiency. Does not require high powered amplifier. Net \$147.50



Add-on E-V EMPIRE*... direct radiator Klipsch-licensed low-boy enclosure tailored for use along-the-wall or in corner. Smooth, extended bass response. With Electro-Voice 15TRXB 3-way speaker, Net \$178

Add-on the new E-V CORONET*... true, balanced high fidelity reproduction in extremely small economical space-saving form; only 10 inches of wall space required.



Complements Aristocrat, Marquis, Baronet or comparable speaker system. With SP8B 8-inch speaker, response down to 70 cps., Net \$45.00 or add an CORONET IA with SP8B and 1.5B VHF driver, \$102.00, or add the REGAL IA, Net \$109

Add-on STEREO IA

The all-new Electro-Voice speaker system that solves your space problem—saves you money. Where space doesn't permit you to add a second full-range speaker, a Stereo IA is the answer. It's compact, because the Stereo reproduces only those frequencies needed for stereo. Bass below 300 cps does not contribute to the stereo effect... so bass from both is handled by your present full-range speaker through the accessory XX3 Stereo Control Filter. (Finest E-V mid bass, treble and high frequency components give smooth response from 300 to 19,000 cps.)



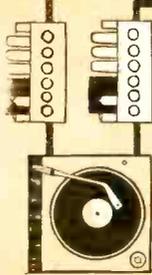
STEREO IA—for systems of normal efficiency, Net \$99.50
 XX3 STEREO CONTROL FILTER, Net \$30

Electro-Voice

ELECTRO-VOICE, INC., BUCHANAN, MICHIGAN
 Formers in Electro-Acoustic—Microphone, Piano Consoles, High Fidelity Loudspeakers, and Enclosures, Public Address Speakers, Marine Instruments, E-V Professional Electronic Instruments and Military Material.

STEP-UP TO THE FINEST ELECTRO-VOICE STEREO'S STANDARD

If this is your present or proposed speaker system



step one

you need the totally compatible **E-V STEREO CARTRIDGE**

Thousands already in use prove it plays all records better; unexcelled for stereo, superior even to your present cartridge for monaural. Highest vertical and horizontal compliance. Best channel separation, over 20 db between channels. Finest response; flat beyond audibility to RIAA curve. Flawless, flat, low distortion, low magnetic noise. Two ceramic elements. No hum. Exclusive E-V Built-in Rumble Eliminator. Private E-V BIAA curve with no hum. Exclusive E-V Rumble Eliminator. 7 mil replaceable (diamond or sapphire) stylus. 3.5 µsec rise... gives better reproduction, longer record wear.

The E-V Totally Compatible Stereo Cartridge is the industry's standard. Choose the model to fit your needs.

MODEL 210—Stereo with 7 mil Diamond Stylus Net \$19.50

MODEL 26 DST—Dual Stylus Turnover from 7 mil Diamond Stereo to 3 mil Sapphire Monaural Net \$22.50

or the E-V Velocity Stereo Cartridge

MODEL 210M—Stereo with 7 mil Diamond Stylus Net \$19.50

MODEL 26MST—Dual Stylus Turnover from 7 mil Diamond Stereo to 3 mil Sapphire Monaural Net \$22.50

Then choose a second amplifier and pre-amplifier. If this is your initial high fidelity system, start with any stereo-phonetic dual amplifier-preamplifier. Play monaurally until you add a second speaker for stereo.

Electro-Voice
 ELECTRO VOICE, INC. BUCHANAN, MICHIGAN
 Foremost in Electro-Acoustics—Microphones, Phono-Cartridges, High-Fidelity Loudspeakers and Enclosures, Public Address Speakers, Marine Instruments, EMI Pro-fessional Electronic Instruments and Military Material.

4-way 12-inch speaker system costing between \$200 and \$300 such as the E-V DUCHESSE IVE (Net \$292)



Add-on the E-V DUCHESSE IVE
 Unexcelled for purity of tone and range through highly developed 4-way driver system. Super-efficient, smooth, efficient wide-range reproduction. Uses folded horn throat in compact furniture piece of pleasing proportions. The walls of the listening room and the living room and the horn mouth required for lowest range response. Diffraction and at rear of enclosure. Compares in performance to corner horns.

Net \$292

3-way speaker system costing between \$300 and \$400 such as the E-V MARQUIS III (Net \$303) or the E-V ARISTOCRAT III (Net \$312)



Add-on the E-V ARISTOCRAT III
 Compact, deluxe Klipsch-licensed speaker. 3-way loudspeaker system for smooth, efficient wide-range reproduction. Uses folded horn throat in compact furniture piece of pleasing proportions. The walls of the living room and the horn mouth required for lowest range response. Diffraction and at rear of enclosure. Compares in performance to corner horns in widest listening area.

Net \$312

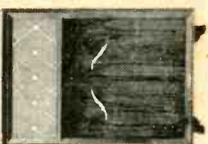
4-way 15-inch speaker system costing between \$325 and \$375 such as the E-V CARLTON IVE (Net \$359)



Add-on the E-V CARLTON IVE
 Deluxe version of the Duchesse IVE in smart, handsome, low-boy design; harmonizes gracefully with many modern furnishing modes. A complete Phase-Loaded System, affording unusual bass response with smooth, realistic, includes deluxe 15-inch indirect bass driver 4-way components.

Net \$359

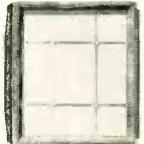
4-way corner 10 inch speaker system costing between \$325 and \$375 such as the E-V CENTURION IVE (Net \$365)



Add-on the E-V CENTURION IVE
 New complete 4-way system incorporating all design features of the magnificent E-V Georgian, but on a smaller scale. Uses Klipsch "K" folded horn with E-V deluxe 12-inch indirect radiator-speaker system, 30 coaxial mid-bass and treble assembly, T35 VHF driver and X336 crossover. Response from 30 cps to beyond audibility.

Net \$365

3-way 15-inch speaker system costing between \$375 and \$400 such as the E-V REGENCY III (Net \$393)



Add-on the E-V REGENCY III
 The versatile Regency III deluxe separate 3-way system allows operation in the corner for full bass efficiency or along the wall for convenience. Powerful 15-inch bass driver crosses over at 800 cycles per second to diffraction-type treble and very high frequency components to give maximum dispersion and full stereo effect.

Net \$393

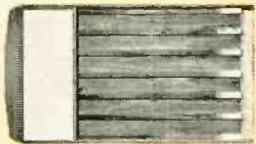
4-way corner 16 inch speaker system costing between \$400 and \$480 such as the E-V CARDINAL IVE (Net \$425)



Add-on the E-V CARDINAL IVE
 Authentic E-V Klipsch "K" horn noted for deep fundamental bass range; complemented by diffraction principle in coaxial mid-bass and treble driver assembly. Very high frequencies insure realism over broadest living room areas.

Net \$425

4-way corner 15-inch speaker system costing between \$480 and \$600 such as the E-V GEORGIAN 600 (Net \$490)



Add-on the E-V GEORGIAN 600
 Utilizes same horn construction and driver complement of Cardinal IVE enclosed by beautiful contemporary housing traditionally styled by Robert W. Fuldaer.

Net \$490

4-way corner 18-inch speaker system costing over \$600 such as the incomparable E-V PATRICIAN IVE Traditional, \$970; Patrician 600 Contemporary, \$819 Net



Add-on the incomparable PATRICIAN
 World's largest, most deluxe loudspeaker system for those discriminating listeners who demand ultimate tonal perfection. The epitome of style combined with peak performance for the ultimate illusion of reality. Available as the Patrician IVE in traditional styling.

Net \$970
Patrician 600 in Fuldaer-designed contemporary housing, Net \$819

Special models available to custom-finish specifications . . . at higher price.

step two

or alternate step two ADD-ON E-V STEREO III

The all-new Electro-Voice speaker system that solves your space problem—saves you money. Where space doesn't permit you to add a second full-range speaker, a Stereo III is the answer. It's compact, because the Stereo reproduces only those frequencies NEEDED for stereo (bass below 300 cps does not contribute to the stereo effect . . . so bass from both is handled by your PRESENT full-range speaker through the accessory XX3 Stereo Control Filter).

Stereos have the finest E-V mid-bass, treble and high frequency components. (frequency response: 300 to 19,000 cps)

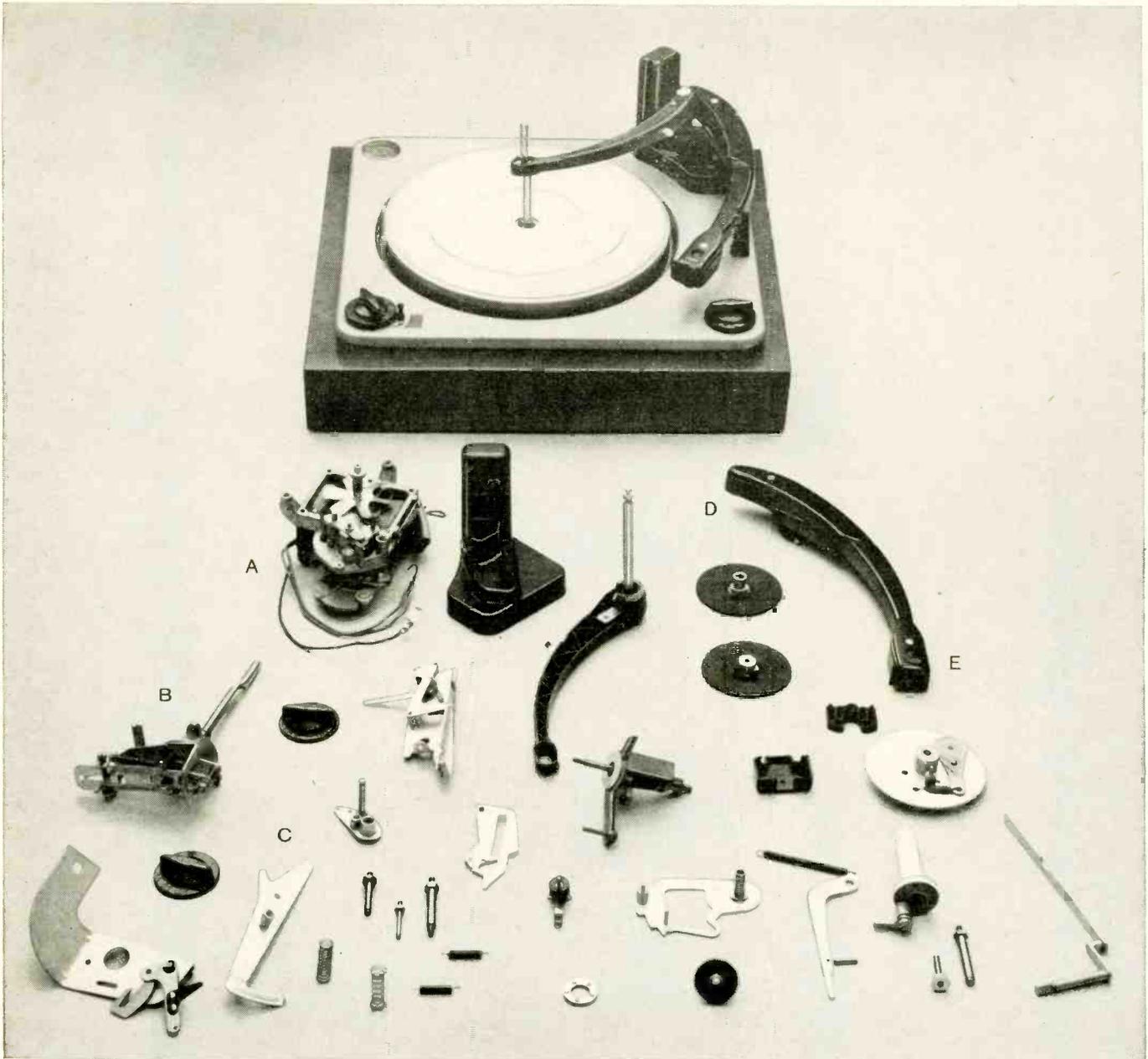
STEREO III for high efficiency systems. Net \$129.50

XX3 STEREO CONTROL Net \$30.00

NOTE: All E-V Systems also available in fumed oak or walnut finishes.

Systems shown are but a few of the multitude of E-V combinations found in every price class. Ask your dealer or write Electro-Voice for information on the industry's most complete line of high fidelity speakers and enclosures.





Every part of every *Collaro* changer is precision-engineered to meet the rigid demands of Stereo

The new stereo records require a higher standard of performance from your record changer than do standard LP's because stereo cartridges are extra-sensitive to noise. That's why, in planning your stereo system, you begin with the Collaro. Every part of every Collaro changer is precision-engineered to meet the rigid quality demands of stereo.

The motor (see A above) is dynamically balanced, so rigidly mounted that wow and flutter specifications are superior to any changer.

The spindle assembly (B) reflects this precision quality in every part. The spindle itself is micro-polished for complete smoothness.

The sensitive velocity trip mechanism (part shown in C) has been designed so that the

changer can trip at extraordinary light tracking pressures.

The exclusive Collaro transcription-type tone arm (D) with the new plug-in head (E) is designed to eliminate all resonances in the audio spectrum. The new four-pin head — the only high fidelity changer with this feature — provides the ultimate in noise-reduction circuitry.

There are three Collaro changers ranging in price from \$38.50 to \$49.50. No matter which you select, you're sure to start your system off right when you choose Collaro — the turntable that changes records.

For new Collaro catalog write to Dept. ET-9, Rockbar Corporation, Mamaroneck, New York.



Rockbar is the American sales representative for Collaro, Ltd.

The Meaning of Stereo

Stereo means a new horizon of electronic entertainment. A refreshing treat is in store for the thousands of audio enthusiasts and millions of music lovers who have made the term High Fidelity a byword in American homes.

Stereo—short for stereophonic sound—adds the dimension of depth to our listening pleasure. It enhances the sense of realism in sound reproduction.

How Stereo Works

Just as our eyes perceive depth by each eye seeing a particular scene slightly different from the other, so our ears detect depth in sound.

In the conventional monophonic sound system, a single one-channel program is reproduced. Even the use of two speakers does not provide a real sense of depth in monophonic sound because the sound reaching the ears does not have the information needed for the stereo effect.

With stereo, two (or more) spaced microphones record the program material in separate channels. Each channel recording is different, in an amount determined by the relative intensities and location of the program source or sources in relation to the microphones.

When the program recordings are picked up and reproduced through separate amplifier-speaker channels, and a greater portion of the sound from each channel reaches each ear, respectively, in a manner similar to the original sound reaching the microphones, depth is perceived aurally.

Equipment for Stereo

Stereo on magnetic tape came first. Recording multiple tracks on a single tape enables the two sound channels to be kept apart and reproduced through separate electronic channels in the same machine.

With disc recordings in very wide use, the industry sought a practical means for producing and reproducing from stereo records. To the notable credit of industry engineers, a means was developed for recording two channels of sound in a single record groove. The two channels are picked up by a single needle in the new stereo cartridges. Basically, this is accomplished by the groove imparting up-and-down motion to the needle, in addition to the conventional side-to-side.

The electrical signals from the cartridge are passed through two preamp/amplifier channels, and reproduced in two speaker systems placed apart in a manner which provides the stereo effect.

Stereo has even entered broadcasting, one sound channel being broadcast on FM, the other on AM. For the future, tuners may be adapted to receive multiplex signals; that is, two channels on one FM station.

Stereo—Now!

Stereo is no longer a drawing-board concept. A wide selection of stereo equipment from many manufacturers is available today at reasonable cost. Good equipment will not only give you stereo . . . it will give you stereo high fidelity.

If you presently own good monophonic equipment which you do not wish to discard, units for the second channel can be added for stereo. For the many people who are not adept at making electronic hookups, the local electronic service technician has the know-how and equipment to make the conversion.

If you are starting afresh, a wide range of attractive equipment, specially designed for stereo, is yours to select.

A rapidly growing number of stereo discs are becoming available.

Get more listening pleasure. Get stereo!

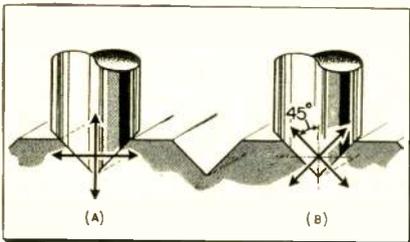
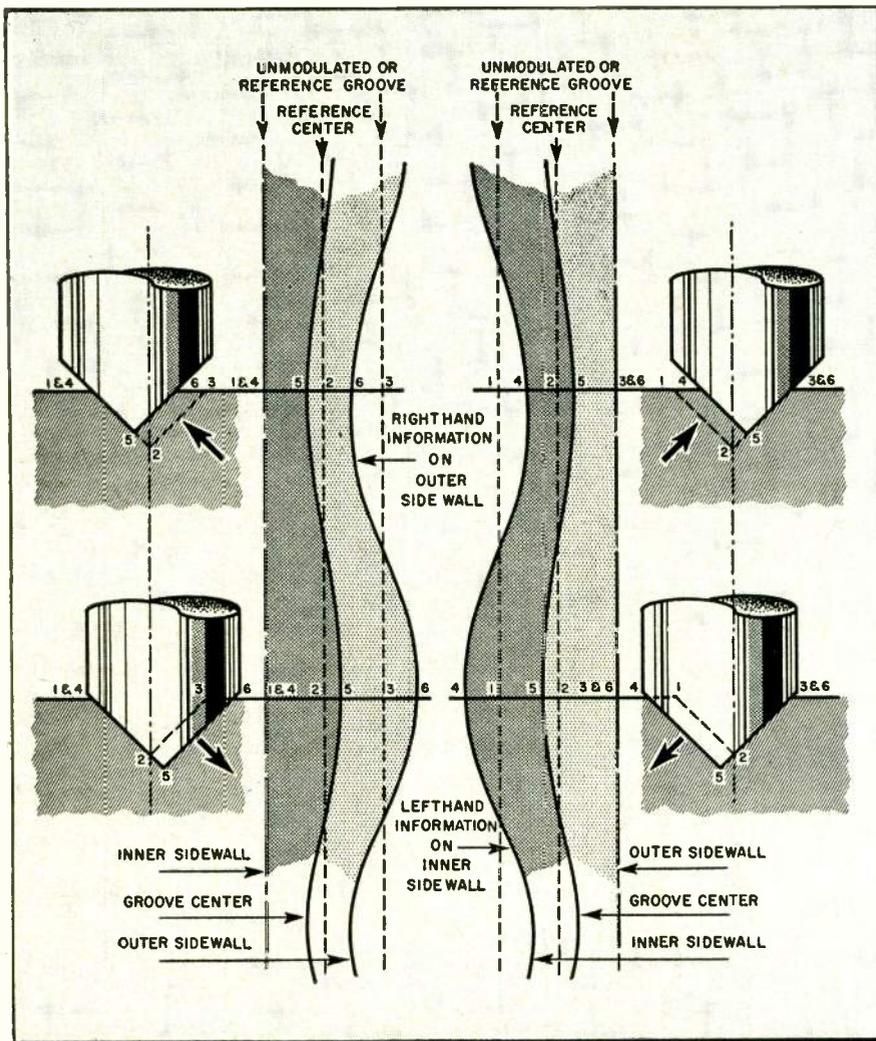


Fig. 1—Early single groove stereo discs had a vertical and horizontal axis. The 45/45 Westrex system, shown on the right, maintains the same relative position between the two axes, but both axes are rotated 45°, as a unit, to obtain symmetry of movement.

Stereo Discs— Two Channels In One Groove

Fig. 2—A. Right channel modulates outer side wall. Stylus travels up to the left and down to the right. B. Inner side wall is modulated by the left channel. Stylus travel is up to the right and down to the left. Groove center is always midway between both walls.



• The intelligence in the modern monophonic LP record is pressed into the groove in such a manner as to enable a cartridge whose stylus is moving in a horizontal plane to recover the information on playback. Older forms of records, now obsolete, required the playback stylus to move up and down. London Records used a combination of these two movements for monogroove stereophonic recording. Demands on the cartridge for equally high compliance in both the horizontal and vertical direction presented difficult mechanical problems. Some of these problems were alleviated when Westrex introduced the 45/45 system. While the 90° relationship between the vertical and horizontal axis was maintained, both axes were rotated 45°, as shown in Fig. 1. Symmetry of movement was thus achieved for each channel.

In this system the stylus is forced to travel a diagonal path for each channel. The right hand channel modulates the outer side wall of the groove, which means that the stylus has to travel up to the left and down to the right as shown in Fig. 2A. Part B of this figure shows that for the left hand channel, which modulates the inner side wall, the stylus must travel up to right and down to the left. In both cases the side wall which is not modulated remains straight. (The groove traverses a spiral path. To simplify drawings and text the unmodulated groove is presented as a straight line which is essentially true for the relationship between the cutting stylus and the groove. The concept of what actually

THE STEREO RECORD

Westrex 45/45

Diagonal Motion
Horizontal Components
Vertical Components

Mechanical Phase

In-Phase
Vertical Movement
Out-Of-Phase
Horizontal Movement

Electrical Phase

In-Phase
Horizontal Movement
Out-Of-Phase
Vertical Movement

Movement Indicators

Groove Width
Vertical Displacement
Groove Center
Lateral Displacement

happens is not affected thereby.) As the stylus rides up and down, the groove becomes narrower and wider respectively, and as the stylus moves back and forth the center line of the groove moves accordingly. It is well to keep in mind that the needle point is always in the groove center, and that the needle always contacts both sidewalls.

This is true, even though there are two different signals impressed in each groove and one sidewall may have many more curves than the other; and the needle may trace out circles, and ellipses; if the stylus is tracking properly it must maintain contact with both sidewalls at all times.

Contrary to some published statements the stylus cannot trace out a corkscrew motion. All motion is confined to the vertical plane which cuts the record in half along its diameter. Vertical, horizontal and diagonal stylus motions are all on this plane. The stylus cannot, or at least is not supposed to, travel either backwards or forwards. This of course applies to actual stylus motion. Relative motion between the groove and stylus—if projected in a drawing—could in some cases appear as a corkscrew.

At any given instant the stylus is in one position only. This position "defines" both walls. The question now is what happens to the stylus when both channels are differently modulated at the same time. Fig. 3 illustrates how the stylus motion and relative groove width, at any given instant, corresponds to the different forces at work. When both channels are pushing up at the same time and the same amount, the stylus will travel straight up.

This in-phase motion can also
(Continued on page 96)

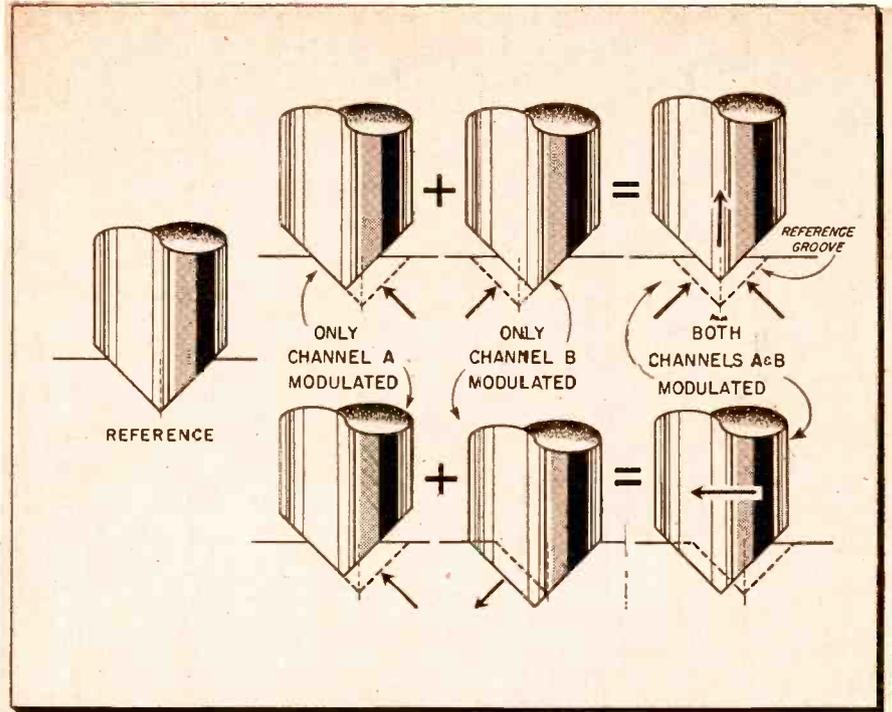


Fig. 3—Stylus position on disc for various conditions of modulation. The stylus may move up or down, and right or left depending upon the information impressed on each channel.

Fig. 4—Top. Pinching and expanding grooves cause stylus to rise and fall. Straight center line indicates that there is no lateral motion. Bottom. Equal size grooves allow the stylus to ride without vertical displacement. Curved center line shows lateral motion.

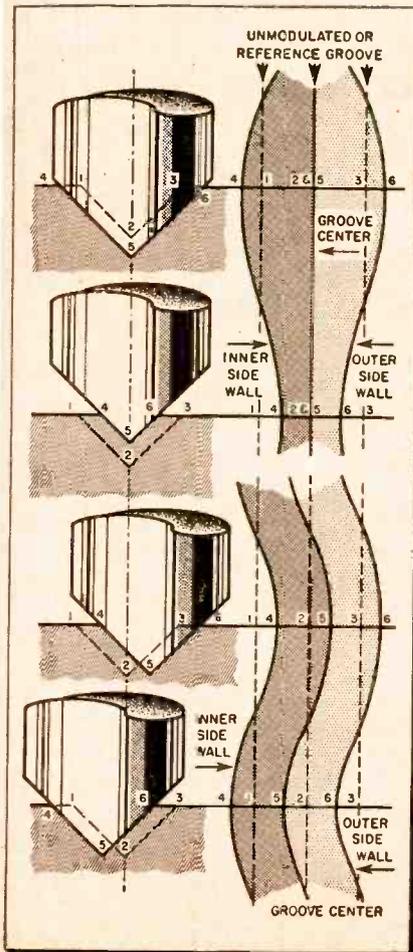
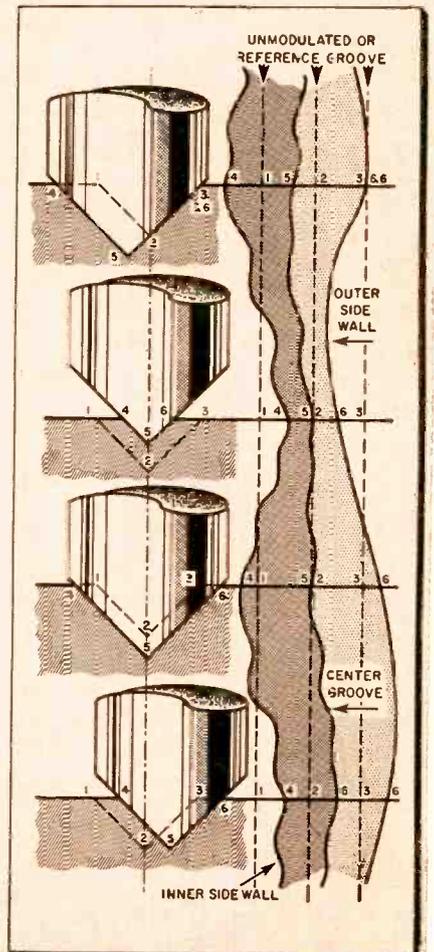


Fig. 5—Combination of both lateral and vertical displacement at the same time, and varying conditions from one instant to the next give the groove a shape that seemingly cannot be tracked. It can—see text!



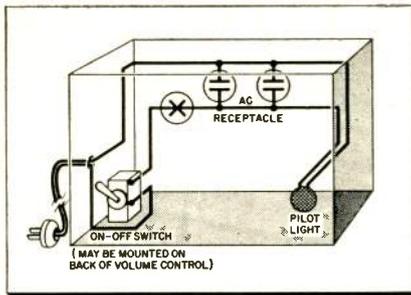


Fig. 1—Switch and outlets on master control box can turn the entire system on or off. It is possible to have the switch on an automatic record player perform this function by inserting it in the line at point X.

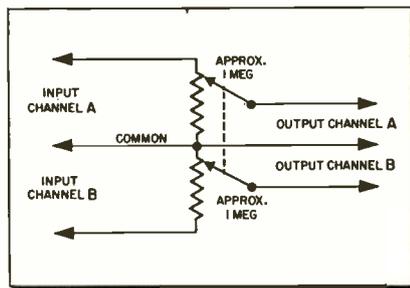


Fig. 2—Dual linear controls, each wired in reverse order can equalize the sound from both channels without changing the overall volume level. As one level goes up the other goes down.

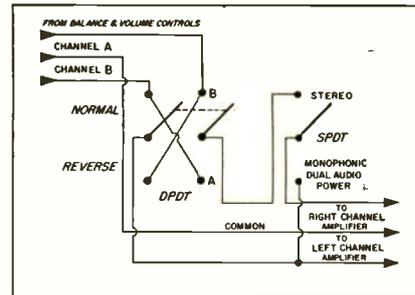


Fig. 3—The SPDT switch enables the listener to change from stereo to monophonic with either channel fed into both amplifiers and speaker systems. The stereo channel reversing switch also determines which signal channel is used for monophonic purposes.

Master Control For Stereo

One-Knob Control For Both Channels.

• Getting stereo is one thing; controlling it to give its best is another. All of the three potential sources, radio, tape, or disc may be present, but the program must be balanced, both tonally and stereophonically, and at the right listening level for best enjoyment. The control unit may be part of the preamplifier, or a separate but complete master control center. The master control may consist of passive and amplifier circuits, or passive circuits only with just switches, plugs, and other controls. It may also contain equalization and other matching networks. The import of the question, "Do we want more or fewer knobs?" is now multiplied by two, and then some.

At first thought it may seem as though the control center would assume monstrous proportions, but actually compact units about $\frac{1}{3}$ rd the size of a tuner are available, or can be constructed. However, the amount of electrical accomplishments and added convenience this little box provides are so great that they may spell the difference between selecting a stereo program in the same manner as an ordinary program from a table radio by just flicking a switch, or selecting an attack of stereo knobitis.

It is possible to perform most or all of the following functions, with a properly designed control box, and with minimum effort:

1. Power—Turn the complete system on or off.
2. Balance—Or focus, equalize output from both channels, without changing volume.

3. Volume—Control volume level without losing balance.
4. Stereo—Normal stereo program in, normal stereo out.
5. Reverse—Reverse stereo program in, normal stereo out; or vice versa.
6. Monophonic—(A) Monophonic program on one channel only. (B) On both channels in parallel for dual power, and use of both speaker systems. (C) Stereo program in, monophonic out of one or both channels.

True, these are a lot of functions, but once the system is installed, there should be no unusual difficulty or need for excessive knob handling. There are as many if not more controls and adjustments on a TV set. Once the system is in operation it is only necessary to flip one switch to turn on the system, select the program, and adjust the volume control.

The control box may also provide tone controls, loudness contour controls, rumble filter and a blend control. So far as the consumer is concerned, this is as far as he has to go, but the technician must consider a mass of additional detail. Like any control center in any mechanical or electrical system, connections to the various components to be controlled must be provided. To obtain the desired functions just described the following jacks or connectors should be available, preferably in the rear of the unit.

1. AC power outlets
2. Audio outputs
3. Tuner Inputs

4. Tape Inputs
5. Phono Inputs

Power Outlets

The power outlets and associated wiring should have sufficient wattage ratings to safely handle the load. If all the a-c power is fed through the switch and outlets on the control box, as shown in Fig. 1, then all the components can be controlled by one switch. It is also possible to arrange a system in which the record changer can shut off all equipment after the last record is played. Usually no more than two outlets are required because the amplifier and other components have power outlets which can be used. It may also be desirable to have a pilot light in the control box.

Balance & Volume

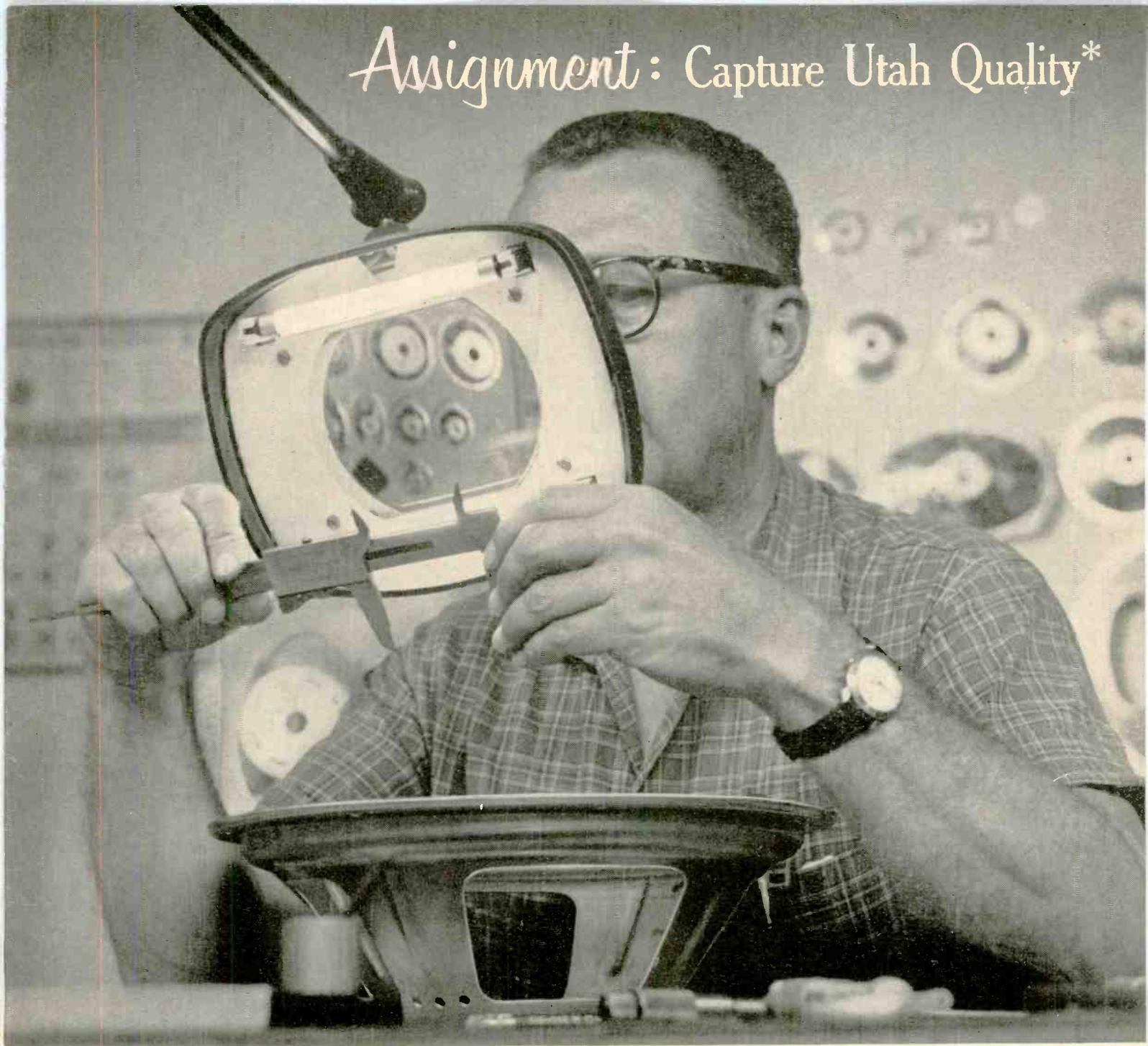
It would seem ideal in a stereo system to gang almost all the similar controls in both channels; equalization, volume, loudness, and tone. This makes for simplicity. If the volume and loudness controls are stacked, a balance or focus control is needed. Although a 1 db change in level is difficult to detect on a single channel, it does make a noticeable difference in stereo. This is a good reason for checking balance with a known stereo recording, while sitting in a desirable position. Separate test and level adjustments of first one channel and then the other is hardly adequate.

Because stereo balance is fairly critical, the balance control may

(Continued on page 94)

Circle 51-01 on inquiry form p. 73 →
ELECTRONIC TECHNICIAN • Stereo, 1959

Assignment: Capture Utah Quality*



THANK THE KEEN-EYED SNOOPER

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Photographer Lieberman that Utah speakers prove rejection is the foundation of perfection. Pre-assembly, plating, coil winding, wiring . . . at every step down the production line stand the "keen-eyed snoopers." They search ruthlessly for the tiniest defect that could mar, even minutely, the response performance of a Utah.

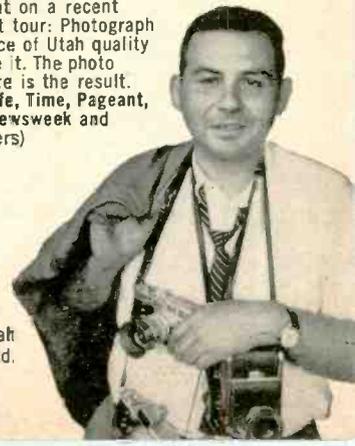
Make certain your next speaker is a Utah. Know that your sound will be as perfectly reproduced as human skills, controlled by rigid inspection, can produce.

See the Utah Custom Line: a quality speaker for every system need.

* ARCHIE LIEBERMAN, famous newsmagazine* photographer, was given this assignment on a recent Utah plant tour: Photograph the essence of Utah quality as you see it. The photo shown here is the result. (*Look, Life, Time, Pageant, Parade, Newsweek and many others)

Let your ear decide **Utah** the ultimate choice
SPEAKERS 

Send for the big Utah Catalog. Dept. 2, Utah Radio & Electronic Corp., Huntington, Ind.



Converting to Stereo

Present Record Players Can Accept The New Stereo Cartridges.

• Probably the most critical portion of the work is in the installation of the stereo cartridge. In most cases it will be necessary to run a new lead through the pickup arm to accommodate the 3rd or 4th terminal. In anticipation of the conversion job, many new cartridges are packaged with the necessary terminals, wire, spacer washers, and screws. Conversion kits are also available for the various record changers and turntables. Tone arms having plug-in cartridge holders, equipped with only two terminals present a bit of a mechanical problem if the plug-in feature is to be maintained.

Most conversion kits solve this problem by providing a new 3 or 4-terminal fitting and shell. However, in some cases it is necessary to dismantle the tone arm to assemble these new parts. It may be possible to do this without upsetting too many adjustments on some changers. It is therefore important that no more work or dismantling be accomplished than is absolutely necessary. Once a changer tone arm is worked on, it becomes necessary to check stylus pressure, set down, trip mechanism and arm elevation during the change cycle. In the absence of a conversion kit it is possible to fit a flat piece of metal in such a manner as to contact another

flat piece of metal which has to be installed on the tone arm, as shown in Fig. 2. This is tricky, and can be avoided by sacrificing a little mobility. Run the third wire directly to the cartridge. Leave enough slack to disengage the shell, and to slide the wire clip on or off the cartridge terminal.

Still another problem manifests itself, if for some reason it is desired to plug in a two-terminal shell and its monophonic cartridge after the arm has been wired for stereo. One of the hot leads for the stereo cartridge will have to be grounded for

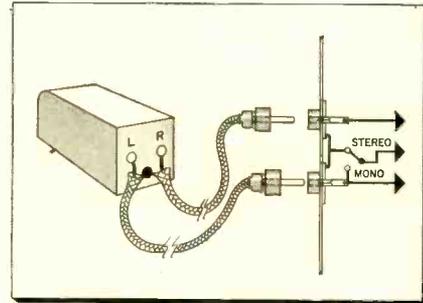


Fig. 3—To revert back to a monophonic shell, once a conversion has been accomplished, it is necessary to provide a hum-free switch.

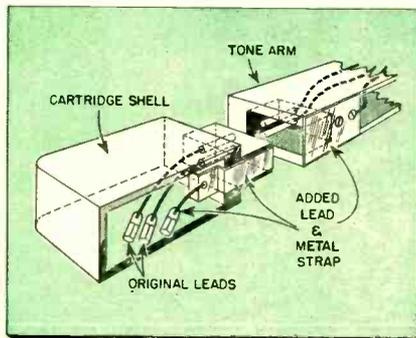


Fig. 2—To convert a two-pin shell to accept a stereo cartridge, it is necessary to provide a connection for the added terminals.

the monophonic cartridge. Looking at the terminal end of a stereo cartridge with the stylus pointing down, the pin on the right is for the right channel, and the pin on the left is for the left channel. The center terminal or terminals go to ground. In the four-pin cartridge the two center terminals may or may not be tied together depending upon wiring and electrical requirements. Since the monophonic cartridge utilizes the two outer terminals, what now constitutes one hot terminal for one stereo channel will have to become a ground connection for the monophonic cartridge. It then becomes necessary to install a SPDT switch as close to the cartridge as possible. The farther away this switch is installed, the greater is the possibility of introducing hum. All this of course points up the fact that the more functions that are

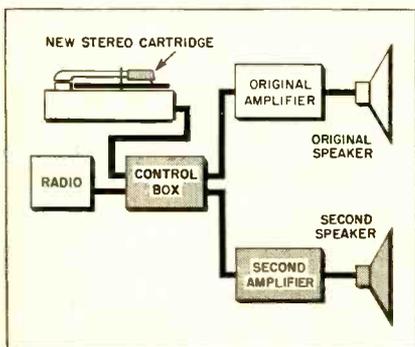
added, and the more complex the installation becomes, the noisier the system is going to be. If the monophonic cartridge is installed in a stereo shell, it can be wired to an appropriate end terminal and the center ground terminal. Keep the installation as simple as possible. Except for very rare occasions, there should be no need to switch back to a monophonic cartridge once a stereo unit is installed.

If the two elements of the stereo cartridge are connected in parallel, it will become fairly insensitive to vertical stylus movement and may even render superior performance on a monophonic system. This is another good reason for installing a stereo cartridge as soon as possible even before the additional amplifier and speaker are obtained. Also, some monophonic cartridges could damage the new stereo discs.

Impedance matching and amplifier input sensitivity are important, and require the same care and consideration as before. As a general rule, the former high-impedance amplitude-sensitive ceramics require still higher input impedance to avoid loss of bass, but in most cases do not require preamplification or equalization. The low-impedance, velocity-sensitive magnetics, moving coil, moving iron and variable reluctance types should be played through a preamplifier and equalization circuitry. Both types give a smaller output voltage to each stereo amplifier. In most cases sufficient reserve power is available.

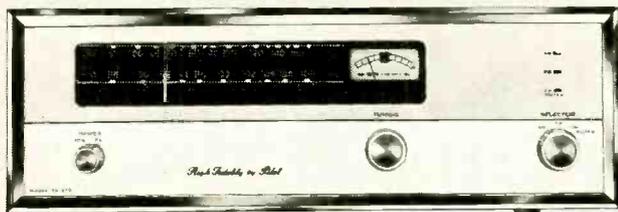
(Continued on page 58)

Fig. 1—To establish the second channel for stereo disc programs, it is necessary to add a second amplifier and speaker, and to change the cartridge. The control box is optional.

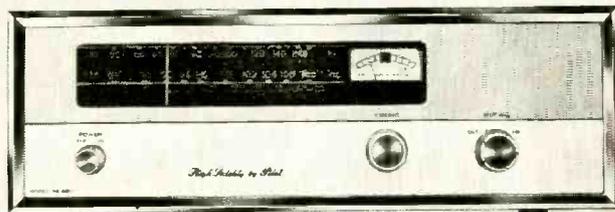




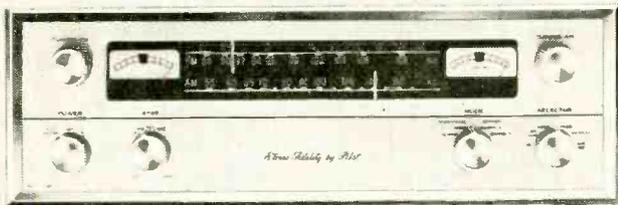
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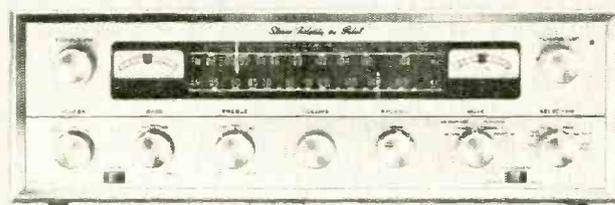
FA-670, Deluxe FM-AM Tuner, \$179.50



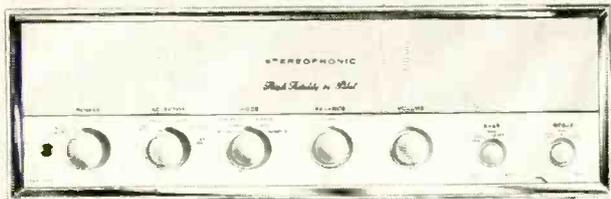
FM-66C, Deluxe FM Tuner, \$149.50



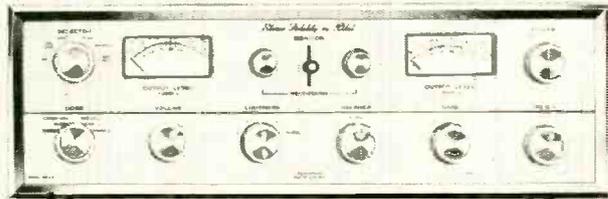
FA-680, Deluxe Stereo FM-AM Tuner, \$199.50



FA-690, Deluxe Stereo FM-AM Tuner and Preamp, \$269.50



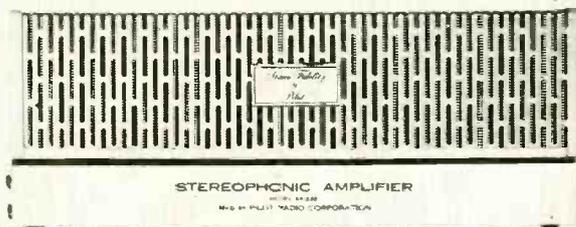
SP-210, Stereo Preamp, \$89.50



SP-216, Stereo Preamp and Audio Control, \$189.50



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SA-232 (64 Watts Peak), Stereo Basic Amplifier, \$69.50
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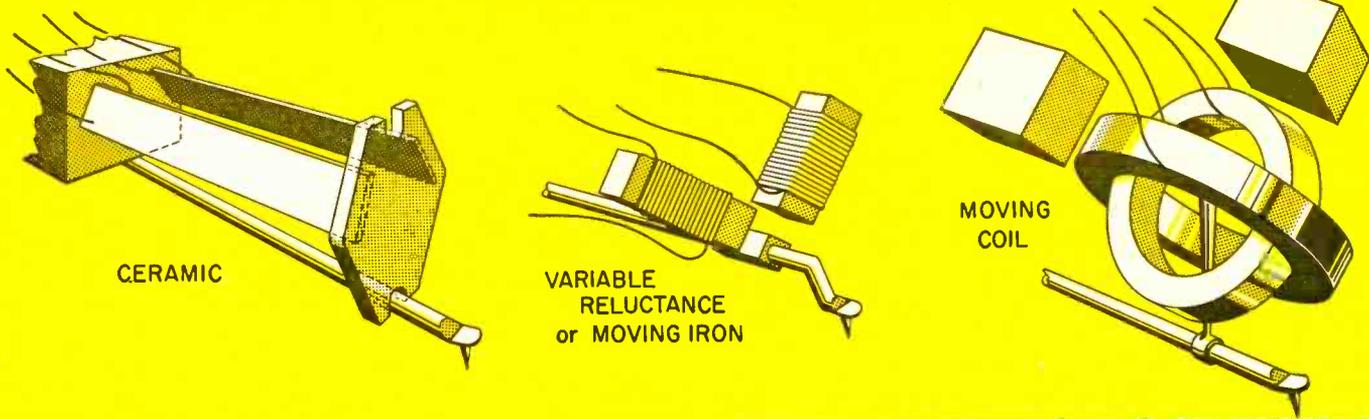


Fig. 1—The stereo cartridge has two elements set at right angles to each other, and 45° from the vertical. The elements may be ceramic, moving coil, moving iron or other conventional types. Cartridges may have 3 or 4 pins. They can be used on monophonic discs.

The Stereo Cartridge

Complex Mechanical Forces Work On Cartridge Having One Stylus, Two Elements, Three Or Four Terminals.

STEREO CARTRIDGE	
Velocity Sensitive	Moving Coil Magnetic Variable Reluctance
Amplitude Sensitive	Ceramic
Output	Levels High Low
Impedance	High Low
Terminals	3 pin 4 pin
Phasing	Mechanical Electrical
Rumble Suppression	Mechanical Electrical

• The stereo cartridge is another example of modern ingenuity. For a long time the industry was wrestling with gigantic monophonic cartridge problems dealing with frequency response, output characteristics, compliance, stylus pressure, undesirable resonance conditions, hum and noise suppression, etc. So much work was accomplished that no longer was it valid to think in

terms of inherent characteristics. Inherent characteristics have been compensated for to the point where a normally non-linear device is more linear than some units which naturally have good linear qualities. This is true for the many other characteristics; so much so, that each cartridge should be evaluated on an individual basis rather than according to type.

Before the engineers could claim victory over all of the problems in monophonic cartridge design, stereo stuck its two-element head into the laboratory.

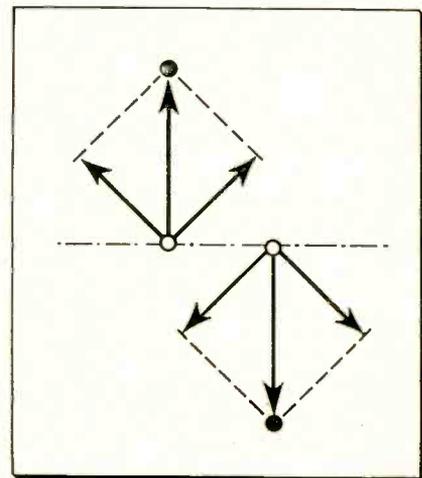
The problems now multiplied at a rate that was pretty much in step with the square law. Twice as many channels meant four times as many complexities.

Several new parameters appeared such as separation between channels, uniform and equal output from both channels, and susceptibility to vertical rumble. The problems of distortion and intermodulation distortion have yet to be resolved 100%. In the early days the cartridge people needed a test stereo disc. The disc people needed a stereo cartridge. Because the final results depended on the quality of both items, and because of an absence of a standard, it looked as though this bottleneck would last a long time.

However, once the stereo ball

started to roll, various segments of the high fidelity industry began to move at once. Now in something better than record time, the stereo cartridge is a reality, as are the stereo disc and the components to play them. Except for three or four terminals the outside appearance of the cartridge is conventional. Internally, almost all stereo cartridges have another element added. The two elements are arranged so that they are at a 90° angle from each other, but at a 45° angle from the vertical, as shown in Fig. 1. The elements used may be any of the conventional types, mov-

Fig. 2—Vertical stylus displacement is a result of in-phase mechanical forces.



ing coil, magnetic, crystal, etc. It may even be possible to use a combination of different elements. Because both elements in the cartridge are placed on a 45° angle, they are sensitive, to a degree, to both vertical and lateral movements. The up and down displacement is a vectorial sum of in-phase mechanical motion as shown in Fig. 2. Since it is specified that the signal must be out of phase for this condition, either one element or its leads must be reversed. This is accomplished in the manufacturing process. Fortunately, this also satisfies the requirement that an in-phase signal be derived from a horizontal motion. Fig. 3 illustrates relative output voltages for different stylus motions.

This also happens to be a very desirable feature for monophonic playback. By connecting both elements in parallel, the cartridge becomes insensitive to vertical motion. (Equal and opposite voltages cancel each other.) For stereo applications it is also possible electrically to mix a portion of the low frequencies in both channels so that the vertical rumble component is cancelled out. It can be done without compromising the stereo effect. Many cartridge makers are using mechanical vertical-suppression devices, usually in the form of a bumper or buffer wedged between the stylus and cartridge body. Some are using the electronic mixing method which may consist of a bridging resistor from one element to the other.

3-Pin or 4-Pin

Some question will no doubt be raised about the use of 3 or 4-terminal cartridges. For most applications the 3-terminal units are quite satisfactory, and if all other

conditions are the same, no difference in performance will be noticed. An advantage offered by the 4-terminal cartridge is the availability of separate ground connectors. Benefits from this feature can be realized if a ground loop is encountered or if for some other reason unstable problems should arise from a common ground connection at the cartridge end.

If it should become necessary to alter the phasing characteristics of the stereo cartridge, in the field, it could be readily accomplished with the 4 terminal units. The systems have been standardized to the point, where it should not be necessary to resort to such phasing gimmicks. The experimenter may for some reason wish to connect both elements in series; this configuration is possible with either the 3 or 4 terminal cartridge. In some cases, in order to minimize hum and satisfy wiring conditions the two ground terminals in the 4-terminal cartridge may have to be tied together. However, the added flexibility of the fourth terminal is desirable, but not necessary, for some of the reasons advanced. A certain amount of precaution should be exercised when interconnecting two ac-dc type amplifiers, or other equipment, especially if the chassis are connected to one side of the power line. If the low side of the plugs or jacks are connected to the chassis there is a danger of placing 117 volts across the two ground terminals on the 4-pin cartridge which may be spaced less than 1/16" apart, as shown in Fig. 4. Normally these jacks are not at chassis ground. Concern here is not so much for equipment protection as it is for protection of the equipment user. The 3-terminal

cartridge in this situation would be a safer bet, because the house fuse or wires going to the cartridge would let go instead of leaving a potential shock hazard. Fortunately most if not all high fidelity equipment is power transformer equipped and line voltage leakage to ground is within safe limits.

Impedance Matching

In general, impedance matching requirements are the same. However, in all cases the manufacturer's specifications should be consulted. Certain normal load conditions which may be satisfactory in many instances can be noticeably improved by the addition or change of only one resistor. The velocity sensitive cartridges which include the

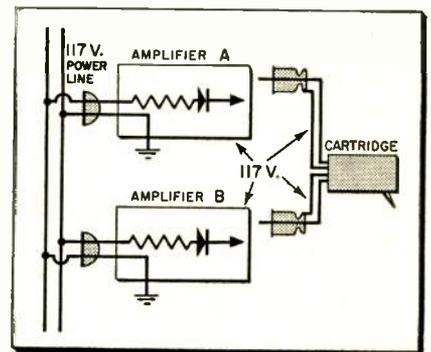


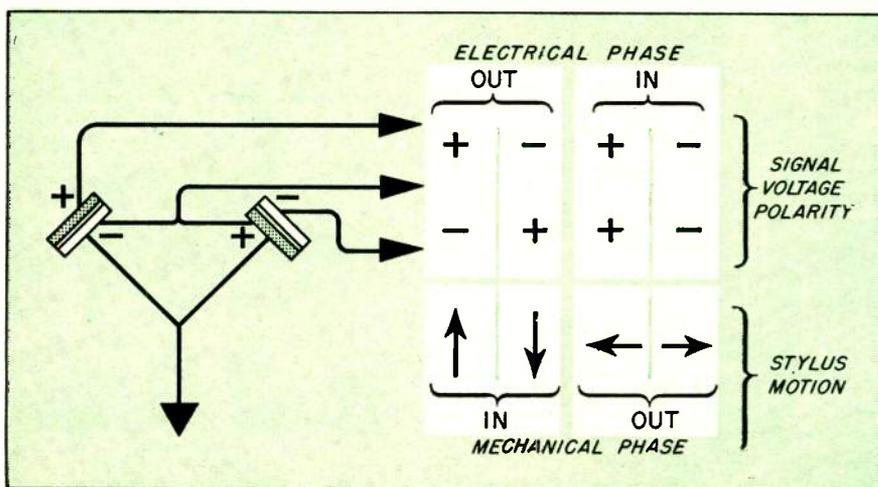
Fig. 4—Possible shock hazard may be set up, with some AC/DC equipment and cartridges.

magnetic, variable reluctance, moving coil, and moving iron require an equalized preamplifier for each channel. The conventional types are satisfactory in most cases. The ceramics and other high level output cartridges generally can work directly into the amplifier. The output versus frequency response curve for these cartridges are equal to the compliment of the RIAA recording curve, and therefore the amplifier should have a flat frequency response.

When the normal high impedance input in amplifiers which are in the order of 500,000 ohms are used for stereo, they will attenuate some of the low frequencies. This condition is easily remedied by following the instructions for each cartridge, which usually specifies an increase in the input resistance. In some cases up to 8 megohms are recommended.

Certain desirable design characteristics are responsible for smaller signal output from the stereo cartridge. There is usually more than enough reserve gain in the preamplifier and amplifier to provide a satisfactory output level. •

Fig. 3—Relative output voltages obtained from various stylus motions. In-phase mechanical forces result in out-of-phase electrical signals. Conversely, out-of-phase mechanical forces cause in-phase signal. Because low frequencies are essentially in-phase signals, they will be found mostly in the horizontal components of the stereo disc.



Needles For Stereo

Vertical Sensitivity Of Cartridge Requires Additional Precautions To Avoid Distortion And Tracking Problems.

CHARACTERISTICS

Electrical

Distortion
IM
Harmonic
Noise

Mechanical

Excessive Wear
Tracking

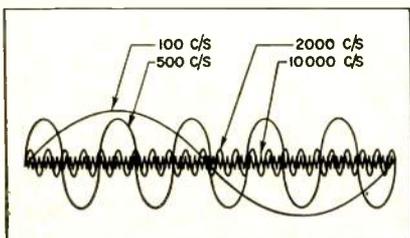
Installation

Alignment
Pressure
Size
Material
Quality

• In spite of certain claims of compatibility in various respects for the new stereo disc systems, a closer look reveals that, while the same stylus and pickup will play both the monophonic and the new stereo discs it is advisable to use the right stylus for each. Here's a quick rundown on the way the new stereo records affect the needle problem.

Both systems use the RIAA curve, therefore the problem frequencies (preemphasized highs) are the same as regards to having the needle follow the groove. This is shown in Fig. 1. The extremely vigorous movement represented at 10,000

Fig. 1—Relative stylus motion at different frequencies at maximum recording level for four frequencies, using the RIAA curve.



cycles is offset for much of the time by the relatively low level of these high frequencies. But, certain sounds with high impact components, such as cymbal clashes, triangle, drummer's traps, a plucked steel guitar, xylophone or marimba played with hard-surface mallets, can produce an extreme demand on needle movement. These place the greatest strain

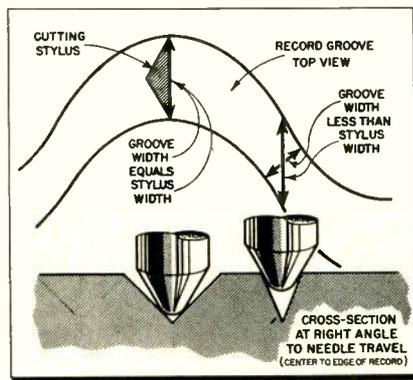


Fig. 2—Sidewise motion of the cutter makes the groove narrower and subsequently forces a round stylus to rise. A 1,000 cycle sine wave even though impressed laterally, causes the playback needle to rise and fall 2,000 times.

on stylus and disc in both systems, often amounting to 2,000 times the normal force required to move the stylus.

There has been much talk about pinch effect. Pinch in a monophonic record is actually a narrowing of the groove width, caused by sidewise movements of the cutting stylus, during the recording process. When the relative motion between the disc and cutter is straight ahead, the width of the groove is maximum. Thus when recording a sinusoidal signal the groove width is maximum only at the peaks, also when there is no modulation, as shown in Fig. 2. Because the playback needle is round, (same radius in all direc-

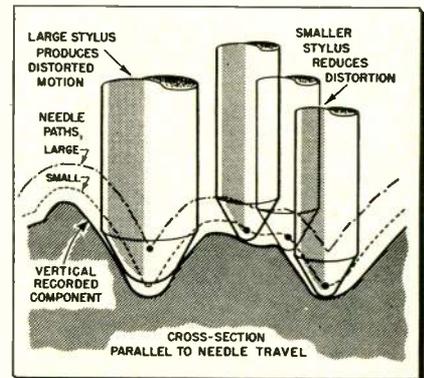
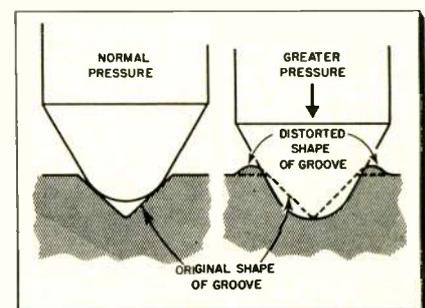


Fig. 3—The path of the larger stylus differs from the actual vertical component causing distortion. The smaller stylus minimizes this distortion. Compare dotted and solid lines.

tions) it is forced to travel up and down twice for each sine wave, or 2,000 times for a 1,000 cycle signal. Provided vertical motion of the stylus produced no output from the pickup, this was relatively unimportant. But stereo records use vertical motion as well as lateral (even though it may be resolved as 45/45), therefore pinch effect can no longer be inconsequential. Pinch effect in stereo discs has three kinds of pickup between vertical and
(Continued on page 97)

Fig. 4A—Larger stylus with normal pressure is liable to bounce. (B) Increased pressure improves tracking, but deforms the groove.



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Conversion
or Replacement**

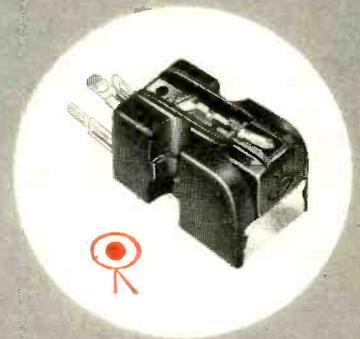
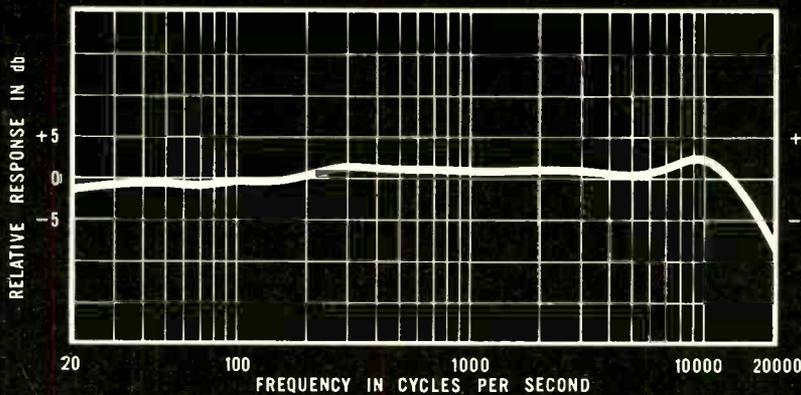
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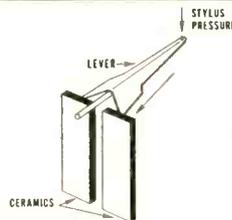
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Stereo Conversions

(Continued from page 52)

If a problem of excessive vertical rumble from the record changer should present itself on stereo programs, it is possible to make the stereo pickup less sensitive to vertical displacement by placing a resistor across the two hot leads on the cartridge. It will also be necessary to connect both ground leads together on a 4-pin cartridge. The stereo effect will not be materially compromised by this gimmick. The value of this resistor can best be determined by experiment; $\frac{1}{2}$ to 2 megohms should do the trick in most instances.

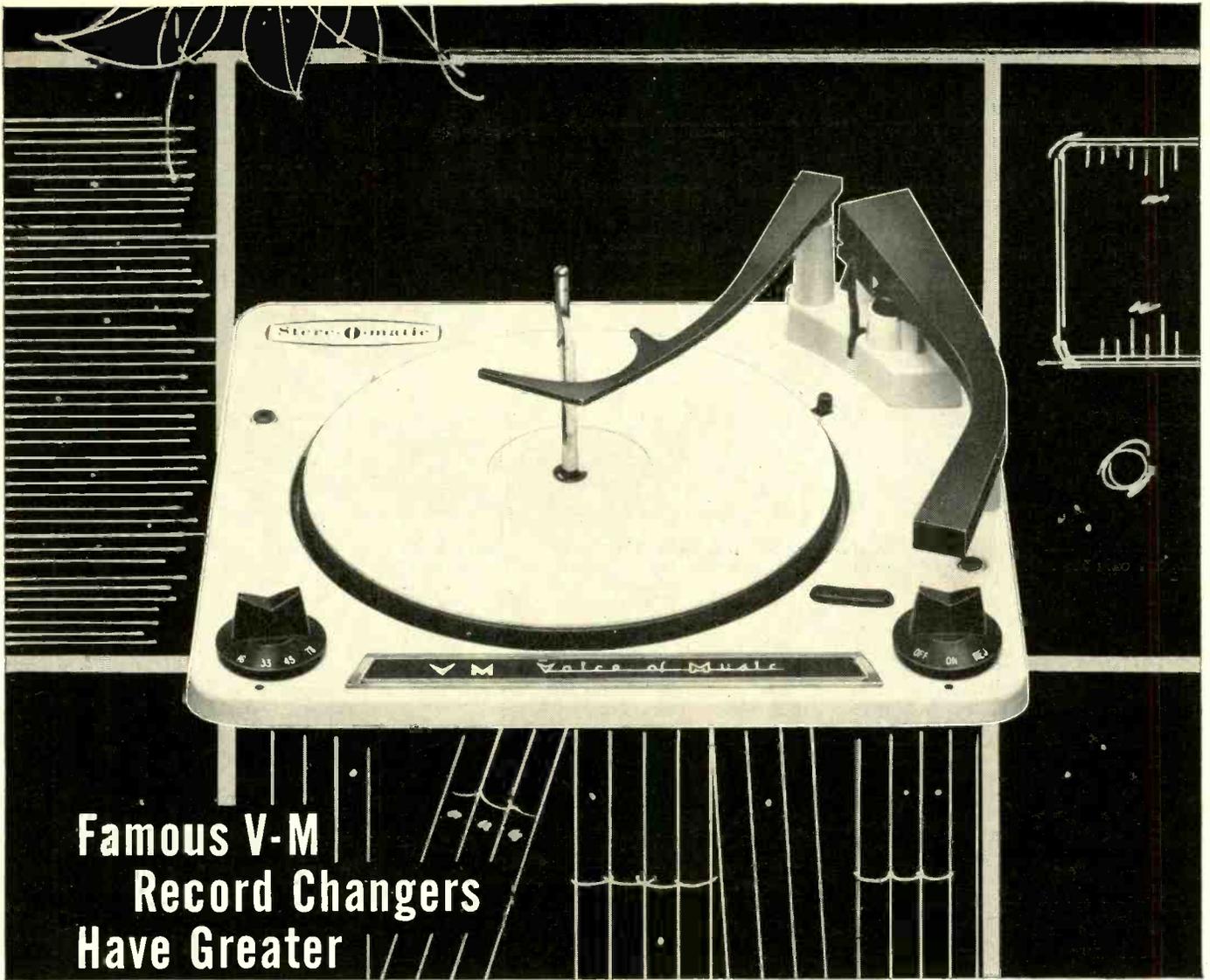
Extra shielding and precautions are necessary for hum-free listening. It may be necessary to try several different methods to obtain best results. Because of the low signal levels at the cartridge output and the necessary high amplification factors, any noise or hum that gets into the front end of the amplifier is going to be heard. Because of this and the increased number of interconnections from one unit to another, an undesirable ground loop may develop. In stubborn situations, it may be necessary to try a different cartridge. In most situations observing the rules layed down by the manufacturer for grounding and connecting his piece of equipment will do.

The muting switch on a record changer presents a problem and the technician's mechanical ingenuity will come to light. The switch normally grounds the hot terminal during the change cycle and sometimes when the tone arm is in its resting position. The problem stems from the fact that a duplicate set of contacts is needed for stereo. In some cases it may be possible to improvise another effective electrical pole by substituting a conducting rather than an insulating switch armature. Other switch modifications will suggest themselves upon inspection. In all probability, later versions of record changers will eliminate this problem by incorporating a dual switch.

Stereo is here . . . and conversions to stereo can be difficult for the inexperienced. In the light of present developments it is worthwhile to install a stereo cartridge as soon as possible. For best results, the conversion should be performed by people with the skills of a qualified technician. •

◀Circle 58-01 on inquiry form p. 73

ELECTRONIC TECHNICIAN • Stereo, 1959



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Acceptance
THAN ANY
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RUMBLE: —48 db for 120 cycle rumble when tested on XEP414 test record (recorded velocity approximately 3.4 cm/sec. at 1,000 cycles.)

WOW AND FLUTTER: ¼ RMS

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MOTOR SPEED: Constant, positive for permanent true pitch.

TONE ARM: Resonance-free. Easily adjustable for any cartridge weight. Compensated to eliminate variation from bottom-to-top of record stack. Jewel-type anti-friction bearings eliminate vertical friction. Stereo cartridge installed. Will accept all popular stereo or monaural cartridges without alteration.

TRACKING ANGLE: Variation reduced to a maximum of 2°.

AUTOMATIC SHUT-OFF: Unit shuts off automatically after last record plays.

RECORD INTERMIX: Will intermix changing of 10" and 12" records of the same speed. V-M 45 spindle fits easily over Tri-O-Matic spindle for 45 rpm records.

Model 1202 has 4-pole motor and plug-in head for GE and other magnetic cartridges. All stereo leads, jacks and switch included. \$50.00 List*

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Circle 59-01 on inquiry form page 73

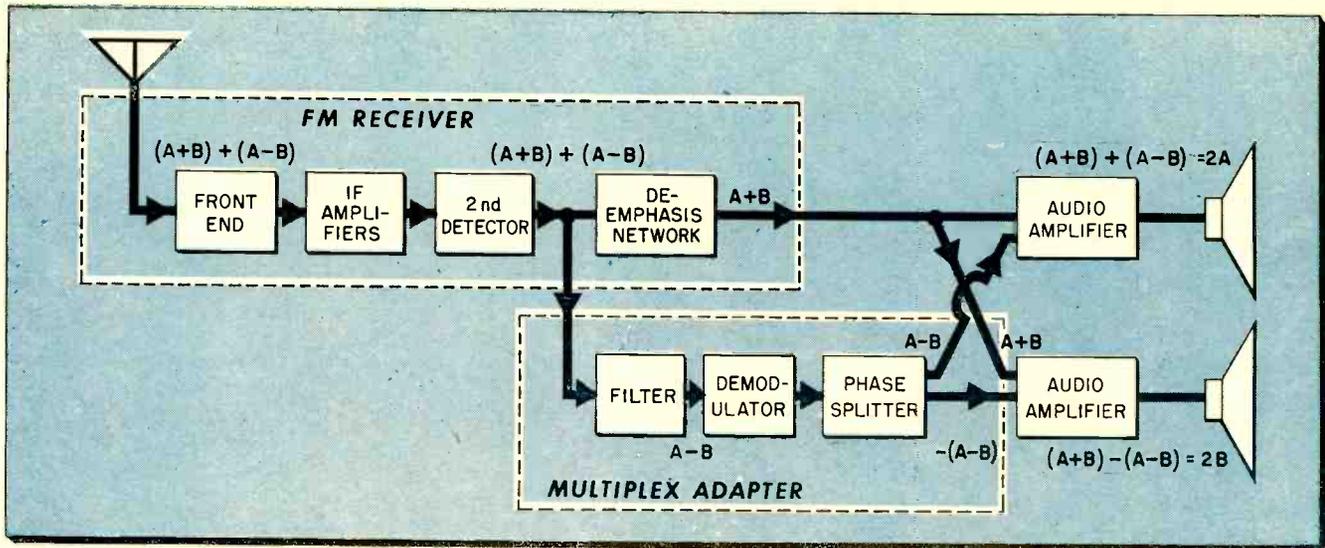


Fig. 1—Conventional FM receiver picks up the entire multiplexed program, but only the monophonic information (A+B) can be heard. The (A-B) signal can be picked off by a multiplex adaptor and fed into both speaker systems to establish the left and right sense.

Multiplex Stereocasting

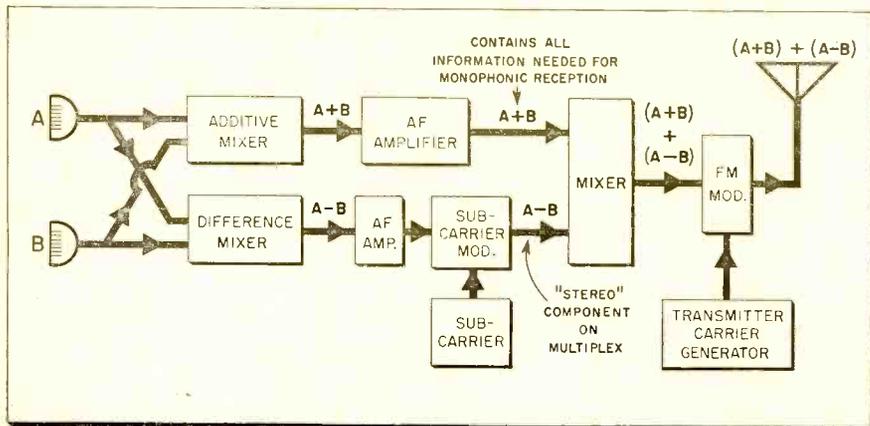
• Multiplex transmission very simply stated is the transmission of more than one program on the same carrier. This differs from the type of transmission found in TV. True, two programs (sound and video) are sent over one TV channel, but separate carriers are used for each, and it is possible to tune in one or the other. In the case of multiplexing, a portion of its carrier is left clear of the main program to accommodate a second channel without increasing bandwidth. To help iden-

tify the various portions, they are termed main carrier and subcarrier. Unlike the TV signal it is not possible to tune in the subcarrier without receiving the main carrier. However, it is possible to filter out the information on the main carrier leaving only the intelligence contained in the subcarrier. Just as it is possible to create a so-called second channel with its related subcarrier, it is possible to subdivide the main carrier into many subcarriers, and transmit many different programs at the same time. Some FM stations which are already using multiplex to broadcast a pro-

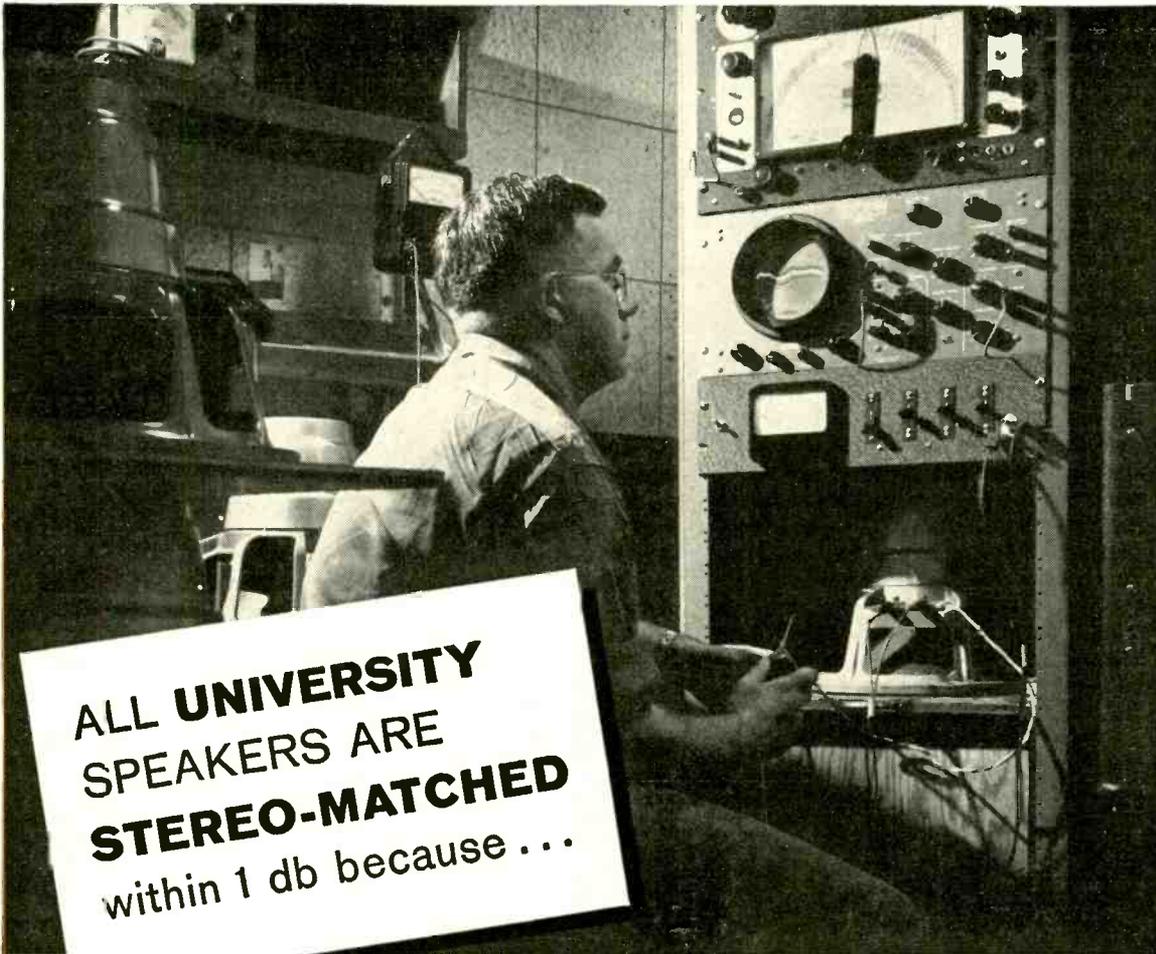
gram into the home, free to the listener, and beam a background music program into commercial establishments for pay, are considering the use of a second subcarrier for stereocasting. This would probably divide the station's signal so that the major portion of the carrier would consist of the main broadcast program; the next adjacent subcarrier would carry the information needed for stereo; and the end subcarrier would continue to provide a source of income from commercial listeners.

How to maintain compatibility to enable the regular FM listener to get his full quality program without interference from the other portions of the multiplexed signal, and how to avoid other problems of poor signal-to-noise ratio, crosstalk, and distortion for the listener of the subcarrier portions, presented some mean problems to the broadcasters. That they have succeeded in developing a workable system is very much to their credit. In the AM-FM technique of broadcasting stereo, it is necessary for each of the two channels to contain all the program information. Therefore the microphone for each channel must, in this application, be placed fairly close together and in the center. This close spacing was also used in some early multiplexing efforts; it goes
(Continued on page 62)

Fig. 2—Sum and Difference technique supplies all the information needed for monophonic listening to the main program. The sum signals modulate the main carrier and the difference signals are impressed on the subcarrier.

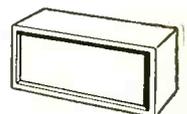
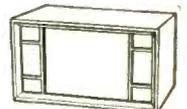
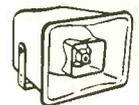
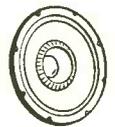
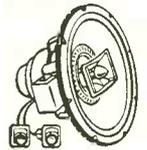


This is part of one of the four testing bays at University where each speaker that leaves the factory goes through a series of exacting tests. Here we see a Model 315-C 15" 3-way Diffaxial being tested for frequency response. As the speaker is "swept" through the entire frequency range, its audio output is fed via a sound box, microphone and amplifier to the oscilloscope where marker lines check that it conforms to laboratory standards within 1 db.



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there's a University speaker or system to meet your space or budget requirements.)



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That's why engineers advise you to use matching speakers or speaker systems for stereo—preferably the same models from one manufacturer. But if production standards change, if tight quality checks aren't maintained, even speakers in the same production run, with identical model numbers, may be mismatched. No problem with monaural. Bad for stereo. But a risk you need never take with University!

Every University speaker or system matches the frequency response and sound output level of any other of the same model within 1 db.

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If you are planning stereo from scratch, or starting with monaural for later conversion, University's famous P-S-E (progressive speaker expansion) plan gives you complete loudspeaker planning flexibility. Start with any two wide-range speakers to fit your budget ... simply add complementary speakers whenever you wish to achieve your ultimate aspirations. Whatever your choice, you can be assured of perfect stereo performance.

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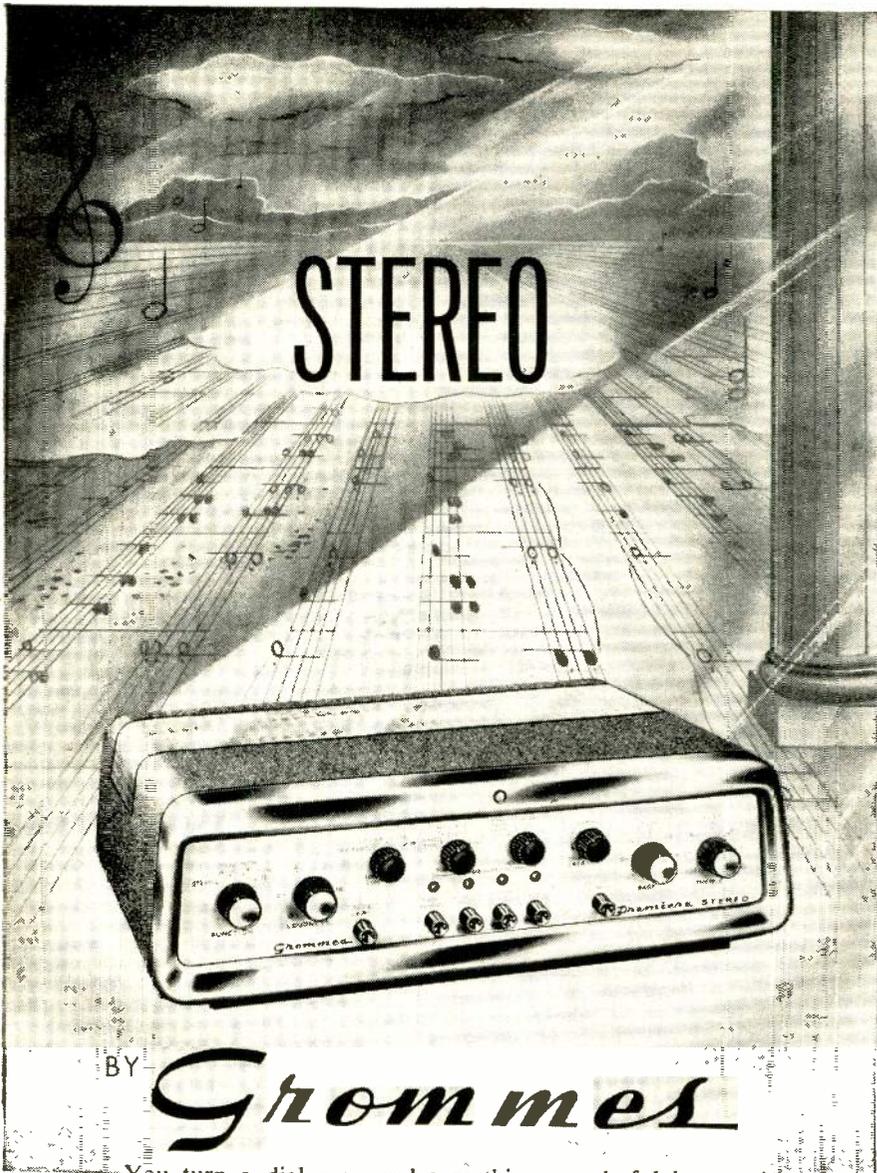


LISTEN

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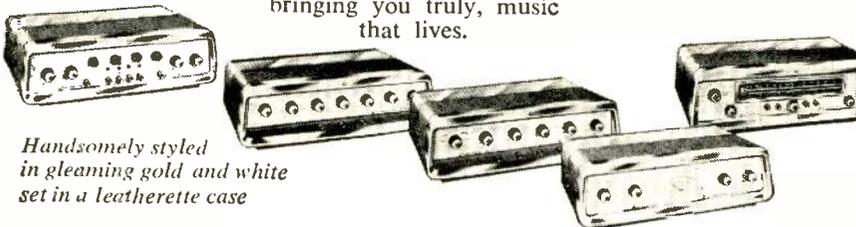


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Multiplexing

(Continued from page 60)

back to the pre-stereo days when binaural was contemplated. The binaural concept was to feed each ear the same type of information as would be heard from some theoretical ideal listening point. This was accomplished by placing the microphones apart as little as six inches, which is supposed to be the distance from ear-to-ear on an average person, and then feeding this information through two separate amplifiers, and finally to the listener's ears via a set of headphones.

The concept of present day stereo provides considerably more freedom and a more realistic listening condition in the home. No longer is it

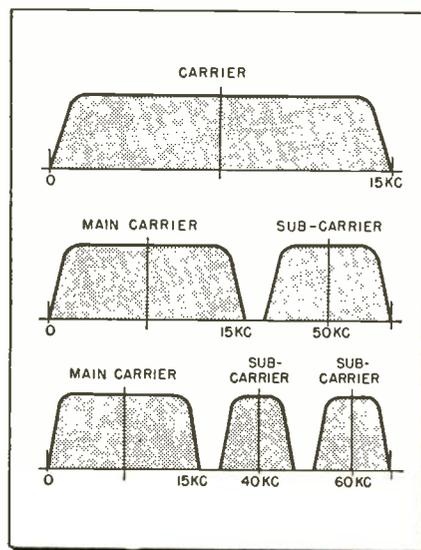


Fig. 3—By restricting the deviation of the main program, it is possible to leave enough room for one or more subcarriers to convey additional programs. Relative deviation and distribution of energy are shown.

necessary to wear a pair of ear-phones. When the listener is sitting off to one side of the room, it is as though he were off to one side in a concert hall; by the same token if he were seated in the center of the room, the feeling would be as though the musicians were spread out in front of him. In other words, stereo offers certain desirable spatial characteristics that binaural doesn't.

Because it is not necessary for the stereo subcarrier to stand on its own feet so to speak, it is possible to take advantage of another microphoning technique which improves the stereophonic effect and still leaves all the necessary information

in the main carrier for monophonic listening. Thus a listener who does not have a multiplex setup will still be able to get his FM station without any noticeable loss in quality.

The manner in which, this is accomplished is quite interesting. The microphones can now be placed further apart and at more advantageous positions. Microphoning techniques are a study unto themselves. There are an infinite number of points where they can be located, and an equal number of directions they can be facing. Directional characteristics of each microphone used also plays a vital roll in the stereo production. However, the important thing at the moment is what happens to the signals after they leave the microphones. Fig. 2 shows how the two signals from each microphone (A and B, or L and R for left and right) are added and fed into the main channel. This is essentially what is done in monophonic practice. Since all the information is present in this A+B signal, it is

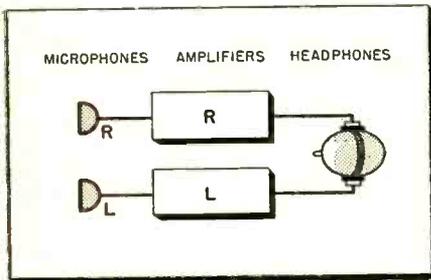


Fig. 4—The binaural concept projects a theoretical ideal listening point to the listener.

the one that is used to modulate the main carrier. For the other channel the two microphone outputs are combined to form a difference signal. This is not difficult; it is only necessary to pass one of the signals through a phase inverter. The A-B component thus developed is then used to frequency modulate the subcarrier, which in turn is used to frequency modulate the main carrier.

The signal A+B is fine for monophonic listening, even A-B may convey enough information to the inexperienced ear, but A+B and A-B as such do not as yet have any significance so far as stereo is concerned. Something else must happen before the right and left sense is restored. This is readily accomplished at the receiver end as shown in Fig. 1. By adding a portion of each signal to each stereo channel amplifier, but once again changing the phase of one signal in one channel, the righthand speaker will

(Continued on page 95)

Subject:
Stereo Cartridges and Garrard Players

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Stereo Tape and Tape Recorders

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• Tape was really the first medium to find fairly extensive acceptance as a source for stereo programs. This was a natural development. Recordings were first placed on tape before transferring to disc for some time. The record companies found it useful to simultaneously record several different tracks from individual microphones placed in different positions and then blend them together later to obtain an optimized effect for transfer to the disc. This means

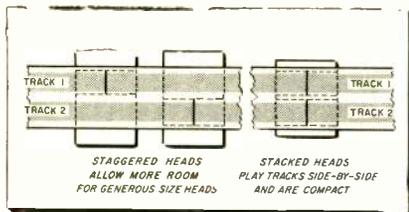


Fig. 1—Staggered and stacked heads as used in tape recorders. Some machines have both.

the record companies' master tapes, by accident or design, are already in a stereo form. As progress in stereo development went forward, it became evident that the new medium presented a potential for later release of the same monophonic programs in stereo.

The development of half-track tape (two tracks on one tape) as a source of extra-long-playing program material opened the way for using both tracks in the same direction and putting two-channel stereo on them.

While there is no doubt that tapes, made and transcribed on really top quality machines, can yield better quality than discs, the scaled down prerecorded tapes played on low priced tape players or recorders, have had a tough time competing with discs for quality in similarly priced systems, although they have

always had the advantage of longer uninterrupted playing time. This reduction in quality was forced by the question of economics in both tape and recorder cost.

Record masters have mostly used at least 15 inches-per-second (ips), and often wider than the standard $\frac{1}{4}$ " tape, to get the best possible dynamic range and quality. Prerecorded tapes have been transferred, by high-speed multiple-copying machines onto $\frac{1}{4}$ " tapes with two $7\frac{1}{2}$ ips tracks. Higher quality results at $7\frac{1}{2}$ ips, but the appeal of the longer playing time at lower cost will undoubtedly encourage the trend toward $3\frac{3}{4}$ ips. Most machines will run at either speeds.

This "stretching" of tape, getting onto narrower tracks, and running at slower speed, has not resulted entirely in proportionate loss of quality, because the head and tape manufacturers have been busy too. They have come up with products that utilize the lower speeds and narrower widths much more effectively. It is reported that a half-track $7\frac{1}{2}$ ips tape, recorded and played with today's best heads, is at least as good as yesterday's full-track 15 ips tapes.

Head Arrangements

Stereo presented a problem of how to arrange the two heads. In the early days materials and production techniques necessitated a fairly bulky head to get the best quality which led to the use of staggered heads. Because of tape stretch and other mechanical tolerances, it was obviously more logical to have both tracks run side-by-side, in time as well as place to avoid phasing problems. So another group preferred stacked heads. Both types are shown in Fig. 1. At present the stacked group seems to have had the best foresight. Techniques for making heads has improved to the point where just as good quality can be

obtained from the stacked arrangement. Some recorders have provision for playing both.

To keep pace with the competition from the new stereo discs, to make the use of tape more economical, and to further the art, the tape engineers have been working on quarter track tape for stereo. Before, there were two tracks on a $\frac{1}{4}$ " tape, which could be used separately for monophonic channels or together for stereo. The four channel tape shown in Fig. 2 will accommodate two separate two-channel stereo programs

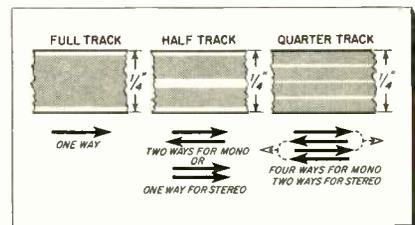


Fig. 2—Progressive development from the original full-track tape to half-track, and now to the new quarter-track, which can be played stereophonically in both directions.

or four single channel recordings. All other things being equal, this would again result in a deterioration of dynamic range. But again production methods, both on tape and heads, continue to develop and it may result in no deterioration in comparison with former one-way stereo tapes.

A recently introduced tape cartridge (all tape wound inside the cartridge) using a four track, $\frac{1}{4}$ ", 600', tape at a speed of $3\frac{3}{4}$ ips, reduces the amount of manipulation required to set up, and eliminates conventional reels and the need for threading. Tracks 1 and 3 are used for stereo play in one direction, and tracks 2 and 4 in the other. Automatic and semi-automatic machines to handle these tape magazines or cartridges have been demonstrated. At this time only a limited number

of cartridge machines are on the market. Sound quality is said to be as good as the two-channel tapes.

One of the big attractions to tape recorders, is the ability to make recordings. Most of the earlier stereo systems could be converted to, or were provided with facilities for playback but not recording stereo. A number of the newer releases have provision for recording stereo. Home stereo recording requires more know how. Most recordings will probably be made in the living room. The average living room requires a very different technique from that used in stereo recording studios.

Two directional type microphones are desirable. A pair of quality cardioids can give very good results. The microphones could then be directed toward different parts of the room, group, piano, etc. Because the directional effect in sound is due to either a difference in sound intensity or a phase difference, and because in the average size living room there is only moderate difference in sound intensity when a person is speaking from a few feet away or from the opposite side of the room, it is essential that the microphones have good directional characteristics for good stereo effect.

In an auditorium or other fairly large area, there may still be some advantage to using directional microphones, but good results can be obtained with the ordinary, mostly omnidirectional, types usually furnished with the recorder.

Techniques will vary with each set-up. If possible it is a good idea to conduct a few trial runs before attempting to record a formal program. Theoretically, the microphones should be placed in the same position and same spacing as the ears of an ideal listener: but because of the absence of certain psychological effects, including the inability to see the performers or their instruments when the recording is played back, wider spacing of the microphones will help create the stereo effect. A distance of about 3 feet may be a good start. When recording piano music, it may be possible to place a mike on each side. Thus one will pick up the bass while the other will receive the sound from the treble strings.

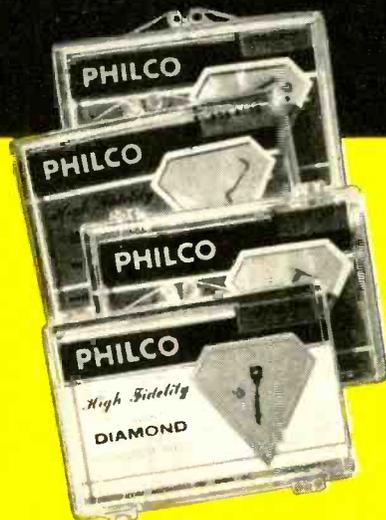
If the mikes are placed too far apart, "ping pong" and other undesirable effects may be encountered. As a general rule, directional microphones may be placed closer together while omnidirectional types will create a better stereo effect if placed closer to the dominant ends of the sound source. •

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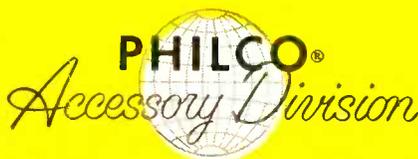
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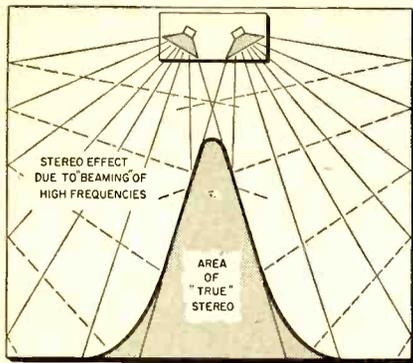


Fig. 1—Two speakers in one enclosure, angled away from each other can create pleasing stereo effects even when the listener is not seated in the true stereo area.

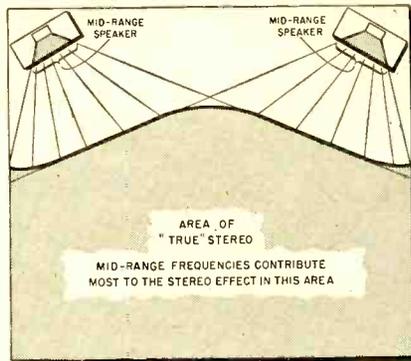


Fig. 2—Separate speaker systems are more desirable particularly for larger listening areas.

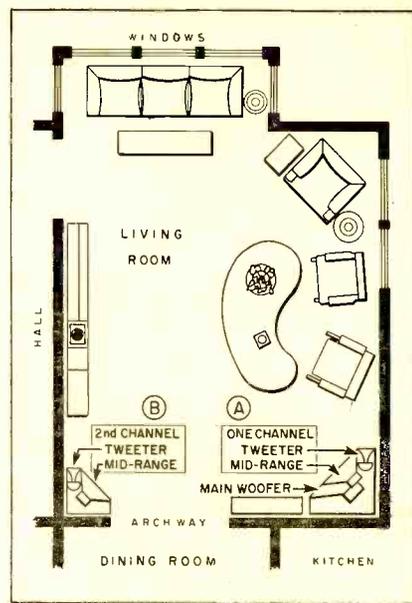


Fig. 3—Multiple speaker system arranged so that the high frequencies are projected along the sides of the wall while the midrange is aimed at a central rearward portion of the room. Because of space limitations only one woofer is used at position A to furnish the necessary bass.

Speaker

Arrangements For Stereo

• A good general rule to use as a starting point is that the smaller living room, up to 12 feet by 14 feet, can be served by two enclosures or a single enclosure type of stereophonic speaker system, with the speakers sufficiently separated and pointing outwards as shown in Fig. 1. For larger rooms it is better to arrange two separate enclosures and their speakers along the shorter wall of the room as shown in Fig. 2. While corner placement is desirable, it isn't absolutely necessary. The shaded portion indicates the so called true stereo listening area. The direction or angle of the speakers is also important. Generally, the high frequencies should be directed down the sides of the room, and perhaps a bit toward its adjacent side wall. This helps to get the higher frequencies into portions of the room where the true stereo effect is not realized, but will nevertheless help to create a pleasing stereo illusion. Angling the woofers so that it covers the central listening area offers the

same advantages, and for the same reasons, found in monophonic hi-fi practice.

This is an easy basic rule, but in actual practice modifying and adapting to suit the circumstances of individual living rooms will be required. Room shape, furnishings, and position of doors, windows, etc., will often make it impossible to adopt the ideal speaker placement and listening positions.

To provide the foundation for approaching any particular installation so as to make the best of the circumstances, it is necessary to know just what it is that stereophonic sound has to do. Many conflicting statements have been made by different authorities on just how stereophonic effects are really achieved, so differences of opinion are inevitable.

Practical experimentation has shown that the bass frequencies (below about 250 cycles) do not in themselves contribute anything to the stereophonic effect. However, sounds below 250 cycles do have a sense of direction, but it is due to their harmonics and other components which are above this range.

These low frequencies are the ones that require the larger speakers and enclosures. However, in small rooms, speakers using the acoustic suspension principle have the advantage of smaller enclosures and good bass response. If there is only one good corner location, or a position where a bass reflex or other type of enclosure, which can do a good job of reproducing the low frequencies, it will be quite in order to use a smaller speaker for the second side without attempting to get too much bass out of it. Bass frequencies referred to are those below 250 cycles. Provided adequate bass is fed into the room from at least one of the speakers, the stereophonic illusion or effect will be satisfactory.

If this method is used, it is well to employ a multi-speaker system for the side that delivers the bass, preferably with a turnover in the region of 250 cycles, and certainly not higher than 350. This enables the woofer to concentrate on the low notes and permits the midrange and tweeter, speakers to perform the function of delivering the stereo effects with maximum efficiency.

This range from 250 to 1,500 cycles may be termed the range of true stereo. It is this range of frequencies that conforms best to the theory of stereo. But this does not mean that it is only necessary to concentrate on getting only 250 to 1,500 cycles. Frequencies above and below this range are also important for getting good stereophonic reproduction, but for different reasons.

The so-called true stereo effect is most critical of listening position. If the midrange frequencies only

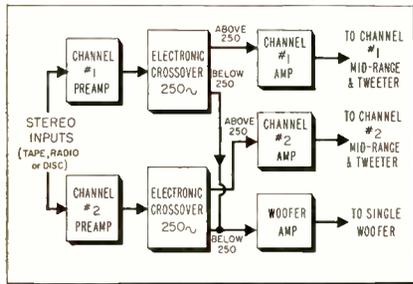


Fig. 4—Electronic crossover removes the bass component from each channel and feeds it into another amplifier and speaker system to form a third channel.

were present, the stereo effect would only be achieved in the shaded areas in Figs. 1 & 2. But, still other effects contribute to the desired stereo illusion, much more than many people seem to realize. The distribution of the high frequencies, those above 1,500 cycles, can help considerably.

This can be demonstrated by the arrangement shown in Fig. 1. The stereo effect in this case is obtained by beaming the high frequencies from each channel directly at the adjacent side wall. Thus one group of high frequencies is coming toward the listener seated off to one side, while the other group of high frequencies is directed away. This give an overall effect, at positions off-center, very similar to sitting at one side of a concert hall. By this means a very real sense of perspective is retained even though the true stereo effect which is dependent principally upon the mid-range frequencies is lost when not in the center of the room. The general effect of a speaker system of this type in a smaller room, with a reasonable degree of furnishing, can be quite pleasing.

Typical Problems

In the first place it is necessary to know how much one is prepared to spend. Then it can be decided whether to get single extended-range speakers or multiple-unit types. With a good extended range type speaker, the stereo effect based on the mid-range frequencies must

be depended upon, because extended range units tend to scatter the high frequencies in a rather indeterminate fashion compared with most tweeters. On the other hand the multiple speaker systems can be used to make the best of some awkward listening room conditions or to extend the useful listening area.

To better understand the applications of these principles, consider some of the more difficult but not unusual situations. This fairly large living room has a relatively large opening in the shorter wall leading into the dining room, as shown in Fig. 3. A corner type enclosure with a multiple speaker system could be placed in the position marked A. Then the most desirable position for the second speaker would be somewhere in the vicinity marked B. But there is very little room to put a speaker here; certainly not a large corner or wall type enclosure. The corner type would project into the opening, while the wall type, with its back against the wall, would project the sound in the wrong direction. This location calls for a much smaller speaker-enclosure arrange-

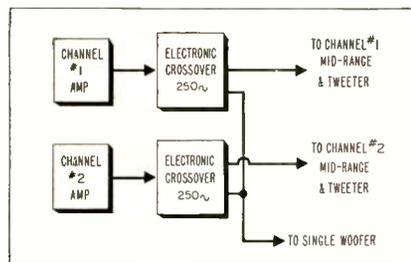


Fig. 5—If the crossover network is inserted between the amplifiers and speakers, it is possible to avoid the use of a third amplifier, and still have the third channel.

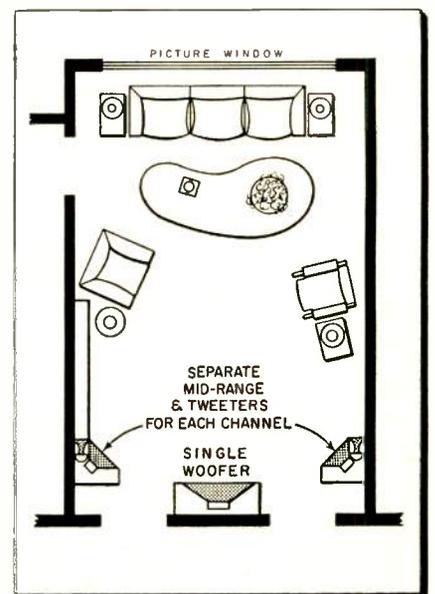
ment. It now becomes a case for the speaker positioned at A to furnish all the bass. It is possible but not necessary to elaborate on this system by combining the bass from both channels using a couple of electronic cross-overs and feeding it to the woofer. Thus relying entirely on the separation of those frequencies above 250 cycles for each channel, to get the stereophonic effect, as shown in Fig. 4. This hookup shows three amplifiers. It can be done with two amplifiers by inserting the crossover network between the amplifier for each channel and the speakers as shown in Fig. 5. The midrange speakers should be directed so that the true stereo effect, is achieved in the central part of the far end of the room. The high frequencies from the tweeters could be directed to cover the areas not properly covered by true stereo.

Therefore, the midrange speakers should be aimed toward the middle of the room, a little more toward the rear, while the tweeters should be aimed down the sides of the room. In some speaker arrangements it is possible to adjust the angle of the speaker at any time to suit the program material and seating arrangement. In some installations where the speaker enclosure itself is sitting inside another piece of furniture, it is possible to angle the enclosure without upsetting the straightforward look.

An extra large living room having two openings at one end and window space at the other, as shown in Fig. 6, may be placed so that the speakers are against the narrow wall as shown, or against the window area, depending upon furniture arrangement. There are several good speaker arrangements. One way requires three speakers. The middle and high frequency range, is covered by the units in the corners. This is an advantage in that normally only relatively small speakers can be used in these spaces. The low-frequency unit should be placed against the wall between the other two speakers. One of the crossover networks just described should be used. If this room had a center opening on the shorter wall and more corner space, an ideal arrangement would consist of two properly baffled full range speaker systems.

The use of the third speaker in the center opens the way for considerable debate on the best approach or technique to use. The

Fig. 6—A large room using widely spaced speakers may require a third speaker in the center to improve the overall stereo presentation and minimize the "hole in the middle" effect.



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center speaker can be used to eliminate a "hole in the middle" effect. Wide spacing between the speakers on each end to accomplish even greater directional characteristics amplify the problems of the hole in the middle. Since it is generally conceded that the base frequencies do not have directional qualities, one school of thought is that the logical place for the third speaker is in the center and that it should furnish the low notes. This leaves the end speakers to provide the true stereo effect. Still another group of engineers believe that a third channel in the center containing bits of information from each of the end channels will not only take care of the hole in the middle problem, but that it creates a better relationship between center stage and the other areas without detracting from the overall sense of lateral spaciousness between one end of the stage and the other. Fig. 7 illustrates one way to tap off the third speaker so that it can provide this information. It should be noted that the center speaker in this application does not have to carry any appreciable amount of bass.

The L-shaped room found in many modern homes, seemingly has

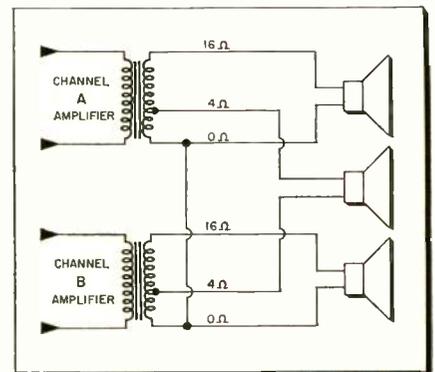


Fig. 7—Another convenient way to establish a third channel. While this method does not add anything to the bass response, it does improve the directional sense with respect to the center of the program source.

its share of problems. One solution is to use the principle embodied in the single enclosure, full range speaker systems.

Two wide-range multiple speakers (or good extended range speakers if the budget dictates) are placed in the positions shown in Fig. 8. The object is to have one channel feed each major section of the room. In the central area of the room the true stereo effect is realized. In other positions the effect is of listening directly to one speaker and hearing the other one playing in another room. With proper balance



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this can be quite an effective way of presenting stereophonic sound in a rather difficult situation.

If a room has plenty of carpeting and upholstered furniture it will not produce many undesirable reflections, and full use can be made of a wide-range system. Recreation and other rooms having linoleum or tiled floors, painted walls and perhaps wrought iron furniture, reverberation can be quite a problem. In fact, it becomes difficult to present

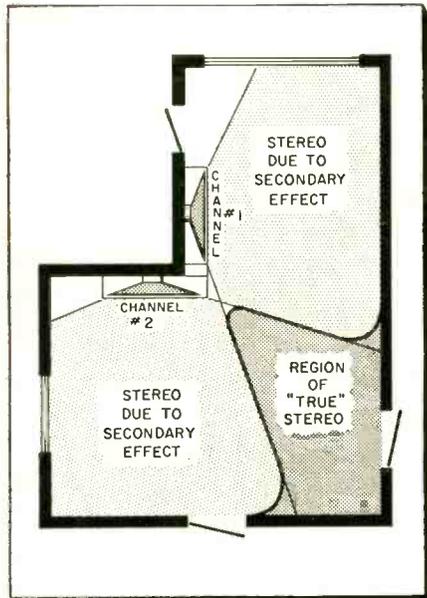


Fig. 8—The problems of the "L" shaped room can be overcome considerably by using two wide-range multiple speaker systems. Good extended range speakers may do.

a good stereo effect in a room like this, because of the way the sound bounces around.

In such a room a good extended range loudspeaker may be the best one to use, because the high frequencies will do little if any good. Much more care should be given to careful angling of the units to avoid bouncing the sound directly back from the opposite wall. Face the speaker units so that the sound hits the opposite wall at an angle. In general it might be better to consider another room for listening to stereophonic sound. Recreation rooms are not necessarily the best listening places for high fidelity stereo or monophonic programs.

Speaker Matching

A question often asked is whether or not to continue using an existing high fidelity speaker. This brings up the question of matching speakers. The answers depend on the type of existing speaker. Two of the large complex type speaker systems each using a fairly widely separated midrange and tweeter as

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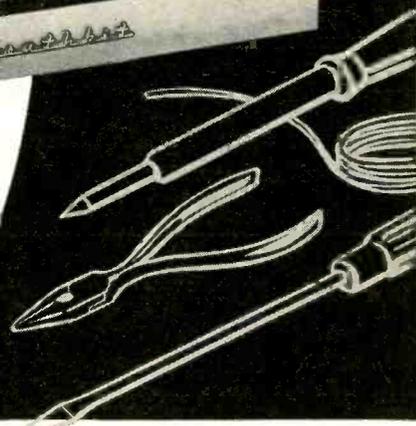
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used in some hi-fi installations, are not advisable for stereophonic presentation. They confuse the sound too much. It is better to use the well-integrated type. It is particularly important for the mid-range and tweeter units to be as close together as possible. Even in the example illustrated in Fig. 3, where the tweeter is directed along a different line from the mid-range unit, they should be mounted close together so that the areas fed by these units will not receive the impression of any noticeable separation between the sounds from its particular channel.

Another important consideration is the question of speaker phasing. First, it is particularly important to have the speakers in the same enclosure correctly phased so there is no dissociation effect at the crossover frequency. This can best be checked by playing a single channel and listening critically. Connect the tweeter first one way, then another. Listen for smoothest response and the best sense of integration. Use program material such as a solo voice. The same method can be repeated for the woofer and mid-range. Here particular attention should be given to the smoothest fill-in of frequencies around 250

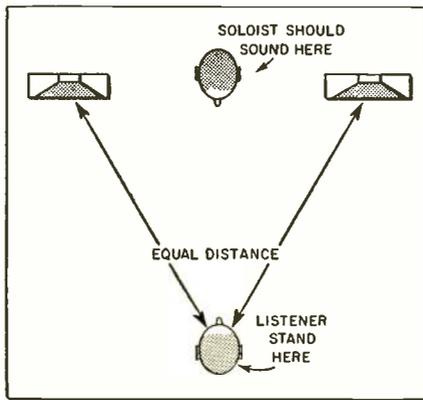


Fig. 9—A soloist's voice will appear to come from the center when the speaker output is properly phased and balanced.

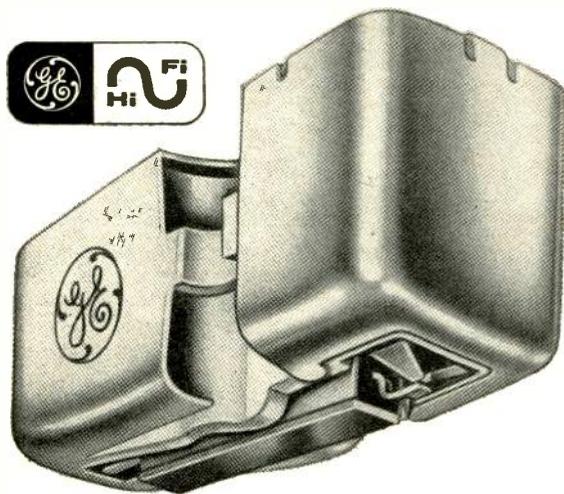
cycles, or whatever crossover is used.

If multiple speaker systems are used in each channel, it is essential that each bank of speakers in the channel be properly phased before attempting to check the phase of the overall stereo system. A simple method is to try reversing the connection to any one channel's speakers to discover which gives the best sense of position for solo program. Select a program where the soloist is intended to be approximately in the middle, and listen from a central position as shown in Fig. 9. The thing to listen for when the two

speakers are operated at the same level is the soloist's voice. It should appear to come from a point midway between the two speakers. If the sound seems to get lost in the room, try reversing the connections to one speaker. If the system uses woofers in both channels, the low frequencies can also be helpful, if each channel is correctly phased within itself.

Contrary to instructions on phasing which have appeared in print from time-to-time, speakers for each channel of a stereo system should be phased when listening to the desired stereo program, and not with batteries or monophonic material played over both channels simultaneously. This is particularly significant if due to the use of dissimilar amplifiers, preamplifiers or if conditions of program material are such that the two channels are not in phase going into the amplifiers, the program fed to the speakers in each channel are out of phase. To correct this condition, it is simply a matter of reversing the leads going from one amplifier to its speaker. This may make the speakers out of phase in the "battery test" sense, which is exactly opposite to the correct phasing situation for conventional monophonic listening. •

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ELECTRONIC TECHNICIAN • Stereo, 1959

Changers & Turntables For Stereo

Lower Recording Level, Vertical Rumble & Arm Consideration

• The controversy of record changer vs. turntable now has a new slant, with the advent of stereo. The argument for the turntable is the one of simplicity. Where the objective is smooth motion without flutter, wow or rumble, a simple mechanism should stand the best chance of achieving the ideal. The argument for the record changer is that it does what a lot of people want it to do. Expert design, close quality control, coupled with precision methods, have provided record changers and turntables whose performance is quite satisfactory for stereo purposes.

Some high fidelity enthusiasts will not look at changers for another reason; they want to keep up with the latest developments in tonearms and pickups. The changer is not readily adaptable for use with a variety of arms. One major advantage the turntable has at the moment is the

ability to operate with lower stylus pressure, but the changer people are working on this and have made some progress.

As quick as a problem is recognized, that is how fast the engineers and manufacturers set about trying to lick it. The sensitivity to the vertical component as found in stereo pickups, has spurred all facets of the record player industry into action. Improvements already incorporated and some yet to come in the changer and turntable field indicate that the relative merits and arguments for the changer and turntable will stay in about the same perspective.

Flutter, Wow, Rumble

Flutter and wow show up exactly the same on stereo as they do on monophonic records. Rumble, on the other hand, has another chance of breaking through in stereo. With a

monophonic pickup the only form of vibration normally picked up is in a horizontal direction.

Since stereo pickups are sensitive to both vertical and lateral vibrations, rumble components now become a more important factor.

To help offset this problem, some of the new stereo pickups include an acoustic, or mechanical filter, to avoid picking up low frequency vertical components. This is permissible because in any legitimate stereo disc recording the low frequencies are essentially in the lateral groove motion. Losing the vertical component at low frequencies should not materially deteriorate the stereo effect, and it does filter out some vertical rumble.

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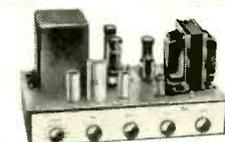
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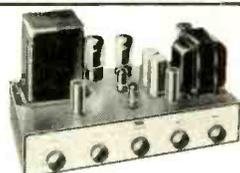
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monophonic records, onto the new stereo recordings without running into much more severe distortion. Consequently the stereo records so far released are recorded at lower levels. From a compatibility viewpoint this level difference has some justification because the addition of the stereo quality to a presentation makes it seem louder than the same level played over a single channel.

Because the lateral component of a stereo record is recorded at lower level, a given amount of rumble will become correspondingly more noticeable. In some instances this can mean the difference between rumble that was not heard and its becoming objectionable. So some units that might have rated as acceptable for monophonic use may not be quite good enough for stereo.

Arm Pivots

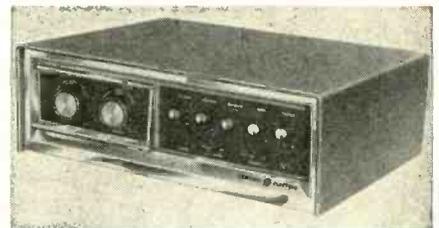
Another factor that affects arms, whether on record changers or turntables, is the matter of pivot friction. Stereo records use smaller styli. Smaller styli mean that a given stylus pressure produces more wear. The minimum stylus pressure is decided by the pickup design. But if there is any appreciable friction in the arm pivot, the stylus pressure must be increased.

So, with the exception that vertical components of rumble vibration now assume a much greater importance, the effect of stereo's advent on arms, changers and turntables is mainly that the already rigorous requirements become just a little more so. Undoubtedly this will stimulate further improvements in each kind of equipment, but most of the existing models can be used for stereo. ●

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Page 59—New "Stereo-O-Matic" 4-speed record changer with stereo/monaural switch

Winegard—96-02

Page 96—Gold anodized FM antennas in high gain and non-directional models

CUT HERE

This coupon must be used before Dec. 31, 1958

1. Circle free literature numbers:

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59-01	61-01	62-01	63-01	65-01	68-01	69-01	70-01
71-01	72-01	74-01	91-01	91-02	92-01	93-01	93-02
93-03	94-01	95-01	95-02	96-01	96-02	96-03	97-01
98-01	98-02	99-01	100-01				

2. Fill in your name and address.

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For all your hi-fi listening... **Jensen** presents these new Stereo Director* Systems with challenging performance... in high fashion furniture... at prices that set new standards for loudspeaker values.



JENSEN DS-100 DUAL 3-WAY SYSTEM WITH THE NEW,

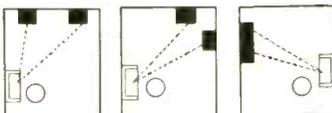
Jensen
STEREO DIRECTOR*

The DS-100 dual stereo unit, in the popular lowboy, is the answer to the buyer's demand for a complete stereo reproducer in one cabinet. This handsomely styled loudspeaker system provides two completely independent 3-way speaker systems with 12" Flexair woofers (total of 6 speakers) which can be used together for superior spread source monophonic sound, as well as stereo. The two Stereo Directors, each having an 8 inch mid-channel and compression driver h-f unit, allow flexibility in cabinet placement with maximum effectiveness in aiming the sound to the favored listening area. Crossover frequencies 600 and 4000 cycles. 32" H., 52" W., 18 1/4" D. Available in Walnut, Tawny Ash and Mahogany

Net Price.....369.50

HOW THE NEW JENSEN STEREO DIRECTOR WORKS...

A pair of these Director assemblies are used in the DS-100 Dual 3-way System (illustrated above), a single assembly in the SS-100, mounted inside on the shelf above the Flexair woofer enclosure. Chassis easily rotated without moving cabinet, has an 8" m-f unit, compression-driver tweeter, network and control. All frequencies above 600 cycles are reproduced by the Stereo Director assembly. Complete system is also available in kit form.



Jensen STEREO DIRECTOR lets you place the speakers wherever decor dictates, square to the wall for best appearance. You send the sound to you, instantly adjust for best stereo listening without moving cabinet.

ABOUT JENSEN'S NEW FLEXAIR WOOFER

The new Jensen Flexair Woofers are designed to extend bass response down to very low frequencies. They have highly-damped superlow resonance at the very bottom of the audio range—16 to 20 cycles. They have an exceptional degree of linearity and are capable of a total movement of 1". In even a relatively small Bass-Superflex enclosure, they deliver their extreme low-frequency performance with a new low in distortion.



JENSEN SS-100 3-WAY SYSTEM
WITH THE NEW

Jensen
STEREO DIRECTOR

Equivalent in performance to one section of the DS-100 Dual Stereo system, this elegant model includes Stereo Director Chassis and 12" Flexair woofer in the Jensen Bass-Superflex enclosure for smooth coverage of the range from 20 to 15,000 cycles. Adequately driven to normal room levels with a 10 watt amplifier. Two SS-100's are ideal for stereo in the difficult-to-arrange living room, assuring perfect sound in the favored listening area. 32" H., 21" W., 18 1/4" D. Available in Walnut, Tawny Ash and Mahogany.

Net Price.....179.95



Space speakers, suit decor... always perfect stereo.



Perfect stereo wherever you listen, even with adjacent wall layout.



... BUILDING YOUR OWN STEREO SYSTEM?

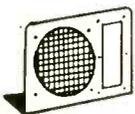
Use these new kits for superb sound... finest stereo performance.

DC-3 STEREO DIRECTOR CHASSIS

Mounts m-f and h-f units of KT-33 to make Stereo Director assembly as used in SS-100 reproducers. Includes panel, base, assembly hardware, and complete instructions.

KT-33 BASIC 3-WAY SYSTEM KIT

Includes Flexair 12-inch woofer, special 8 inch m-f unit, and RP-103 compression h-f unit. Complete with control, crossover network, wiring cable, and full instructions. Impedance 16 ohms; power rating 30 watts.



Send for Bulletin JH-1

*Trademark. Patents pending.

Jensen

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In Mexico: Radios Y Television, S.A., Mexico D.F.

Circle 74-01 on inquiry form page 73

STEREO CATALOG

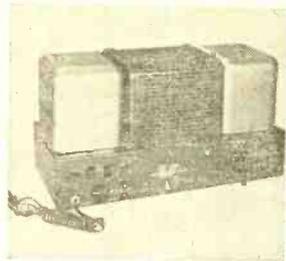
Specifications based on manufacturers' reports

For more information on these products
SEE INQUIRY COUPON ON PAGE 73
& Directory of Manufacturers on Page 88

AMPLIFIERS & PREAMPS

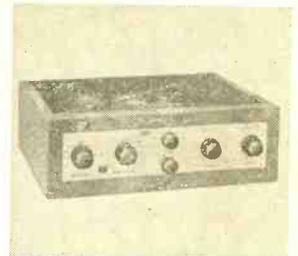
ACROSOUND Ultra-Linear II

Single channel, 60-watt amplifier has 18 to 30,000 cps response ± 1 db at full 60 watts. Hum is 90 db below rated output. IM distortion less than 0.5% at 50 watts. Harmonic distortion less than 1%. Damping variable 0.5 to 15. Undistorted square wave. \$109.50 wired; \$79.50 kit.



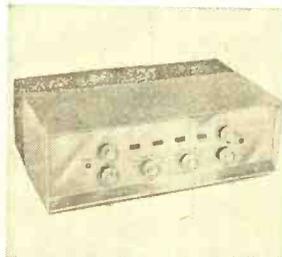
EICO HF-81

Dual preamp/amplifier, 14 watts per channel, has 10 cps to 100 kc response ± 0.5 db at 2 watts. IM distortion 0.5% at 5 watts/channel. Harmonic distortion less than 1%. Hum and noise -75 db. Speaker impedances 4, 8 and 16 ohms. \$109.95 wired, with cover; \$69.95 kit.



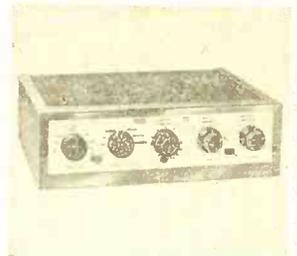
ARKAY SA-25

Dual preamp drives 25-watt Williamson amplifier in channel 1. Output of channel 2 is fed to existing monaural amplifier. IM distortion 1.8% at 20 watts. Harmonic distortion 1.5%. Hum -90 db. Damping factor 16. Kit \$59.95. Also, not shown, SP-6 dual preamp/amp kit \$39.95.



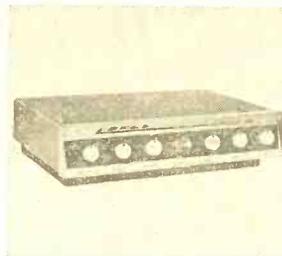
EICO HF-85

Dual preamp and control center has independent level controls with built-in clutch, hum balance control. 30 db feedback. Response 5 to 200,000 cps ± 0.3 db, to 3 v rms out. Hum 75 db. IM distortion 0.03% at 1 v. Harmonic distortion 0.1% at 3 v. \$64.95 wired; \$39.95 kit.



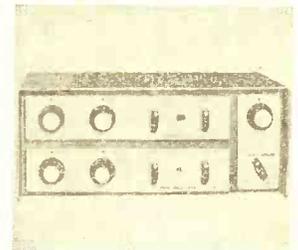
BELL 3030

Dual preamp/amplifier, 15 watts/channel, has 20 to 20,000 cps response ± 0.5 db. Harmonic distortion is 0.5% at 1 db below 15 watts. Hum -79 db. Dual outputs, 4, 8, 16 ohms and hi-Z. \$169.95. Also, not shown, Model 2221 dual channel 10-watt preamp/amplifier @ \$129.95.



FAIRCHILD 248

Dual preamp consists of stacked Model 245. Harmonic distortion is less than 1% at 1 v. Noise -85 db. Voltage gain is 60 db in phono and tape inputs. Record changer position provides RIAA curve and rumble filter. Ganged volume control. \$239.50. Model 245 monaural, \$119.50.



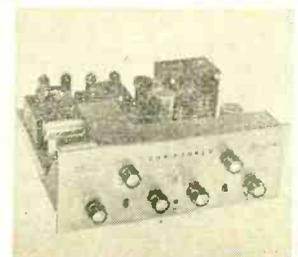
BOGEN DB212

Dual preamp/amplifier, 12 watts/channel, has speaker phasing switch. Response is 20 to 20,000 cps ± 1 db. Noise and hum -80 db. Harmonic distortion 0.5% at rated output. Chassis \$115.00; enclosure and legs \$7.50. Also, not shown, AC-10 single channel amplifier \$35.00.



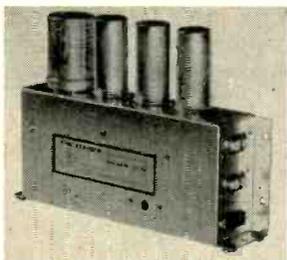
FISHER X-101

Dual preamp/amplifier, 20 watts/channel, has 0.7% harmonic distortion at rated output. IM distortion 2%. Hum and noise -80 db. Crosstalk 50 db between channels. Sensitivity 2 mv for phono input. 6 pairs of stereo inputs. 4, 8 and 16 ohm outputs. \$189.50.



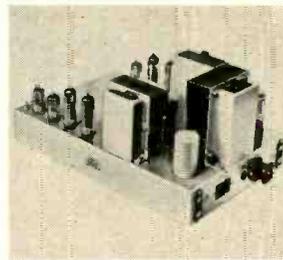
FISHER PR-66

Dual preamp, self-powered, has no controls, is designed for remote control. 2 inputs and 2 outputs for connection to audio control. AC hum balance pot. Response 20 to 20,000 cps ± 2 db. Gain 40 db. Hum & noise -68 db. Distortion 0.2% for 2 v out. Crosstalk -60 db. \$29.95.



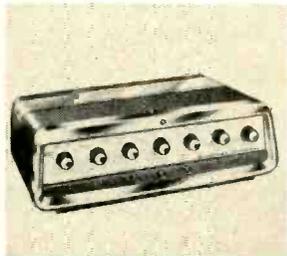
LEAK 20

Dual amplifier, 12 watts/channel, has 20 to 20,000 cps response ± 0.5 db. Harmonic distortion 0.1% at 10 watts. Hum & noise -80 db. 26 db feedback. Input sensitivity 125 mv for 10 watts. \$139. Also, not shown, Model 50 stereo, \$179; Point One preamp, \$109.50.



GROMMES 40PG

Dual preamp/amplifier, 20 watts/channel, has 20 to 20,000 cps response ± 0.5 db. Harmonic distortion 1%, IM distortion 2% at rated output. Hum & noise -80 db. Push-button rumble & scratch filters. \$159.50. Also, not shown, Model 24PG, 12 watts/channel, \$99.50.



MADISON FIELDING 320

Dual preamp/amplifier, 20 watts/channel, has 20 to 20,000 cps response ± 0.5 db. Hum & noise -75 db. Power is calibrated on knobs in peak watts. Magic eye aids pre-program level settings. 4, 8 and 16 ohm speaker outputs. \$169.95. Enclosure is \$19.95. Also, Model 340



GROMMES 209

Dual preamp with dc filaments has 10 to 20,000 cps response ± 0.25 db. Harmonic distortion 0.05%, IM distortion 0.1% at rated output. Hum & noise -80 db. Output 1 v, up to 20 v without overload. \$159.50. Also, not shown, Model 214 dual preamp priced at \$99.50.



McINTOSH C-8S

Preamp is designed for adding stereo to existing monaural system. Stereo balance control permits both channels to be balanced with one control. Includes mode selector, rumble filter and record compensator. \$99. Blonde or mahogany enclosure \$10 extra.



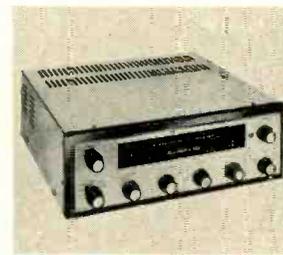
HARMAN-KARDON A-250

Dual preamp/amplifier, 25 watts/channel, has 20 to 20,000 cps response ± 1 db at 20 watts. Harmonic distortion less than 0.5% at 20 watts, IM distortion 2%. Separation over 50 db. Has filters, dc filaments. \$179.50. Enclosure \$12.50. Also, not shown, AX20 stereo, \$99.95.



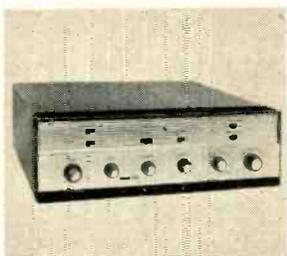
PILOT SM-244

Dual preamp/amplifier, 14 watts/channel, has 20 to 20,000 cps response ± 1 db. Hum & noise -80 db. Harmonic distortion 1%, IM 1.5%. Balance control, dc filaments. \$189.50. Also, not shown, SP-215 stereo preamp with two VU meters for setting reference levels, \$189.50.



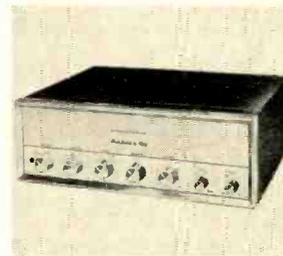
HARMAN-KARDON A-224

Dual preamp/amplifier, 12 watts/channel, has 45 to 20,000 cps response ± 1 db at 12 watts. Harmonic distortion less than 1%, IM 2%. Hum -80 db. Channel separation over 50 db. Separate ganged controls, mode switch, balance control, rumble filter. \$99.95. Enclosure \$7.



PILOT SP-210

Dual preamp may be powered from separate stereo amplifier (SA-232, \$89.50; SA-260, \$129.50, not shown) or separate power supply (P-10, \$19.50). Response 20 to 20,000 cps ± 1 db. Hum & noise -80 db. Harmonic distortion 0.2% at max. sensitivity. \$89.50.



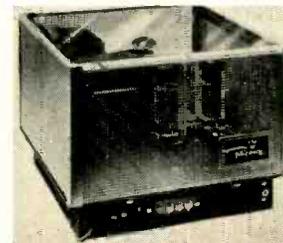
HEATH SP-2

Dual preamp has built-in power supply and scratch filter. Features 2-channel mixing and remote balance control with 20 ft. of cable. Includes 6 inputs with 4 level controls. Sensitivity 2.5 mv. 2 on-off switches, one for ac receptacles. \$56.95 in kit form.



REGENCY HF-50

Single channel 50 watt amplifier has 20 to 20,000 cps response ± 0.2 db. Harmonic distortion 1%, IM distortion 1%. Output 8 and 16 ohms. 1.5 v input for rated output. Negative feedback circuits. Available wired at \$89.50; kit \$74.50.



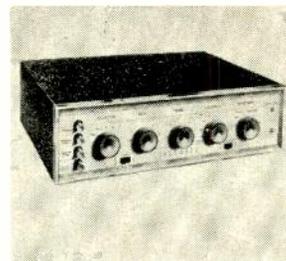
**SARGENT-RAYMENT
SR-17-17**

Dual preamp/amplifier 17 watts/channel, has 20 to 15,000 cps response ± 1 db. Harmonic distortion 0.32% at 17 watts, IM 1.5%. Hum & noise -70 db. Ganged controls. Balance control. \$189.60. Also, not shown, SR-534 dual channel 17 watt stereo amplifier, \$106.60.



SHERWOOD S-4000

20-watt amplifier with pre-amp has dual controls, reverse and phase inversion switches, for converting mono-aural system to stereo. Response is 20 to 20,000 cps ± 1.5 db at rated output. Hum & noise -80 db. Also, not shown, S-5000 dual 20-watt preamp/amp.



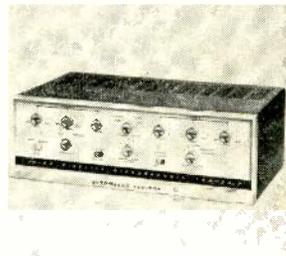
H. H. SCOTT 299

Dual preamp/amplifier, 17 watts/channel, has rumble and scratch filters. Harmonic distortion 0.8% at full power, IM 0.3%. Noise & hum -80 db. DC on filaments. Phase reversing switch. \$199.95. Also, not shown, 209 dual preamp/amplifier, 15 watts/channel, \$139.95.



**STROMBERG-CARLSON
ASR-433**

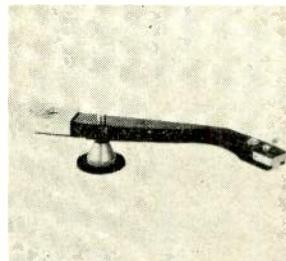
Dual preamp/amplifier has 1% distortion at usual listening levels. Controls include channel selector, master volume control, and individual channel controls. \$119.95. Also, not shown, are single channel amplifiers AR-430, 431 and 432 @ \$59.95, \$99.95 and \$119.95.



Arms

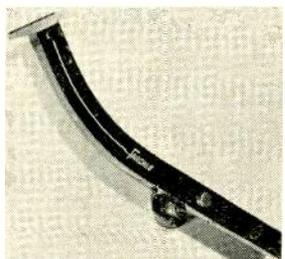
GRADO

Arm of gunstock walnut wood features one-piece construction. One knob adjustment for tracking force, ± 7 grams. Tracking error 0.8°. Resonance 10 cps. Offset angle 24.5%. Wired for stereo cartridges. For 12" records, \$29.95; 16" transcription arm \$32.50.



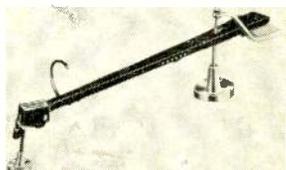
FAIRCHILD 282

Arm wired for 4-pin cartridges is designed for records up to 12"; usable to 16". Operates down to 2 grams stylus force, adjustable by thumbscrew. Self-contained arm locking detent. No arm rest required. Separate ground wire. Black anodized aluminum. \$42.50.



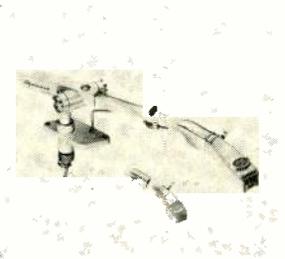
PICKERING 196

Arm includes same design cartridge as Fluxvalve Model 371. Single pivot bearing. Will mount on motorboard measuring only 1 1/2" x 1 1/2". Uni-mount installation employs single thumbscrew and bolt. Arm rest with sable brush keeps stylus dust free. \$59.85.



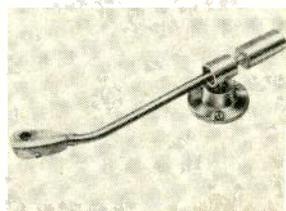
GARRARD TPA/12

Arm with plug-in head replaces TPA/10 tone arm. Two leads wired for stereo to take any cartridges. Usable for up to 16" records. Fixed length and tracking angle preset. Independent weight adjustment screw atop arm. Single hole mounting. Price \$19.50.



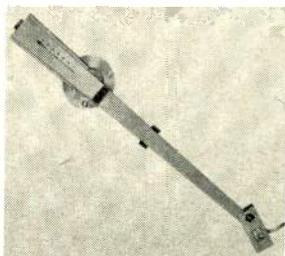
REK-O-KUT S-120

Arm of tubular aluminum, die-cast zamak cartridge shell and brass counterweight, has 2 ball bearing races. Plug-in shell takes 3 and 4 pin cartridges. Resonance 12 to 15 cps. 12" stereo unit \$27.95. Also S-160 16", \$30.95. PS-20 4-pin lead & extra shell \$5.95.



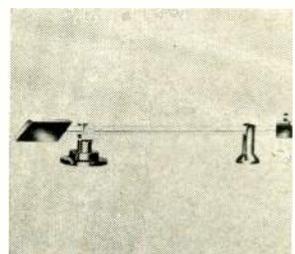
**GENERAL ELECTRIC
TM-2G**

Arm, statically balanced, features 2-step adjustment for precise setting of tracking force between 0 and 6 grams. Play up to 12" records. Designed for VR-II cartridge. Built-in arm rest. Height adjustable from 3/8" to 2 1/4". 1 ground & 4 lead terminals. \$29.95.



H. H. SCOTT 1000

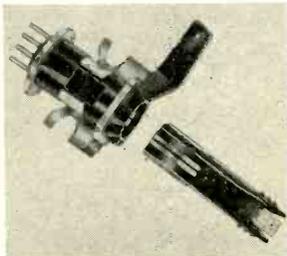
Arm with magnetic stereo cartridge (made in conjunction with London Recording) is 12.5" long. Optimum tracking force is 3.5 grams. Stylus tip 0.5 mil, output 4 mv. Height adjustable 1 1/8" to 2 1/2". Crosstalk better than -20 db. With arm rest, hardware. \$89.95.



CARTRIDGES

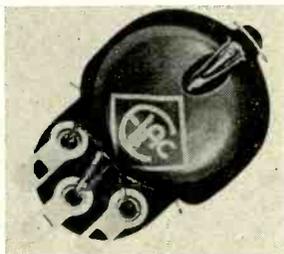
ASTATIC 13TBX

Stereo ceramic plug-in turn-over cartridge has 20 to 15,000 cps response. 4 terminals. Tracking is 5 to 7 grams. Separation -25 db. Compliance 2. Output 0.5 v/channel. Load 2 meg. With holder and 0.7 mil diamond & 3 mil sapphire \$20.50. Model 13TB, 2 sapphires, \$7.95.



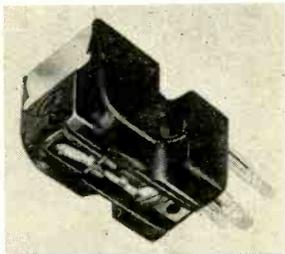
AUDIOGERSH 200

Stereo variable reluctance cartridge has 30 to 18,500 cps response ± 2 db. 3 terminals. Tracking force 4 to 6 grams. Crosstalk less than -20 db. Compliance 4. Output 25 mv at 1 kc for 10 cm/sec. Recommended load 37 k. Completely shielded. With 0.7 mil diamond \$59.50.



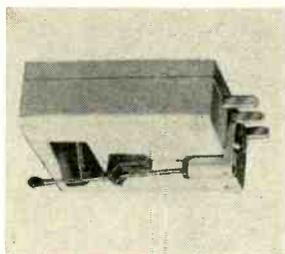
COLUMBIA SC-1

Stereo ceramic cartridge has 30 to 16,000 cps response ± 2.5 db. 3 terminals. Tracking 5 to 7 grams. Separation 20 db. Compliance 2. Output 0.4 v at 1 kc for 5 cm/sec. Load 1.2 meg. With flexible cable, hardware and 0.8 mil diamond needle \$36.25.



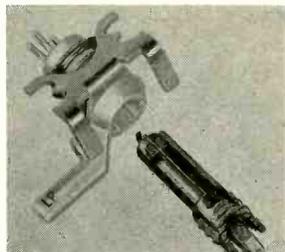
DUOTONE GP580-1

Stereo ceramic cartridge has 20 to 17,500 cps response ± 2 db. 3 terminals. Recommended tracking force is 6 grams. Output 1 v. Compliance 2. Channel separation 20 db. Floating needle action nullifies pinch. With 0.7 mil diamond \$31.25; sapphire \$20.



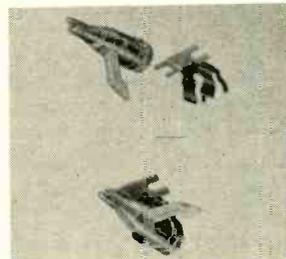
ELECTRO-VOICE 66DS

Stereo ceramic plug-in cartridge has 20 to 15,000 cps response. 3 terminals. Tracking 5 to 8 grams. Compliance 1.8. Output 1 v. With 0.7 mil diamond and 3 mil sapphire \$19.50. Both sapphires \$5.95. Mount \$1. Also, not shown, 21D, \$32.50, PZT magnetic \$16.50-\$37.50.



ERIE

Stereo ceramic plug-in cartridge has 0.4 v output. 3 terminals. Turnover design. Single ceramic element. Recommended tracking force 5 to 6 grams. Separation 20 db over most of frequency range. Compliance 1.7. With diamond and sapphire needles \$24.50; 2 sapphires \$5.95.



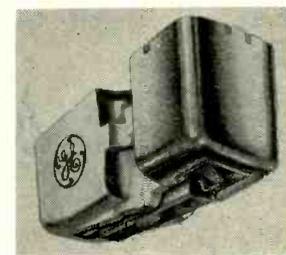
FAIRCHILD 232

Stereo dual rotating coil cartridge will track 30 cm/sec at 1 kc with 4 grams of stylus force. 4 terminals. Output 3 mv/channel. Impedance 600 ohms. Fits both $\frac{1}{2}$ " and $\frac{7}{16}$ " mounting centers. With extra twisted pair leads and diamond needle \$49.50.



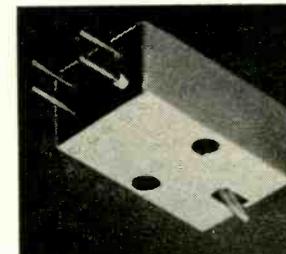
GENERAL ELECTRIC GC-7

Stereo magnetic variable reluctance cartridge has 20 to 17,000 cps response. Output 6 mv/channel. Lateral compliance 3; vertical 2. Tracking 3.5 to 7 grams. With 0.7 mil diamond needle \$23.95. Model CL-7 with sapphire \$16.95. Model GC-5 with 0.5 mil diamond \$26.95.



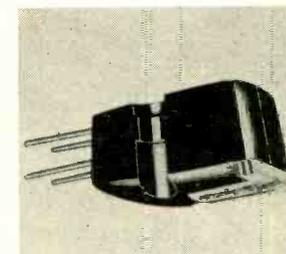
GRADO

Stereo dynamic cartridge has 5 mv/channel output @ 10 cm/sec. 4 terminals. 10 to 35,000 cps. Tracking force 2 grams. Channel separation is 25 db. Compliance 8. IM distortion approximately 2%. Impedance 600 ohms. Input load over 5 k. Stylus mass 1 mg. \$49.50.



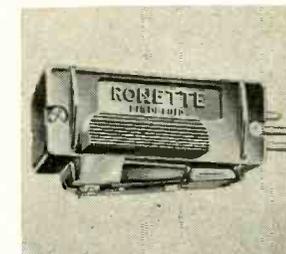
PICKERING 371D

Stereo magnetic cartridge has flat stereo range response ± 2 db. 4 terminals. Inter-channel interference -20 db. Includes hum rejection circuit. Recommended load resistance 27 k to 47 k. T-guard stylus for quick replacement. With 0.7 mil diamond stylus \$29.85.



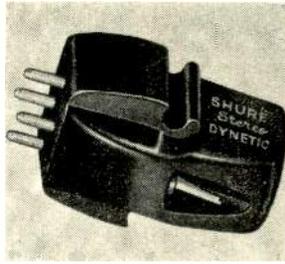
RONETTE BF-40

Stereo cartridge has 20 to 15,000 cps response. Optimum tracking force 4 to 6 grams. Lateral and vertical compliances 3.5. Dual-element Binofluid unit with clip-in diamond needle, Model BF-40D is priced at \$18.60. Model BF-40S with sapphire needle is \$12.



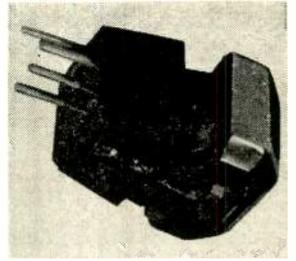
SHURE M3D

Stereo "dynetic" cartridge has 20 to 15,000 cps response ± 3 db. 4 terminals. Channel separation -20 db. Output 5 mv. Recommended load 50 k. Compliance 4. Recommended tracking force 3 to 4 grams. DC resistance 440 ohms. With 0.7 mil diamond needle \$45.



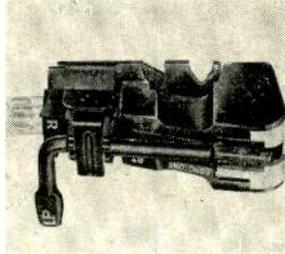
TANNOY

Stereo variable reluctance cartridge has 30 to 16,000 cps response ± 2 db. Output is 6 to 8 mv/channel. Tracking force is 3 to 4 grams. Not recommended for record changers or record players with heavy tracking force. With 0.7 mil diamond needle \$37.



SONOTONE 8T

Stereo turnover ceramic cartridge has 20 to 12,000 cps response. 4 terminals. Tracking force 5 to 7 grams. Output 0.3 v. Compliance 2. Isolation -20 db. Recommended load 1 to 5 meg. With 0.7 mil diamond and 3 mil sapphire \$24.50; both diamond \$34.50; both sapphire \$14.50.



WEATHERS

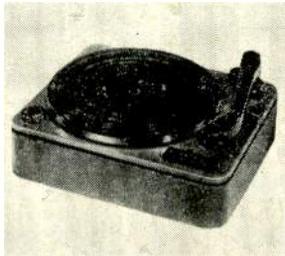
Stereo ceramic cartridge has 15 to 30,000 cps response. Output 0.25 v at 7 cm/sec. Recommended tracking force 2 grams. Separation between channels 25 db. Completely shielded. Complete with pick-up leads, connectors. With diamond needle \$17.50; sapphire needle \$9.75.



CHANGERS

AUDIOGERSH XS-200

Four-speed automatic and manual changer with push-buttons has rubber matted turntable. Intermixes 10" and 12" records in any sequence. Single play and automatic spindles. \$67.50. With GE cartridge, diamond needle, \$86.25. Also, not shown, XM-110A manual, \$37.50.



GLASER-STEERS GS77

Four-speed automatic and manual changer has stereo-monaural switch, muting switch, receptacle for automatic amplifier shut-off. Turntable pauses during change cycle. Intermixes 33 1/3 and 45 records. Automatic speed selector. \$59.50. 45 rpm spindle \$3.60.



COLLARO TSC-840

Four-speed automatic & manual changer has 2-piece arm with 5-terminal plug-in head. 7", 10" and 12" automatic intermix. Wow and flutter 0.25%. Counterbalanced arm. \$49.50. Also, not shown, TSC-740 4-speed, \$42.50; TSC-640, 4-speed, one-piece arm, \$38.50.

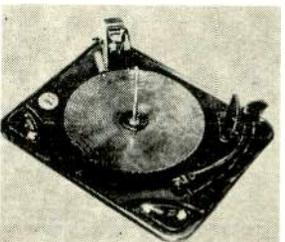


VM 1201

4-speed changer includes stereo cartridge. Stereo-monaural switch and jacks. Jam-proof spindle. Rumble -48 db. Tracking angle variation 2°. 4-pole motor. \$50. As replacement changer on metal base pan, Model 1226, \$56. Model 1202, with plug-in head, no cartridge. \$50.

GARRARD RC88

Four-speed automatic and manual changer comes with interchangeable spindles. Plug-in head. Muting switch. With GE cartridge, diamond & sapphire, \$73.80; changer alone, \$54.50. Also, not shown, RC98 alone, variable speed, \$67.50; RC121 automatic alone, \$42.50.

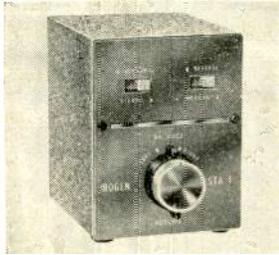


For more information on these products
SEE INQUIRY COUPON ON PAGE 73
& Directory of Manufacturers on Page 88

CONTROL UNITS & ADAPTERS

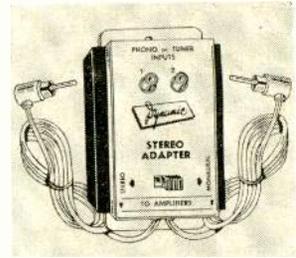
BOGEN STA-1

Stereo adapter permits single knob control of both channel volumes. Monaural-stereo switch. Reverse and normal switch. Left-right balance adjustment for 2 speakers. Connects to 2 amplifiers. \$13.50. Also, not shown, ST10-A adapter-amplifier, \$52.50.



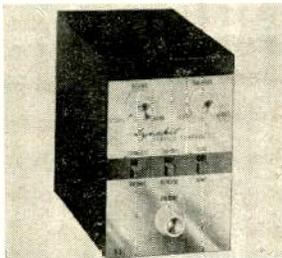
DYNAMIC SA-70

Stereo adapter permits coupling cartridges, tape heads or tuner to 2 amplifiers. 2 inputs with stereo-monaural slide selector switch. With two 31" shielded leads and molded-on pin plugs \$7.50.



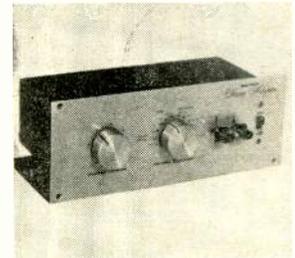
DYNAKIT DSC-1

Stereo control unit adds control facilities to pair of preamps. Passive network. 3 controls include volume, balance and blend to fill "hole in middle" by feeding input through both amplifiers. Reverse, loudness & tape switches. Kit \$12.95.



MARANTZ 6

Stereo adapter provides step-attenuator master volume control. Selector switch chooses phono, tuner, tape, TV, extra, stereo or monaural. Speaker reversal switch. 12 inputs, 2 recording outputs. With 2 output cables to preamps. \$45.



CONVERSION KITS

FANON STK-10

Conversion kit adapts any phono to stereo. Includes 2-way speaker system with 3" and 8" speakers, 5-tube amplifier. With stereo cartridge, wood cabinet jacks, leads, \$59.95. Also STK-5 \$49.95; STK-4 with 3-tube amplifier, two 4" speakers, \$39.95.



H. H. SCOTT 135

Stereo-Daptor permits simultaneous control of 2 separate amplifiers. Master volume control for both channels. Function selector. Passive circuit. Loudness control. Input 300 k, output 100 k. Reverse stereo. Record-play-back switch. \$24.95.



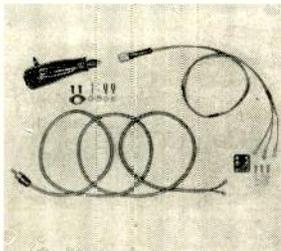
For more information on these products

SEE INQUIRY COUPON ON PAGE 73

& Directory of Manufacturers on Page 88

GARRARD SCK-1

Kit converts company's record players for stereo. Consists of female connector wired with 2 leads for tone arm, audio cable for second amplifier, cartridge shell and hardware. No soldering. For RC 88, 98, 121 and Tmk II, \$4.05. Also SCK-2 for RC 121/II.



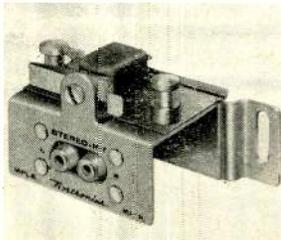
REK-O-KUT SC-12

Stereo arm conversion kit includes all parts and two simple tools to convert company's A-120 and A-160 arms to stereo. Includes plug-in head, terminal board and basic arm element. For 12" arm, \$17.95. Model SC-16 for 16" arm, \$19.95.



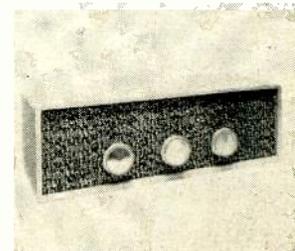
NORTRONICS SK-100

Kit converts monaural tape recorders to 1/2-track, 2-channel stereo when proper amplifiers are added. Playback and record functions. Includes head and wired assembly. Crosstalk -50 db. 4 mv out @ 1 kc. \$23.50. Also, not shown, SK-50 1/4-track, 4-channel \$26.



WALCO

Complete conversion kit for home phono includes stereo cartridge, 0.7 mil diamond needle, 4-watt, 5-tube amplifier and preamp for second channel, speaker in enclosure and related hardware. Amplifier has separate treble and bass controls. \$69.50.



MICROPHONES

SONOTONE

Model CM-10 omnidirectional high-impedance ceramic type has 50 to 13,000 cps response. ± 3 db. Sensitivity -57 db. Perforated aluminum grid damping. With 7' of shielded cable terminating in standard phone plug, \$19.50.

AMERICAN

D204 dynamic type, 70 to 9500 cps, -57 db output, with pushbutton, for tape recording and general purpose, \$7 to \$24.30. D9A low impedance dynamic cardioid, 100 to 7000 cps, -57 db, \$82.50. D22 dynamic omni-directional, 50 to 12,000 cps, -55 db, variable Z. \$99.50.

ELECTRO-VOICE

Model 951 cardioid crystal type, 50 to 11,000 cps, -55 db, hi-Z, \$49.50. 664 cardioid dynamic, 40 to 15,000 cps, -55 db, \$85. 926 omnidirectional crystal, 60 to 8,000 cps, -60 db, for pa and recorders, \$29.50. 666 cardioid dynamic, 40 to 15,000 cps, -55 db, \$150.

SHURE

Model 535 omnidirectional dynamic, 60 to 13,500 cps, -59 db, \$72.50. Model 55S unidirectional dynamic, 50 to 15,000 cps, -60 db, \$83. Model 777 general purpose crystal, 60 to 10,000 cps, -62 db, \$25. Model 737A super-cardioid crystal, -54 db, \$46.

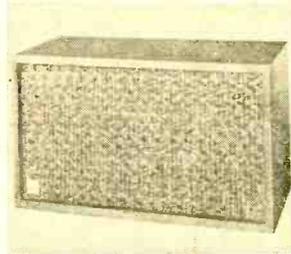
TURNER

Model L-100 crystal type, 50 to 10,000 cps, -52 db level, with 20' shielded cable, \$12.50. Model 139 multi-impedance dynamic, 60 to 10,000 cps, -52 db, \$45. Model 98 cardioid dynamic, 65 to 11,000 cps, -52 db, \$59.50; on-off switch add \$4.

SPEAKERS & ENCLOSURES

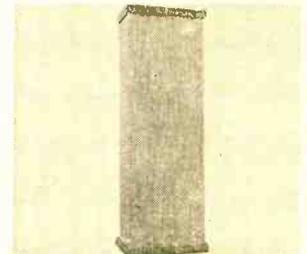
ACOUSTIC RESEARCH AR-2

Speaker system with acoustic suspension has two 5" cone tweeters, and 10" woofer with 1.1 lb. Alnico magnet, resonant frequency 58 cps. 40 to 15,000 cps. 20 to 40 watts. $13\frac{1}{2}$ " x 11" x 24". 8 ohms. 2000 cps crossover. \$96. Also, not shown, AR-1 @ \$185.



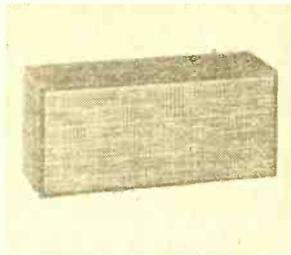
AUDIOSPEAKER 12

Enclosure with wrap-around cloth is 4' high, takes up 1 sq. ft. of floor space. Anechoic design. Standard model for 12" speakers \$79; also for 3", \$59; 15", \$89. Utility models, painted plywood, \$39, \$49 and \$59. Also, not shown, Custom 16 woofer, 18 cps res., \$89.



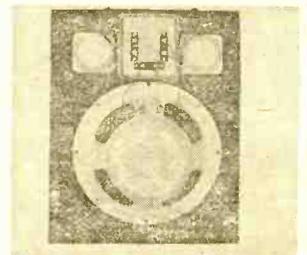
ARGOS TSE-1

Enclosure with forward front design and ducted ports has 2165 cu. in. volume. Size 24" x 11" x 10 $\frac{1}{2}$ ". This bookshelf arrangement can accommodate an 8" woofer plus tweeter. Covered with ribbed pyroxylin fabric. \$16.50. Also, not shown, DSE-2 @ \$44.50.



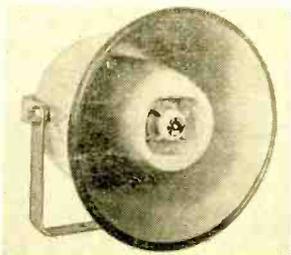
CLETRON C-1233

Woofer-tweeter combination with crossover network mounted on sounding board comprises 12" woofer with 21-cz. Alnico magnet and two 3" tweeters. Board 16" x 20" x 7". 30 to 18,500 cps. Resonance 35 cps. 35 watts. \$60. Also, not shown, C-15PC coax, 15", \$59; C-3JC \$13.



ATLAS WT-6

Outdoor coax-projector speaker comprises weather-proof cone type driver with 6" throat coupled to individual woofer horn. Separate pressure-type driver and tweeter horn. 15 watts. 140 to 15,000 cps response. 8 ohms. 15" bell opening, 12" depth. \$34.50.



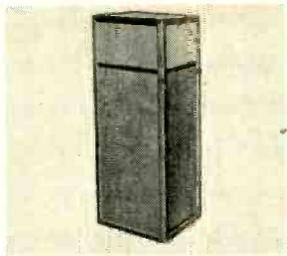
DYNAMIC S-4

Speaker system with one 8" woofer, two 5" midranges and one 4" tweeter and crossover measures 18" x 14" x 10". In walnut, mahogany or blonde. \$39.50. Model S-2 with woofer and one midrange \$29.50. Also, not shown, Model S-12, 12" coax and 4" tweeter, \$49.50.



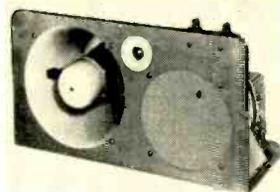
EICO HFS-2

Speaker system completely wired and assembled is omnidirectional. 36" x 15 1/4" x 11 1/2". 45 to 20,000 cps flat. Has coax with free floating cone and slot loaded split conical horn. 30 watts, 16 ohms. \$139.95. Also, not shown, HFS-1 two way system \$39.95.



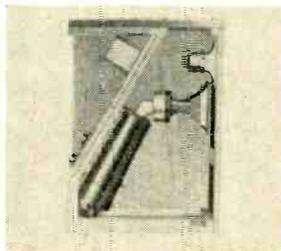
JENSEN KT-44

4-way speaker component kit 15" woofer, 8" upper lf unit, midrange and supertweeter, 40 watts, 16 cps to beyond audibility. 16 ohms. \$192.50. On DC-4 (\$15.95) chassis as shown, when mounted in E-200 enclosure, (\$295.50) SS-200 Stereo Director (not shown), \$439.50.



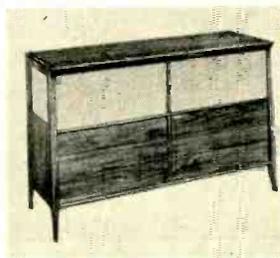
ELECTRO-VOICE 1A

Coronet model speaker system measures 25" x 9 1/2" x 17 3/8". It includes the company's SP8B coax, T35V vhf driver, X36 crossover and AT37 level control. \$102. Enclosure alone \$35.50. Also, not shown, are speaker systems Patriciaan IVD \$1086; Centurion IV \$392; Aristocrat \$72.



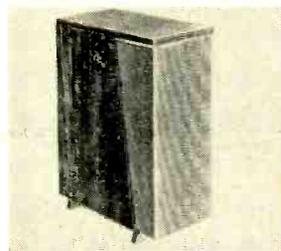
JENSEN DS-100

Dual 3-way speaker system has two 3-way Stereo Directors, each with 12" woofer, 8" mf, compression hf unit. Directors may be rotated to beam sound. 32" x 52" x 18 1/4". 20 to 15,000 cps. 30 watts/channel. \$369.50. Also, not shown, SS-100 single 3-way system \$179.95.



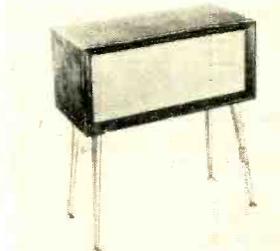
ELECTRO-VOICE

Second channel "Stereon" speaker system eliminates need for full range by producing main stereo frequencies above 300 cps. Lower frequencies phased to main speaker by XX3 filter. 3-way, \$129.50 and \$99.50. Also, not shown, enclosure kits KD1 through KD7, \$118 to \$26.



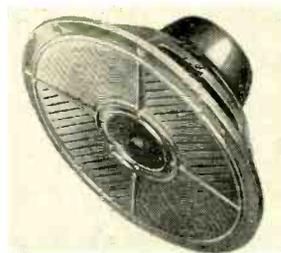
KINGDOM KAL

2-way speaker system has 35 to 17,000 cps range. 14 watts. 11" x 23 3/4" x 10". leatherette covered, \$49.50. 15" brass legs \$5.95. Also, not shown, Audette Senior 2-way system, 35 to 17,000 cps, 22 1/4" x 22 1/4" x 10 1/2", \$69.50. Compass-1, 20 to 20,000 cps, \$149.50.



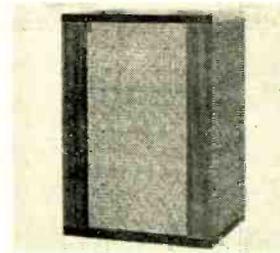
GENERAL ELECTRIC A1-401

12" golden coax speaker has 40 to 15,000 cps response. 25 watts, 8 ohms. 14.5 oz. Alnico woofer magnet, 6.8 oz. for tweeter. 1500 cps crossover. Slotted plate baffles tweeter. \$49.75. Also, not shown, Model 850 8" extended range, 50 to 12,000 cps, 8 ohms, \$10.95.



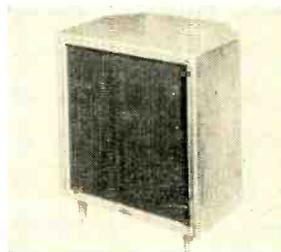
KLIPSCH H

3-way speaker system is designed to derive a third stereo channel from 2 sound tracks. 11" x 12" x 16". With 12" woofer \$198; with 8" woofer \$188. Also, not shown, Model T Shorthorn, 30 to 22,000 cps, \$382; Deluxe Klipschorn \$785; economy model \$460.



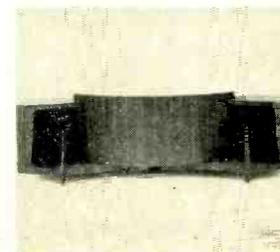
GENERAL ELECTRIC A1-406

6 cu. ft. distributed port enclosure is designed for 12" speakers. May be used in straight wall or corner locations. 25 3/8" x 18 1/4" x 31 1/4". Heavily lined absorbent interior. \$64.95. Also, not shown, A1-411 enclosure, 26" x 11" x 10", 1.2 cu. ft. \$35.95.



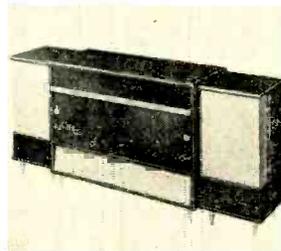
JAMES B. LANSING D44000

Dual 3-way system has two sets of JB 150-4C 15" woofers, 375 hf drivers, 075 ring radiators, and dividing networks. 33 3/4" x 24 1/2" x 106". \$1830 and \$1884. Also, not shown, D42216 system, 11 7/8" x 24" x 12", \$84.30; D130 extended range 15" speaker, \$84.



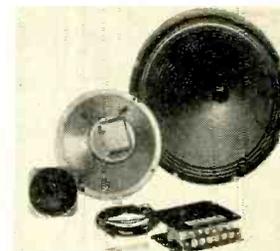
HEATH SE-1/SC-1

Speaker enclosures SC-1, left and right models, flank equipment cabinet SE-1. Available in birch and mahogany. Wing speaker enclosures are open backed to hold closed systems; 16" x 29 1/4" x 14 1/2" inside. Cabinet 47 1/4" x 36 1/2" x 20". SE-1 \$149.95; SC-1 \$39.95 ea.



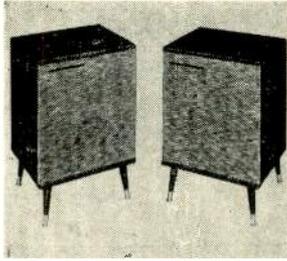
OXFORD 3W20

3-way speaker components include 12" woofer, 8" mid-range, 3 1/2" tweeter and hardware. To 15,000 cps. \$39. OXN-31 crossover network shown, \$12.30. Also, not shown, bass reflex cabinet, 33 3/8" x 23 3/4" x 17", \$111; C15L608 15" coax, 30 to 15,000 cps, 25 watts, \$43.50.



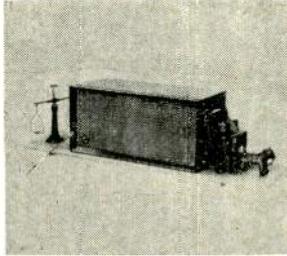
RCA SHS11

Speaker system has 8" woofer-midrange and two 3½" tweeters. 29¾" x 20" x 16". Ebony, mahogany, oak and walnut finishes. With 25' connecting cable, \$49.95 ea. Also, not shown, SHS10 corner system, \$49.95; SHS12 bookshelf, \$19.95; SHS8, \$125.



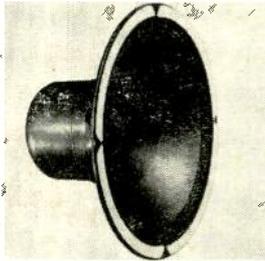
RJ Super 8

Speaker system with 8" full range speaker for bookshelf installation, \$50.50 unfinished, \$59.50 finished. 11" x 23½" x 10". Enclosure alone, \$28.50 and \$37.50. Also, not shown, Model 12-S enclosure, 24" x 21" x 10", \$49.50; Model 13 enclosure, 20" x 20" x 16", \$56.



SONOTONE WR-8

Wide range 8" speaker has 55 to 13,000 cps response, 8 watts, 8 ohms. Flux density 12,000 gauss. \$12. Also, not shown, speaker in Caprice enclosure, 20" x 11" x 10", ¾" plywood hand finished, \$53.50; CA-12A coax speaker, 35 to 20,000 cps, 10 watts, 8 to 16 ohms, \$27.50.

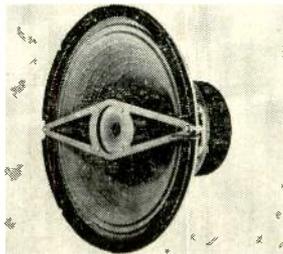


STENTORIAN HF1016U

10" universal speaker with 30 to 15,000 cps response has 35 cps cone resonance, 16,000 gauss, 3½ lb. Alcomax magnet. Option of 4, 8 or 16 ohms. \$36.50. Also, not shown, 3½" cone tweeter T-359, 3000 to 17,000 cps, 15 watts, 16 ohms, 9000 gauss, \$14.95.

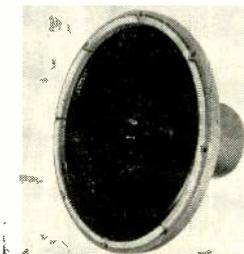
STEPHENS BWD

2-way speaker system includes Model 120W 12" woofer (\$60) with 30-watt, 30 cps resonance ratings, and Model 5-KT toroid tweeter (\$49.50) with high pass filter and brilliance control. Also, enclosures from 815 bookshelf @ \$48 to Eames E-3 with 3-way @ \$595.



STROMBERG-CARLSON RF483

Coax speaker, 15" woofer and tweeter, has 25 to 18,000 cps response. 45 cps free air resonance. 16 ohms. \$99.95. Also, not shown, RF-480 8" speaker, 18 watts, 30 to 17,000 cps, \$24.95; RS-461 labyrinth system, 2-way, second channel, 40 to 18,000 cps, \$69.95.

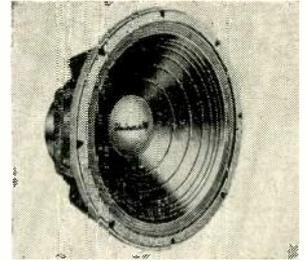


TANNOY 15

Dual concentric 15" speaker is rated at 25 watts, 15 ohms. Resonance 40 cps. Crossover 1000 cps. Complete cone assembly may be removed for gap cleaning. Less than 2% IM products. 18,000 gauss in hf gap. Depth 9". \$159.

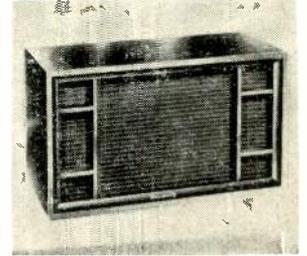
UNIVERSITY C-15HC

High compliance 15" woofer down to free air resonance, 15 cps, 800 cps cutoff, 20 watts. 4-8 and 10-20 ohms. Also, not shown, UXC-123 3-way diffraxial, 45 to 17,500 cps, \$64; HF 206 tweeter, \$33; T-50 high frequency horn driver, \$49.50; C-12HC woofer, \$49.50.



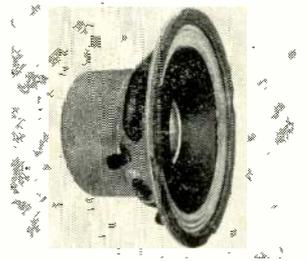
UNIVERSITY S-10

2-way speaker system with 12" woofer and tweeter has low 15-20 cps resonance. 1500 cps crossover. Full bass response down to 30 cps. 25" x 14" x 14½". \$139. Also, not shown, S-11 3-way with 15" woofer, \$245; EN-15LH multiple speaker enclosure, \$139.50.



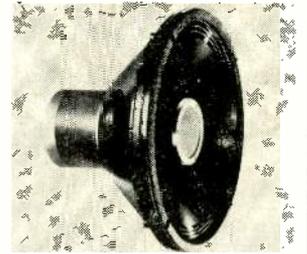
UTAH C8S

Expanded range 8" speaker, 20 to 15,000 cps, 16 ohms, solderless terminals, \$47.50. Also, not shown, are C8R 8" low frequency unit @ \$54.95; C12S expanded range, \$52; C12R 20 to 7500 cps, \$59.95; C15R \$67.50; CT5JN 5" tweeter, 3500 to 20,000 cps, \$19.50.



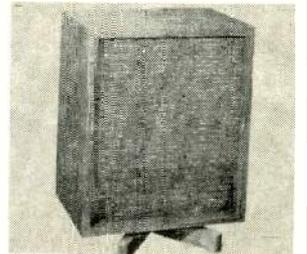
VITAVOX DU-120

Coax speaker with 12" woofer and 3" tweeter has 30 to 15,000 cps response is rated at 30 watts, 15 ohms. Resonance 40 to 45 cps. Crossover 2000 cps. Tweeter has polyester film diaphragm. External dividing network other than capacitor not required. \$89.50.



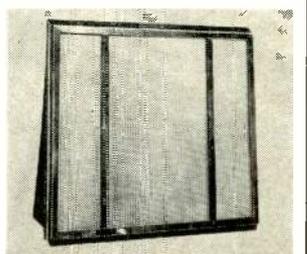
WELLCOR CBC-8-12

Bass reflex enclosure with inclined port allows floor to act as cabinet extension. Over 3 cu. ft. Cut out for 8" and 12" speakers. 22½" x 19¼" x 13¾". On swivel base, \$24.45. Also, not shown, CS-12 corner enclosure, 24" x 28" x 21", precut 12 and 15", \$72.



WHARFEDALE SFB/3

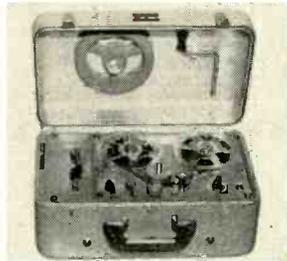
Custom model 3-way speaker system with 12" woofer, 10" midrange and 3" tweeter has sand-filled baffle. 30-35 cps resonance. 20 to 20,000 cps. 15 ohms. 34" x 31" x 12". \$199. Also, not shown, Deluxe model \$249; W/AF/1 2-way system, 30" x 17" x 12", \$144.50.



TAPE RECORDERS

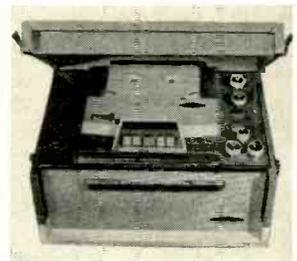
AMPLIFIER CORP. 611-D

"Stereo-Magnemite" tape recorder has battery-operated motor. 50 to 7500 cps. 50 db range. 17 lbs. 0.1% flutter. 7½ ips. 5 v out. Earphone stereo playback. In weather-tight case \$445. 611-C, 3¾ ips, 100 to 3000 cps, \$405; 611-E, 50 to 15,000 cps, \$475.



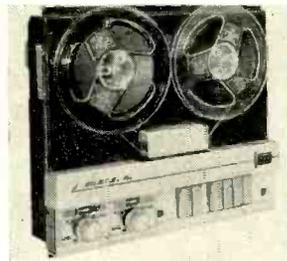
PENTRON

Stereo tape playback and monaural recorder plays 4-track RCA tape cartridge which snaps into position, eliminating conventional reels. 3¾ and 7½ ips. 40 to 15,000 cps. Separate preamp for each channel. VU meter. Auto shutoff. Index counter. \$269.50.



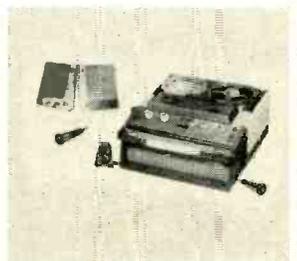
BELL T-203/RP-120

Tape transport (T-203) with monaural and stereo inline and offset erase/record-playback heads is \$139.95. With two RP-120 record-playback preamps, \$59.95 each, response is 20 to 10,000 cps ±2 db. Sensitivity 0.001 v on mike. 5 v out. 50 db S/N. 1% distortion.



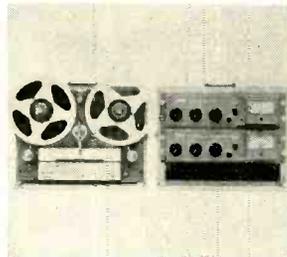
PENTRON NL-4

Dual channel unit records and plays back 2- & 4-track stereo. 40 to 15,000 cps at 7½ ips; 40 to 10,000 cps at 3¾ ips. 50 db S/N. Flutter 0.3%. 8 speakers. \$349.95. ES-2 speakers \$59.95. RC-6 remote control \$9.95. Not shown, NL-1S stereo \$139.95.



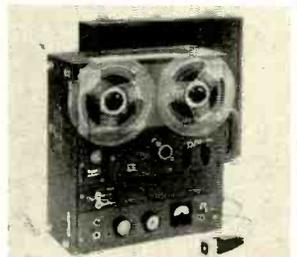
BERLANT-CONCERTONE 33-2

2-channel stereo tape recorder includes separate erase on each channel. 7½ and 15 ips. 55 db S/N. 40 to 15,000 cps at 15 ips. 0.1% flutter and wow. \$995. Also, not shown, Model 63 dual record and playback stereo, \$695; with case \$755.



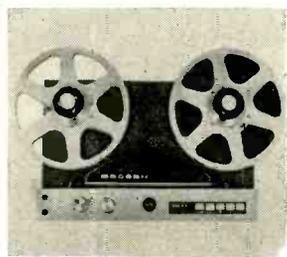
ROBERTS 90-S

Dual channel unit plays back stereo and records stereo from broadcasts and stereo recordings. Hysteresis-synchronous drive motor. 40 to 15,000 cps ±2 db at 7½ ips; 40 to 7500 cps ±2 db at 3¾ ips. Dual remote speaker outputs. \$325.



BOGEN TR-30

Tape recorder designed for half-track monaural recording and stacked stereo playback. Built-in dual preamps. 7½ and 15 ips. 50 db S/N at 3% distortion. 40 to 15,000 cps at 15 ips; 50 to 10,000 cps at 7½ ips. 3 motors. Takes 10½" reel. About \$400.



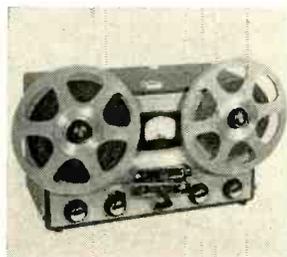
SUPERSCOPE DK-555A

Dual channel unit records and plays back stereo. 30 to 16,000 cps at 7½ ips. 30 to 10,000 cps at 3¾ ips. Flutter and wow 0.2%. 2% harmonic distortion. 4 watts output. Stacked heads. -50 db crosstalk. With 2 Sony mikes \$525. Portable case \$70.



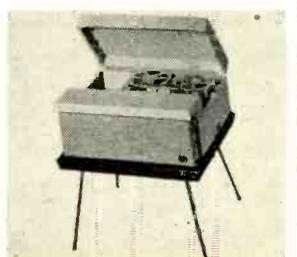
CROWN

Imperial model tape recorder with monaural record and stereo inline playback provision takes up to 10½" reels. Two tracks. 30 to 15,000 cps ±2 db at 7½ ips. 0.15% flutter. 52 db S/N. \$535. Also available, not shown, Stereo-X for stereo record.



V-M 750

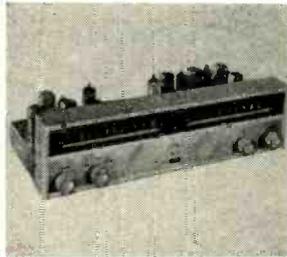
Tape recorder plays back stereo and records monaural. 45 db S/N ration. 5 watts output. 0.4% flutter and wow. 7½ and 3¾ ips. Storage compartment for 16 reels plus accessories. \$275. Also, not shown, Model 714, plays stacked and staggered tapes, \$225.



TUNERS

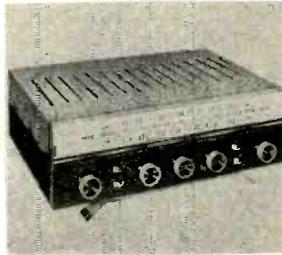
ARKAY ST-11

Tuner provides simultaneous FM/AM reception. FM sensitivity 4 μ v for 20 db quieting. Hum -65 db. 20 to 20,000 cps \pm 0.5 db. Distortion 1%. Selectivity 200 kc 6 db down. \$49.95 kit, \$74.50 wired. Also, not shown, FM-8 tuner, \$39.95 kit, \$59.95 wired.



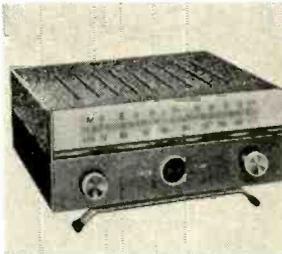
BOGEN RB115

FM/AM tuner with single channel preamp and 15 watt amplifier has 20 to 20,000 cps response \pm 1 db. Distortion 2%. FM sensitivity 3.5 μ v for 30 db quieting. Selectivity 180 kc, 3 db. \$149.50. Enclosure \$7.50. Also, not shown, TC-100 FM/AM tuner \$87.50.



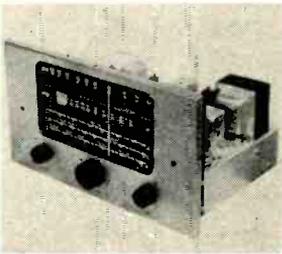
BOGEN T661

FM/AM tuner has FM sensitivity of 2.5 μ v for 30 db quieting, 300 ohm antenna. Selectivity 180 kc, 3 db down. 20 to 18,000 cps \pm 0.5 db. Distortion 1.5%. Hum -60 db. \$129.50. Enclosure \$6. Also, not shown, RB-140 FM/AM tuner-amplifier \$249.50.



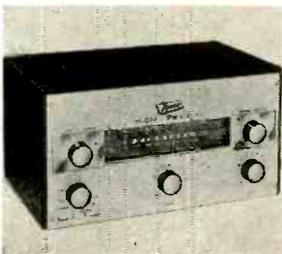
CHAPMAN S-5E

FM/AM/SW tuner has 2 i-f stages. Sensitivity 4 μ v on FM for 20 db quieting. Selectivity 200 kc, 3 db down. EM-81 tuning eye. Tuning ranges are 1.1-3.3 mc, 3-8.5 mc, 8.1-23 mc, 88-108 mc, and 545-1600 kc. High and low impedance outputs. \$149.95.



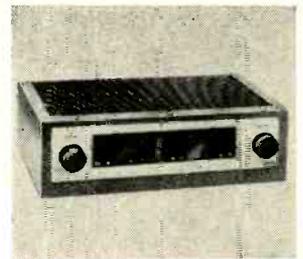
DYNAMIC AF-250PA

FM/AM tuner with built in single channel preamp and 12 watt amplifier has 11 tubes. 20 to 20,000 cps response. Loudness, bass, treble and function controls. \$129.50. AF-250 without preamp, \$119.50. Also, not shown, T2000 FM/AM tuner alone, afc, \$99.50.



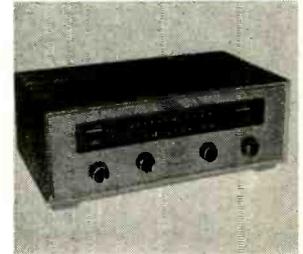
EICO HFT 90

FM tuner with traveling neon indicator has 20 to 20,000 cps response \pm 1 db. Sensitivity 2.5 μ v for 30 db quieting. I-F bandwidth 260 kc, 6 db down. Hum -60 db. Maximum drift 20 kc from cold start. Kit with front end wired \$39.95; wired \$65.95. Enclosure \$3.95.



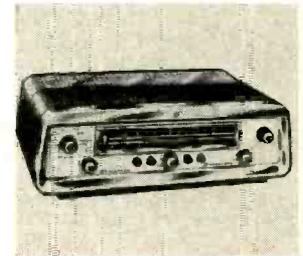
FISHER 101-R

FM/AM tuner has 20 to 20,000 cps response \pm 1 db. FM sensitivity 2.2 μ v for 30 db quieting. I-F bandwidth 180 kc, 3 db down. 60 db signal/hum. Crosstalk -80 db. Separate FM and AM indicator. \$229.50. Also, not shown, Model 90-T FM/AM with preamp \$239.50.



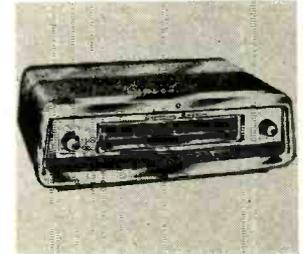
GROMMES 120GAT

FM/AM tuner with single channel preamp and 20 watt amplifier has 20 to 20 cps response \pm 1 db. 1% harmonic distortion, 2% IM. FM sensitivity 2 μ v for 20 db quieting. Selectivity 250 kc, 6 db down. Amplifier hum and noise -80 db. Filters. \$169.50.



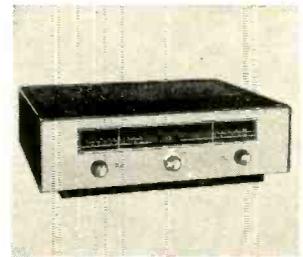
GROMMES

FM tuner with electronic eye, afc, two i-f stages and two limiters has 20 to 20,000 cps response \pm 0.5 db. Sensitivity 1 μ v for 20 db quieting. 2% IM and 1% harmonic distortion. Hum & noise -60 db. \$79.50. Also, not shown, 102GT, FM/AM, \$119.50.



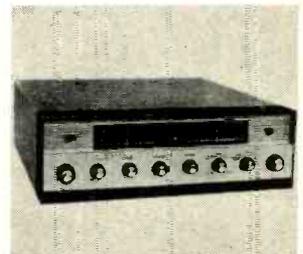
HARMAN-KARDON T-224

"Duet" FM/AM tuner with separate channels for each, 30 to 15,000 cps \pm 0.75 db. Sensitivity 3.5 μ v for 20 db quieting. Selectivity 240 kc, 6 db down. Drift 5 kc max. IM 0.5%. Hum -60 db. \$114.95. Also, not shown, TX20 single channel FM/AM, \$99.95.



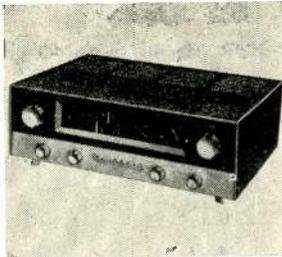
HARMAN-KARDON TP200

FM/AM tuner with dual preamps has 12 operating controls. Separate FM and AM sections. Indexer identifies FM/AM station pairs. 15 to 30,000 cps \pm 0.5 db. 0.3% IM and harmonic. Hum -80 db. Crosstalk -50 db. \$189.95. Also, not shown, T-250 tuner \$139.95.



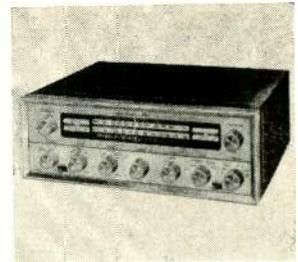
HEATH PT-1

FM/AM tuner has 16 tubes, afc and AM variable bandwidth control, 15 kc on narrow, 35 kc on broad, 6 db down. 300 kc i-f band for FM. 600 kc FM discriminator. I-F strip consists of two printed circuit boards. Kit form, front end prewired, \$89.95.



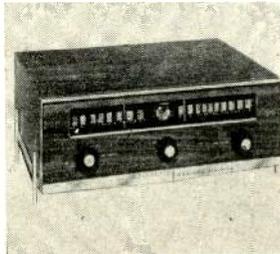
PILOT FA-690

FM/AM tuner with dual preamp has 2 tuning meters, and other specifications similar to Model FA-680. Pre-amp ratings for each channel are 20 to 20,000 cps ± 1 db, output 1 v, hum and noise -80 db below 1 v, 0.2% harmonic distortion. \$269.50.



MADISON FIELDING 330

FM/AM tuner with two channels has tuning indicator for simultaneous tuning of FM and AM. 20 to 20,000 cps ± 1 db. I-F bandwidth 420 kc, 6 db down. AFC. AM sensitivity 15 μ v per meter loop. \$149.95. Enclosure \$149.95 in mahogany, walnut, blonde.



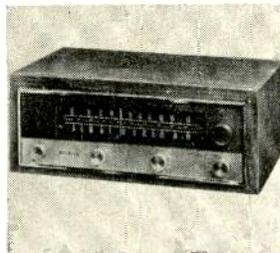
SARGENT-RAYMENT SR-380

FM/AM tuner with dual preamp 20 to 20,000 cps response ± 1 db. Sensitivity on FM 3 μ v for 20 db quieting. Harmonic distortion 0.17% for 1 v out. Hum -75 db. Rumble and scratch filters. Cathode follower outputs. Carbon deposited resistors in preamp. \$189.60.



McINTOSH MR-55

FM/AM tuner has afc, 20 to 20,000 cps response ± 3 db. FM sensitivity 3 μ v at 100% modulation. 4 i-f stages. 2 limiters. Hum -75 db. Drift 30 kc without afc. Capture ratio 1 to 0.8. AM distortion 1%. Whistle filter. \$249. Enclosure \$25.



H. H. SCOTT 330-C

FM/AM tuner has sensitivity of 2 μ v for 20 db quieting. Includes tuning meter and vernier tuning controls. AGC. Separate channels. 2 limiter stages. \$209.95. Also, not shown, are Model 300 FM/AM tuner with single channel preamp \$167.95; 310-B FM \$178.45.



PILOT FA-680

FM/AM tuner for simultaneous reception has separate AM and FM tuning meters. 3 i-f stages, 2 limiters. Sensitivity 1 μ v with 30% modulation for 20 db quieting. 1 kc wideband detector eliminates afc. \$199.50. Also, not shown, FA-690 FM/AM tuner, \$179.50.



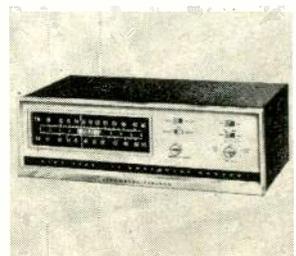
SHERWOOD S-2000

FM/AM tuner has 20 to 20,000 cps response ± 0.5 db. Sensitivity on FM 1.8 μ v for 30 db quieting. IM 0.25% at 100% modulation, 400 cps. Hum -60 db. AFC. 2 v out. \$139.50; with case \$144.50-\$154.50. Also, not shown, S-2000 FM tuner \$99.50 without case.



STROMBERG-CARLSON SR-440

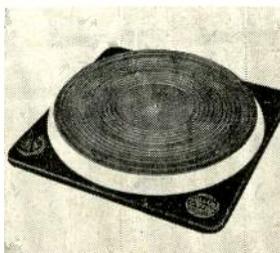
FM/AM tuner has 20 to 20,000 cps response. FM sensitivity 1.8 μ v for 20 db quieting. I-F bandwidth 200 kc. 11 tubes. AM bandwidths 15 kc in broad position, 7 kc in sharp. Low impedance cathode follower output. \$159.95 without top cover.



TURNTABLES

COLLARO 4TR200

4-speed turntable has 4-pole motor isolated by 3 tension springs parallel to unit plate. Bearing with steel ball takes total thrust. Shuts off each time before changing speed. Black rubber mat. \$49.50. Also, not shown, manual player TP59, 4 speeds, \$29.50.



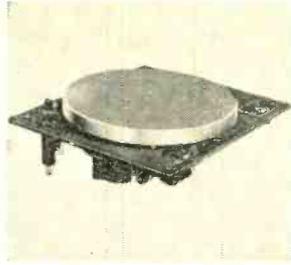
COMPONENTS

Four-speed turntable has 33 1/3 pulley; others interchangeable. Noise -60 db. Wow and flutter 0.25%. Speed accuracy 0.5%. 4-pole induction motor. Professional Jr., \$39.50. Extra pulleys \$2.50. Base \$10. Also, not shown, Models PBT & PBT4, \$99.50 & \$109.



CONNOISSEUR

Three-speed turntable with continuously variable speeds, $\pm 2\%$ around each speed range. Wow less than 0.15% of rated speed. Rumble better than -50 db at 7 cm/sec and 500 cps. 12" non-magnetic table. Synchronous hysteresis motor. With Mark II tone arm \$110.



FAIRCHILD 412-4

Four-speed turntable has electronic control regulator consisting of variable frequency oscillator/amplifier, which drives motor; speed determined by control frequency, adjustable $\pm 5\%$. \$229.50. Two speed without electronic regulator, \$129.50; one speed, \$99.50.



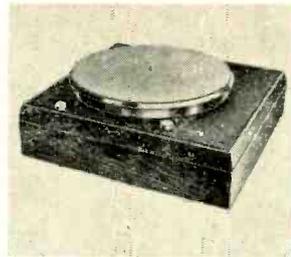
GARRARD 4HF

Four-speed turntable is variable around each speed. 12" table. Automatic start-stop in arm rest. Lift arm to start; replace to stop. \$59.50. With GE cartridges, \$68.45 to \$83.45. Also, not shown, 301 turntable only @ \$89; Model T complete \$56.45.



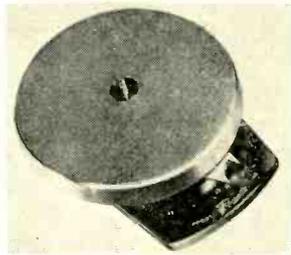
PICKERING 800

Single-speed 33 1/3 rpm floats on air cushion. Vertical period of spring suspension below 5 cps. Noise -65 db. Speed accuracy $\pm 0.2\%$. Built-in precision leveling indicator. Foam rubber mat. Plays 7" to 12" records. \$59.85. Bases available at \$7.50 and \$12.



PRESTO T-18A

Three-speed turntable has 11 7/8" table. Speed selector has 5 positions, two offs included. Wow and flutter 0.2%. Rumble -47 db. With 4-pole induction motor \$75. T-18-AH with hysteresis motor \$131. Also, not shown, T-2 @ \$59.50.



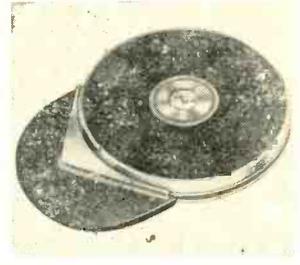
REK-O-KUT B-12H

Three-speed turntable requires no external 45 adapter. Neon light on-off indicator. Noise -57 db. Strobe disc affixed. With hysteresis synchronous motor \$129.95. Similar Rondine B-12GH \$99.95. Also, not shown, B-12 @ \$84.95; N-33H @ \$69.95; L-34 and L-37 @ \$59.95.



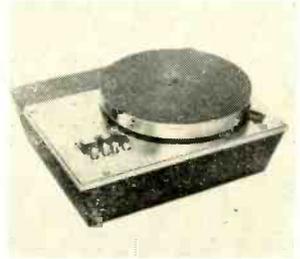
REK-O-KUT K33

Single-speed 33 1/3 rpm turntable with 4-pole induction motor has built-in strobe for checking speed. Table tapered for easy disc handling, made of lathe turned aluminum. Noise -47 db. Comes in kit form, requiring about 30 minutes for assembly. \$39.95.



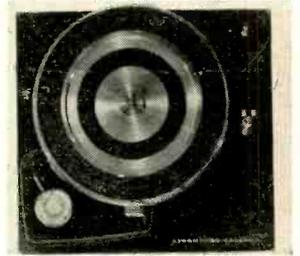
H. H. SCOTT 710-A

Three-speed turntable has each speed range adjustable by $\pm 5\%$. Expanded scale optical strobe. Rumble -60 db. Wow and flutter 0.1%. Machined aluminum casting table. Slip clutch for cueing. Induction motor. Helical drive gears in oil transmission. \$139.95.



STROMBERG-CARLSON PR-499

Continuously variable turntable from 14 to 80 rpm has 4-pole motor. Stroboscopic window pilot light. Noise level -55 db. Wow 0.18% rms. Flutter 0.1% peak, 0.01% rms. Elastic drive belt. Deck provided with legs for operation without base. \$99.95.



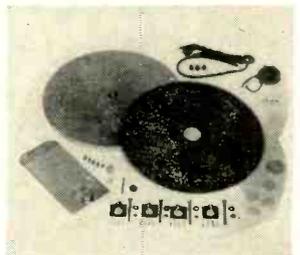
THORENS TD-134

Four-speed turntable with transcription arm has adjustment provision for speed. With line cord and shielded cable \$59.95. Wood base \$9. Also, not shown, TD-184 with dialing arrangement to set arm on disc's lead-in groove, priced at \$74.95.



WEATHERS

Single-speed 33 1/3 rpm turntable kit comes up to synchronous speed in 3/4 of a revolution. Conical spring shock mounting isolate turntable from table vibrations. Turntable pad touches outer rim of discs, not grooves. Small 12-pole synchronous motor. \$34.50.



For more information on these products
SEE INQUIRY CARD ON PAGE 73
& Directory of Manufacturers on Page 88

STEREO BUYERS DIRECTORY

Manufacturers grouped in 12 product categories

1—AMPLIFIERS, PREAMPLIFIERS, & CONTROLS

- Amplifiers, 1-channel** 1
- Amplifiers, 2-channel** 2
- Control Units, stereo** 3
- Preamplifiers, 1-channel** 4
- Preamplifiers, 2-channel** 5

Acro Products Co., 369 Shurs Lane, Philadelphia 28, Pa.-1-2-4-5
 Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.-1-2-3-5
 Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif.-1-2-3-4-5
 Ampex Audio, Inc., 1020 Kifer Rd., Sunnyvale, Calif.-1-5
 A.R.F. Products, Inc., 7627 Lake St., River Forest, Ill.-1
 Arkay Radio Kits, 120 Cedar St., New York 6, N.Y.-1-2-3-5
 Barker Sales Co., 339 S. Broad Ave., Ridgefield, N.J.-1-4
 Bell Sound Systems, 555 Marion Rd., Columbus 7, Ohio-1-2-4
 Blonder-Tongue Labs., 9 Alling St., Newark 2, N.J.-1-4
 Bogen Co., David, P.O. Box 500, Paramus, N.J.-1-2-3-4-5
 Brand Products Inc. (Madison Fielding), 11 Lorimer St., Brooklyn 6, N.Y.-2-5
 British Industries Corp. (Leak) 80 Shore Rd., Port Washington, N.Y.-1-2-4-5
 Capehart Co., 216 W. 14 St., New York 11, N.Y.-1-2
 Components Corp., 106 Main St., Denville, N.J.-5
 Cook Laboratories, Inc., 101 2 St., Stamford, Conn.-1-2-4-5
 DeRo Electronics 134 Nassau Rd., Roosevelt, L.I., N.Y.-3
 DeWald Radio, Div. United Scientific Labs., 35-15 37 Ave., Long Island City 1, N.Y.-1-2
 Dynaco Inc., 617 N. 41st., Philadelphia 4, Pa.-3
 Dynamic Electronics-New York Inc., 73-39 Woodhaven Blvd., Forest Hills, L.I., N.Y.-1-2-3-4
 Electron Enterprises, 6917 W. Stanley Ave., Berwyn, Ill.-1-2
 Electronic Applications, 194 Richmond Hill Ave., Stamford Conn.-2
 Electronic Development Associates, 126 E. 46 St., New York 17, N.Y.-1-2-4-5
 Electronic Instrument Co. (Eico), 3300 Northern Blvd., Long Island City 1, N.Y.-1-2-4-5
 Electro-Voice, Inc., Buchanan Mich.-3
 Ercona Corp., 16 W. 46 St., New York 36, N.Y.-1-2-3
 Erie Resistor Corp., 644 W. 12 St., Erie 6, Pa.-1
 Fairchild Recording Equipment Corp., 10-40 45 Ave., Long Island City 1, N.Y.-1-2-4-5
 Fannon Electric Co., 98 Berriman St., Brooklyn 8, N.Y.-1-2-3
 Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.-1-2-4-5
 General Electric, Specialty Electronic Components Dept., W. Genesee St., Auburn, N.Y.-1-4
 Greene Co., L. Charlton, 314 Washington St., Newton 58, Mass.-1
 Harman-Kardon Inc., 520 Main St., Westbury, N.Y.-1-2-3-4-5
 Heath Co., Benton Harbor, Mich.-1-3-4-5
 Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.-1-2-3-4-5
 McIntosh Lab. Inc., 2 Chambers St., Binghamton, N.Y.-1-3-4-5
 Marantz Co., 25-14 Broadway, Long Island City 6, N.Y.-1-3
 Musical Corp., 4512 W. Jefferson, Los Angeles 16, Calif.-1-2-4-5
 Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, Calif.-2
 Nortronic Co., 1015 S. 6 St., Minneapolis 4, Minn.-1-2-3-4-5
 Pentron Corp., 777 S. Tripp Ave., Chicago 24, Ill.-4-5
 Permotex Products Co., 4101 San Fernando Rd., Glendale 4, Calif.-1-2-4-5
 Pilot Radio Corp., 37-06 36 St., Long Island City 1, N.Y.-1-2-3-4-5
 Powers Co., J.J., 1317 S. 5 Ave., Maywood, Ill.-1-2
 Precise Development Corp., 2 Neil Court, Oceanside, N.Y.-1-2-4

Precision Electronics Inc., (Grommes) 9101 King St., Franklin Park, Ill.-1-2-3-4-5
 Radio Music Corp., 84 S. Water St., Port Chester, N.Y.-1-2-4-5
 Regency Div., Idea Inc., 7900 Pendleton Pike, Indianapolis 26, Ind.-1-4
 Roberts Electronics, 1028 N. LaBrea Hollywood 38, Calif.-5
 Sargent-Raymont Co., 4926 E. 12 St., Oakland 1, Calif.-2-5
 Scott Inc., H.H., 111 Powder Mill Rd., Maynard, Mass.-1-3-4-5
 Setchell-Carlson, Inc., New Brighton, St. Paul 12, Minn.-2
 Sherwood Electronics Labs., 4300 N. Calif. Ave., Chicago 18, Ill.-1
 Simpson Mfg. Co., Mark, 32-28 49 St., Long Island City 3, N.Y.-1
 Stromberg-Carlson, Special Products Div., 1400 N. Goodman St., Rochester 3, N.Y.-1-2-4-5
 Tannoy (America) Ltd., P.O. Box 177, E. Norwich, L.I., N.Y.-1-4
 Tech Master Corp., 75 Front St., Brooklyn 1, N.Y.-1-2-3-4-5
 Telectro Industries Corp., 35-16 37 St., Long Island City 1, N.Y.-1-2-3-4-5
 Universal Woodcrafters Inc., La Porte, Ind. 1-2-4-5
 Video Instruments Co., 3002 Penna. Ave., Santa Monica, Calif.-1-2-4-5
 Weathers Industries, 66 E. Gloucester Pike, Barrington, N.J.-2
 Webcor, Inc., 5610 W. Bloomingdale Ave., Chicago 39, Ill.-3
 Webster Electric Co., 1900 Clark St., Racine, Wis.-1-2-4-5
 Wells-Gardner & Co., 2701 N. Kildare Ave., Chicago 39, Ill.-1-2-3-4-5
 Whitley Electronics, Inc., 411 S. Chauncey St., Columbia City, Ind.-1-3

2—CARTRIDGES, STEREO PHONO

American Microphone Mfg. Co., 412 S. Wyman St., Rockford, Ill.
 Astatic Corp., Harbor & Jackson Sts., Conneaut, Ohio
 Audiogersh Corp., 514 Broadway, New York 12, N.Y.
 Barker Sales Co., 339 S. Broad Ave., Ridgefield, N.J.
 Berger Communications, 109-01 72 Rd., Forest Hills N.Y.
 CBS-Hytron, 100 Endicott St., Danvers, Mass.
 Duotone Co., Lucust St., Keyport, N.J.
 Electro-Sonic Labs., 35-54 36 St., Long Island City 6, N.Y.
 Electro-Voice, Inc., Buchanan, Mich.
 Ercona Corp. 16 W. 46 St., New York 36, N.Y.
 Erie Resistor Corp., 644 W. 12 St., Erie 6, Pa.
 Fairchild Recording Equipment Corp., 10-40 45 Ave., Long Island City 1, N.Y.
 Federal Electronics Sales, Federal Electronics Bldg., Rockville Centre, L.I., N.Y.
 Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.
 General Electric Specialty Electronics Components Dept., W. Genesee St., Auburn, N.Y.
 Heath Co., Benton Harbor, Mich.
 Jensen Industries. 7333 W. Harrison St., Forest Park, Ill.
 Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.
 Miller Mfg. Co., M. A., 4 & Church St., Libertyville, Ill.
 Pickering & Co., Sunnyside Blvd., Plainview, L.I., N.Y.
 Radio Music Corp., 84 S. Water St., Port Chester, N.Y.
 Recoton Corp., 62-35 Barnett Ave., Long Island City 4, N.Y.
 Ronette Sales Corp., 190 Earle Ave., Lynbrook, N.Y.
 Scott Inc., H. H., 111 Powder Mill Rd., Maynard, Mass.
 Shure Bros., 222 Hartrey Ave., Evanston, Ill.
 Sonotone Corp., Elmsford, N.Y.
 Tannoy (America) Ltd., P.O. Box 177, E. Norwich, L.I., N.Y.
 Televox Co., 46 Lakeview Ave., Yonkers, N.Y.
 United Audio Products, 202 E. 19 St., New York 3, N.Y.
 Weathers Industries, 66 E. Gloucester Pike, Barrington, N.J.
 Webster Electric Co., 1900 Clark St., Racine, Wis.

3—CHANGERS, TURNTABLES & ARMS

- Arms** 1
- Changers** 2
- Turntables** 3

American Microphone Mfg. Co., 412 S. Wyman St., Rockford, Ill.-1
 Astatic Corp., Harbor & Jackson Sts., Conneaut, Ohio-1
 Audiogersh Corp., 514 Broadway, New York 12, N.Y.-2-3
 Bogen Co., David, P.O. Box 500, Paramus, N.J.-3
 British Industries Corp. (Garrard), 80 Shore Rd., Port Washington, N.Y.-1-2-3
 Components Corp., 106 Main St., Denville, N.J.-3
 Electronics Applications, 194 Richmond Hill Ave., Stamford, Conn.-3
 Electro-Sonic Labs., 35-54 36 St., Long Island City 6, N.Y.-1
 Ercona Corp., 16 W. 46 St., New York 36, N.Y.-1-2-3
 Fairchild Recording Equipment Corp., 10-40 45 Ave., Long Island City 1, N.Y.-1-3
 Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.-2
 General Electric, Specialty Electronic Components Dept., W. Genesee St., Auburn, N.Y.-1
 Glaser-Sievers Corp., 20 Main St., Belleville 9 N.J.-2
 Heath Co., Benton Harbor, Mich.-3
 Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.-1-2-3
 Metzner Eng'g Corp., 1041 N. Sycamore Ave., Hollywood 38, Calif.-3
 Pickering & Co., Sunnyside Blvd., Plainview, L.I., N.Y.-1-3
 Radio Eng'g Co., Inquirer Bldg., Philadelphia 30, Pa.-2
 Radio Music Corp., 84 S. Water St., Port Chester, N.Y.-1-3
 Rek-O-Kut Co., 38-19 108 St., Corona 68, N.Y.-1-3
 Riemer Co., David, (Rystl), 601 W. 26 St., New York 1, N.Y.-1
 Rockbar Corp. (Collaro), 650 Halstead Ave., Mamaroneck, N.Y.-2
 Ronette Sales Corp., 190 Earle Ave., Lynbrook, N.Y.-1
 Scott Inc., H. H., 111 Powder Mill Rd., Maynard, Mass.-1-3
 Shure Bros., 222 Hartrey Ave., Evanston, Ill.-1
 Smolin Labs. Woodbrook Dr., Springdale, Conn.-2
 Stromberg-Carlson, Special Products Div., 1400 N. Goodman St., Rochester 3, N.Y.-1-2-3
 Thorens Co., Thorens Ave., New Hyde Park, N.Y.-2-3
 United Audio Products, 202 E. 19 St., New York 3, N.Y.-2
 V-M Corp., Benton Harbor, Mich.-2
 Weathers Industries, 66 E. Gloucester Pike, Barrington, N.J.-3
 Webcor, Inc., 5610 W. Bloomingdale Ave., Chicago 39, Ill.-2

4—CONVERSION KITS

- Stereo Phono** 1
- Stereo Tape Recorder** 2

Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.-1
 Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif.-1
 American Electronics, Inc., 9449 W. Jefferson Blvd., Culver City, Calif.-2
 Ampex Audio Inc., 1020 Kifer Rd., Sunnyvale, Calif.-1-2
 A.R.F. Products, Inc., 7627 Lake St., River Forest, Ill.-1
 Audiogersh Corp., 514 Broadway, New York 12, N.Y.-1
 Blonder-Tongue Labs, 9 Alling St., Newark 2, N.Y.-1-2
 Bogen Co. David, P.O. Box 500, Paramus, N.J.-1
 British Industries Corp., 80 Shore Rd., Port Washington, N.Y.-1

Capehart Corp., 216 W. 14 St., New York 11, N.Y.-1
 Components Corp., 106 Main St., Denville, N.J.-1
 Dynamic Electronics-New York Inc., 73-39 Woodhaven Blvd., Forest Hills, L.I., N.Y.-1
 Electron Enterprises, 6917 W. Stanley Ave., Berwyn, Ill.-1
 Electronic Applications, 194 Richmond Hill Ave. Stamford, Conn.-2
 Electronic Development Associates, 126 E. 46 St., New York 17, N.Y.-1
 Electrovox Co. (Walco), 60 Franklin St., E. Orange, N.J.-1
 Ercona Corp., 16 W 46 St., New York 36, N.Y. 2
 Fanon Electric Co., 98 Berriman St., Brooklyn 8, N.Y.-1
 Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.-2
 Miller Mfg. Co., M. A., 4 & Church St., Libertyville, Ill.-1
 Nortronic Co., 1015 S. 6 St., Minneapolis 4, Minn.-2
 Olympic Radio & Television, 34-01 28 Ave., Long Island City 1, N.Y.-1
 Pentron Corp., 777 S. Tripp Ave., Chicago 24, Ill.-2
 Pickering & Co., Sunnyside Blvd., Plainview, L.I., N.Y.-1
 Pilot Radio Corp., 37-06 36 St., Long Island City 1, N.Y.-1
 Powers Co., J. J., 1317 S. 5 Ave., Maywood, Ill.-1
 Rek-O-Kut Co., 38-19 108 St., Corona 68, N.Y.-1
 Revere Camera Co., 320 E. 21 St., Chicago 16, Ill.-2
 Roberts Electronics, 1028 N. La Brea, Hollywood 38, Calif.-2
 Scott Inc., H. H., 111 Powder Mill Rd., Maynard, Mass.-1
 Smolin Labs., Woodbrook Dr., Springdale, Conn.-2
 Stromberg-Carlson, Special Products Div., 1400 N. Goodman St., Rochester 3, N.Y.-1
 Tech Master Corp., 75 Front St., Brooklyn 1, N.Y.-1
 Telectro Industries Corp., 35-16 37 St., Long Island City 1 N.Y.-1-2
 Viking of Minneapolis, 9600 Aldrich Ave. S., Minneapolis 20, Minn.-2
 V-M Corp., Benton Harbor, Mich.-1-2
 Weathers Industries, 66 E. Gloucester Pike, Barrington, N.J.-1
 Webcor, Inc., 5610 W. Bloomingdale Ave., Chicago 39, Ill.-1
 Webster Electric Co., 1900 Clark St., Racine, Wis.-1-2
 Wells-Gardner & Co., 2701 N. Kildare Ave., Chicago 39, Ill.-1
 Whitley Electronics, Inc., 411 S. Chauncey St., Columbia City, Ind.-1-2

5—MICROPHONES & ACCESSORIES

Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.
 Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif.
 American Gelo Electronics, Inc., 312 7 Ave., New York 1, N.Y.
 American Microphone Mfg. Co., 412 S. Wyman St., Rockford, Ill.
 Astatic Corp., Harbor & Jackson Sts., Conneaut, Ohio
 Duotone Co., Locust St., Keyport, N. J.
 Electronic Applications, 194 Richmond Hill Ave., Stamford, Conn.
 Electro-Voice Inc., Buchanan, Mich.
 Ercona Corp., 16 W. 46 St., New York 36, N.Y.
 Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.
 Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.
 Luxo Lamp Corp., 102 Columbus Ave., Tucka-hoe, N.Y.
 North American Philips Co., 230 Duffy Ave., Hicksville, N.Y.
 Riemer Co., David, (Rystl), 601 W. 26 St., New York 1 N.Y.
 Shure Bros., 222 Hartrey Ave., Evanston, Ill.
 Sonotone Corp., Elmsford, N.Y.
 Stephens Truson Inc., 8538 Warner Dr., Culver City, Calif.
 Tannoy (America) Ltd., P.O. Box 177, E. Norwich, L.I., N.Y.
 Turner Co., 909 17 St., N.E., Cedar Rapids, Iowa
 Webster Electric Co., 1900 Clark St., Racine, Wis.

6—NEEDLES, 0.5 OR 0.7 MIL

American Phono Needle Co., 1 Continental Ave., Forest Hills 75, N.Y.
 Astatic Corp., Harbor & Jackson Sts., Conneaut, Ohio
 Berger Communications, 109-01 72 Rd., Forest Hills, N.Y.
 Duotone Co., Locust St., Keyport, N.J.

Electrovox Co. (Walco), 60 Franklin St., E. Orange, N.J.
 Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.
 Fidelitone Inc., 6415 Ravenswood Ave., Chicago 26, Ill.
 General Electric, Specialty Electronic Components Dept., W. Genesee St., Auburn, N.Y.
 Jensen Industries, 7333 W. Harrison St., Forest Park, Ill.
 Miller Mfg. Co., M. A., 4 & Church St., Libertyville, Ill.
 Pfanstiehl Chemical Corp., 104 Lake View Ave., Waukegan, Ill.
 Pickering & Co., Sunnyside Blvd., Plainview, L.I., N.Y.
 Recoton Corp., 62-35 Barnett Ave., Long Island City 4, N.Y.
 Shure Bros., 222 Hartrey Ave., Evanston, Ill.
 Televex Co., 46 Lakeview Ave., Yonkers, N.Y.
 Webster Electric Co., 1900 Clark St., Racine, Wis.

7—PHONOGRAPH SYSTEMS

Accessories 1
Stereo, complete 2
 Admiral Corp., 3800 W. Cortland St., Chicago 47, Ill.-2
 Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.-2
 Ampex Audio Inc., 1020 Kifer Rd., Sunnyvale, Calif.-2
 A.R.F. Products, Inc., 7627 Lake St., River Forest, Ill.-2
 Audio-Master Corp., 17 E. 45 St., New York 17, N.Y.-2
 Berger Communications, 109-01 72 Rd., Forest Hills, N.Y.-2
 British Industries Corp., 80 Shore Rd., Port Washington, N.Y.-1
 Capehart Corp., 216 W. 14 St., New York 11, N.Y.-2
 Components Corp., 106 Main St., Denville, N.J.-2
 DeRo Electronics, 134 Nassau Rd., Roosevelt, L.I. N.Y.-1
 Duotone Co., Locust St., Keyport, N.J.-1
 Dynamic Electronics-New York Inc., 73-39 Woodhaven Blvd., Forest Hills, L.I., N.Y.-1-2
 Electron Enterprises, 6917 W. Stanley Ave., Berwyn, Ill.-2
 Electrovox Co. (Walco), 60 Franklin St., E. Orange, N.J.-1
 Emerson Radio & Phono. Corp., 14 & Coles Sts., Jersey City 2, N.J.-2
 Fairchild Recording Equipment Corp., 10-40 45 Ave., Long Island City 1, N.Y.-2
 Fanon Electric Co., 98 Berriman St., Brooklyn 8, N.Y.-2
 Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.-1
 Fidelitone Inc., 6415 Ravenswood Ave., Chicago 26, Ill.-1
 General Electric, Specialty Electronic Components Dept., W. Genesee St., Auburn, N.Y.-1
 Granco Products, Inc., 36-07 20 Ave., Long Island City 5, N.Y.-2
 Greene Co., L. Charlton, 314 Washington St., Newton 58, Mass.-1
 Hallmark Electronics Corp., 383 Concord Ave., New York 54, N.Y.-2
 Heath Co., Benton Harbor, Mich.-2
 Leslie Creations, Lafayette Hill, Pa.-1
 Magnavox Co., 2131 Bueter Rd., Ft. Wayne, Ind.-2
 Microtran Co., 145 E. Mineola Ave., Valley Stream, N.Y.-1
 Miller Mfg. Co., M. A., 4 & Church St., Libertyville, Ill.-1
 Motorola, Inc., 4545 W. Augusta Blvd., Chicago 51, Ill.-2
 Musical Corp., 4512 W. Jefferson, Los Angeles 16 Calif.-2
 Olympic Radio & Television, 34-01 28 Ave., Long Island City 1, N.Y.-2
 Philco Corp., "C" & Tioga Sts., Philadelphia 34, Pa.-2
 Pilot Radio Corp., 37-06 36 St., Long Island City 1, N.Y.-2
 Precise Development Corp., 2 Neil Court, Oceanside, N.Y.-2
 Radio Corp. of America, Cherry Hill, Delaware Township, Camden 8, N.J.-2
 Recoton Corp., 62-35 Barnett Ave., Long Island City 4, N.Y.-1
 Riemer Co., David (Rystl), 601 W. 26 St., New York 1, N.Y.-1
 Robins Industries Corp., 36-27 Prince St., Flushing 54, N.Y.-1
 Setchell-Carlson, Inc., New Brighton, St. Paul 12, Minn.-2
 Stevens Products, Inc., 86 Main St., East Orange, N.J.-1
 Stromberg-Carlson, Special Products Div., 1400 N. Goodman St., Rochester 3, N.Y.-2
 Telectro Industries Corp., 35-16 37 St., Long Island City 1, N.Y.-2
 United Audio Products, 202 E. 19 St., New York 3, N.Y.-1
 Vidair Electronics Mfg. Co., 44 Church St., Baldwin, L. I., N.Y.-1
 V-M Corp., Benton Harbor, Mich.-1-2
 Walsco Electronics Mfg. Co., 100 W. Green St., Rockford, Ill.-1

Wafers Conley Co., 17 E. Chestnut St., Chicago 11, Ill.-2
 Webcor, Inc., 5610 W. Bloomingdale Ave., Chicago 39, Ill.-1-2
 Wells-Gardner & Co., 2701 N. Kildare Ave., Chicago 39, Ill.-2
 Wendell Plastic Fabrics Corp., 1220 Broadway, New York 1, N.Y.-1
 Westinghouse Electric Corp., Metuchen, N.J.-2
 Whitley Electronics, Inc., 411 S. Chauncey St., Columbia City, Ind.-2
 Zenith Radic Corp., 6001 W. Dickens Ave., Chicago 39, Ill.-2

8—RECORDS, STEREO

Audio Fidelity, Inc., 770 11 Ave., New York, N.Y.
 Columbia Records, 799 7 Ave., New York 19, N.Y.
 Components Corp., 106 Main St., Denville, N.J.
 Concertapes, Inc., P.O. Box 88, Wilmette, Ill.
 Cook Laboratories, Inc., 101 2 St., Stamford, Conn.
 Counterpoint Recordings Inc., 333 6 Ave., New York 14, N.Y.
 Decca Records, 50 W. 57 St., New York 19, N.Y.
 Elektra Corp., 361 Bleecker St., New York 14, N.Y.
 Fidelity Distributors, 7803 Sunset Blvd., Hollywood 46, Calif.
 Hallmark Electronics Corp., 383 Concord Ave., New York 54, N.Y.
 Int'l Pacific Recording, (Omega) 854 N. Vine St., Hollywood 38, Calif.
 London Records, 539 W. 25 St., New York, N.Y.
 Mercury Records, 35 E. Wacker Dr., Chicago 1, Ill.
 Radio Corp. of America, RCA Records Div., 155 E. 24 St., New York, N.Y.
 Smolin Labs., Woodbrook Dr., Springdale, Conn.
 Stere-O-Craft, Div. Craft Recording Corp., 1650 Broadway, New York, N.Y.
 Stereo Sound Studios, 238 E. 26 St., New York 10, N.Y.
 Urania Records, 233 Main St., Belleville 9, N.J.
 Vanguard Recording Society, 256 W. 55 St., New York 19, N.Y.
 Vox Productions (Stereovox), 236 W. 55 St., New York 19, N.Y.
 Westminster Recordings Co., 275 7 Ave., New York 1, N.Y.
 Zodiac Recording Co., 501 Madison Ave., New York 22, N.Y.

9—SPEAKERS & CABINETS

Enclosures & Cabinets 1
Speakers & Speaker Systems 2
 Acoustic Research, Inc., 24 Thorndike St., Cambridge 41, Mass.-2
 Allied Radio Corp. (Knight), 100 N. Western Ave., Chicago 80, Ill.-1-2
 Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif.-1-2
 American Loudspeaker Div., Contemporary American Furniture, 1821 Berneau, Chicago 13, Ill.-1
 Ampex Audio Inc., 1020 Kifer Rd., Sunnyvale, Calif.-2
 A.R.F. Products, Inc., 7627 Lake St., River Forest, Ill.-1
 Argos Products Co., 301 Main St., Genoa, Ill.-1
 Arnold Ceramics Inc., Isophon Div., 1 E. 57 St., New York 22, N.Y.-2
 Atlas Sound Corp., 1449-39 St., Brooklyn 18, N.Y.-2
 Audiogersh Corp. (Kingdom), 514 Broadway, New York 12, N.Y.-2
 Audiospeaker Laboratories, 1114 E. Emporia St., Ontario, Calif.-1-2
 Barker Sales Co., 339 S. Broad Ave., Ridgefield, N.J.-2
 Becker Electronic Mfg. Corp., 1091 Rockaway Ave., Valley Stream, N.Y.-2
 Berger Communications, 109-01 72 Rd., Forest Hills, N.Y.-1
 Blonder-Tongue Labs., 9 Alling St., Newark 2, N.J.-1-2
 Bozak Sales Co., R. T., Box 1166, Darien, Conn.-1-2
 Bradford Audio Corp., 27 E. 38 St., New York 16, N.Y.-1-2
 British Industries Corp. (Wharfedale, R-J) 80 Shore Rd., Port Washington, N.Y.-1-2
 Cabinet Div., G & H Wood Products, 99 N. 11 St., Brooklyn 11, N.Y.-1
 Calif Cabinet Co., 522 S. San Pedro St., Los Angeles 13, Calif.-1
 Capehart Corp., 216 W. 14 St., New York 11, N.Y.-1
 Cletron, Inc., 1974 E. 61 St., Cleveland 3, Ohio-2
 DeRo Electronics, 134 Nassau Rd., Roosevelt, L.I. N.Y.-1
 Duotone Co., Locust St., Keyport, N.J.-1
 Dynamic Electronics-New York Inc., 73-39 Woodhaven Blvd., Forest Hills, L.I., N.Y.-1
 Electron Enterprises, 6917 W. Stanley Ave., Berwyn, Ill.-1

Electronic Applications, 194 Richmond Hill Ave., Stamford, Conn.-2
 Electronic Instrument Co. (Eico), 3300 Northern Blvd., Long Island City 1, N.Y.-1-2
 Electro-Voice, Inc., Buchanan, Mich.-1-2
 Ercona Corp., 16 W. 46 St., New York 36, N.Y.-1-2
 Fourjay Industries, 2360 W. Dorothy Lane Dayton 39, Ohio-1
 General Electric, Specialty Electronic Components Dept., W Genesee St., Auburn, N.Y.-1-2
 Granco Products, Inc., 36-07 20 Ave., Long Island City 5, N.Y.-2
 Greene Co., L. Charlton, 314 Washington St., Newton 58, Mass.-1
 Hallmark Electronics Corp., 383 Concord Ave., New York 54, N.Y.-2
 Hartley Products Co., 521 E. 162 St., New York 51, N.Y.-2
 Heath Co., Benton Harbor, Mich.-1
 Jensen Mfg. Co., 6601 S. Laramie Ave., Chicago 38, Ill.-1-2
 Klipsch & Associates, Hope, Ark.-2
 KLH Research & Devel. Corp., 30 Cross St., Cambridge, Mass.-2
 Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.-1-2
 Lansing Sound Co., James, 3249 Casitas Ave., Los Angeles 39, Calif.-1-2
 Lowell Mfg. Co., 3030 Laclede Station Rd., St. Louis 17, Mo.-2
 Mobil Electronics Mfg. Co., 1111 State Rd. 67 E., Anderson, Ind.-1
 Neshaminy Electronic Corp. (JansZen) Neshaminy, Pa.-2
 North American Philips Co., 230 Duffy Ave., Hicksville, N.Y.-1-2
 Olympic Radio & Television, 34-01 28 Ave., Long Island City 1, N.Y.-1
 Oxford Components, Inc., 556 W. Monroe St., Chicago 6, Ill.-1-2
 Pentron Corp., 777 S. Tripp Ave., Chicago 24, Ill.-2
 Permoflux Products Co., 4101 San Fernando Rd., Glendale 4, Calif.-1-2
 Pickering & Co., Sunnyside Blvd., Plainview, L.I., N.Y.-2
 Pilot Radio Corp., 37-06 36 St., Long Island City 1, N.Y.-2
 Powers Co., J. J., 1317 S. 5 Ave., Maywood, Ill.-2
 Quom-Nichols Co., 226 E. Morquette Rd., Chicago 37, Ill.-2
 Raco Electronic Co., 1261 Broadway, New York 1, N.Y.-1-2
 Radio Merchandise Sales, 2016 Bronxdale Ave., New York 62, N.Y.-1
 Riemer Co., David, (Rystl), 601 W. 26 St., New York 1, N.Y.-2
 Rockbar Corp. (Goodman) 650 Halstead Ave., Mamaroneck, N.Y.-1-2
 Saxton Products, Inc., 1661 Boone Ave., New York 60, N.Y.-1
 Setchell-Carlson Inc., New Brighton, St. Paul 12, Minn.-1-2
 Smolin Labs., Woodbrook Dr., Springdale, Conn.-2
 Sonotone Corp., Elmsford, N.Y.-2
 Stephens Truson Inc., 6538 Warner Dr., Culver City, Calif.-1-2
 Stromberg-Carlson, Special Products Div., 1400 E. Goodman St., Rochester 3, N.Y.-1-2
 Tandberg of America, 10 E. 52 St., New York 22, N.Y.-2
 Tannoy (America) Ltd., P.O. Box 177, E. Norwich L.I., N.Y.-1-2
 United Audio Products (Wigo), 202 E. 19 St., New York 3, N.Y.-2
 Universal Woodcrafters Inc., La Porte, Ind.-1-2
 University Loudspeakers, Inc., 80 S. Kensico Ave., White Plains, N.Y.-1-2
 Utah Radio & Electronic Corp., 1124 E. Franklin St., Huntington, Ind.-1-2
 V-M Corp., Benton Harbor, Mich.-1-2
 Weathers Industries, 66 E. Gloucester Pike, Barrington, N.J.-1
 Webcor Inc., 5610 W. Bloomingdale Ave., Chicago 39, Ill.-2
 Webster Electric Co., 1900 Clark St., Racine, Wis.-2
 Wellcor Inc., 1218 N. Wells St., Chicago 10, Ill.-1
 Wells-Gardner & Co., 2701 N. Kildare Ave., Chicago 39, Ill.-1
 White Inc., Stan, 725 S. LaSalle St., Chicago 5, Ill.-1-2
 Whitley Electronics, Inc., 411 S. Chauncey St., Columbia City, Ind.-1-2

10—TAPE

Blank 1
Pre-recorded stereo 2

Audio Devices Inc., 444 Madison Ave., New York 22, N.Y.-1
 Audio Fidelity, Inc., 770 11 Ave., New York, N.Y.-2
 Audio-Master Corp., 17 E. 45 St., New York 17, N.Y.-2
 Concertapes, Inc., P.O. Box 88, Wilmette, Ill.-2
 Cook Laboratories, Inc., 101 2 St., Stamford, Conn.-2
 Counterpoint Recordings, Inc., 333 6 Ave., New York 14, N.Y.-2

Duotone Co., Locust St., Keyport, N.J.-1
 Elektra Corp., 361 Bleecker St., New York 14, N.Y.-2
 Ercona Corp., 16 W. 46 St., New York 36, N.Y.-1
 Ferrodynamics Corp., Gregg St. & Route 17, Lodi, N.J. (Sonaromic)-1
 Fidelitone Inc., 6415 Ravenswood Ave., Chicago 26, Ill.-1
 Fidelity Distributors, 7803 Sunset Blvd., Hollywood 46, Calif.-2
 Int'l Pacific Recording (Omegatape), 854 N. Vine St., Hollywood 38, Calif.-2
 Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.-1
 Livingston Audio Products, P.O. Box 202, Caldwell, N.J.-2
 Minnesota Mining & Mfg. Co., 900 Bush St., St. Paul 6, Minn.-1
 National Tape Library, 2413 Penna Ave., N.W., Washington 7, D.C.-2
 ORRadio Industries Inc. (Irish), Shamrock Circle, Opelika, Ala.-1
 Reeves Soundcraft Corp., 10 E. 52 St., New York 22, N.Y.-1
 Smolin Labs., Woodbrook Dr., Springdale, Conn.-2
 Stere-O-Craft, Div. Craft Recording Corp., 1650 Broadway, New York, N.Y.-2
 Stereophony Inc., 112 Oak Plaza, St. Paul 9, Minn.-2
 Stereo Sound Studios, 238 E. 26 St., New York 10, N.Y.-2
 Tandberg of America, 10 E. 52 St., New York 22, N.Y.-1
 Urania Records, 233 Main St., Belleville 9, N.J.-2
 Vanguard Recording Society, 256 W. 55 St., New York 19, N.Y.-2
 Vox Productions (Stereovox), 236 W. 55 St., New York 19, N.Y.-2
 Westminster Recordings Co., 275 7 Ave., New York 1, N.Y.-2
 Zodiac Recording Co., 501 Madison Ave., New York 22, N.Y.-2

11—TAPE RECORDERS, PLAYBACKS, & ACCESSORIES

Accessories 1
Heads, stereo 2
Recorders & Playbacks, stereo 3

Along Products Inc., 163 W. 23 St., New York 11, N.Y.-1
 American Electronics, Inc., 9449 W. Jefferson Blvd., Culver City, Calif.-1-2-3
 American Geloso Electronics, Inc., 312 7 Ave., New York 1, N.Y.-1
 American Microphone Mfg. Co., 412 S. Wyman St., Rockford, Ill.-2
 Ampex Audio Inc., 1020 Kifer Rd., Sunnyvale, Calif.-1-3
 Amplifier Corp. of America, 398 Broadway, New York 13, N.Y.-3
 Audio Devices Inc., 444 Madison Ave., New York 22, N.Y.-1
 Audiogersh Corp., 514 Broadway, New York 12, N.Y.-3
 Audio-Master Corp., 17 E. 45 St., New York 17, N.Y.-2
 Bell Sound Systems, 555 Marion Rd., Columbus 7, Ohio-1-3
 Berger Communications, 109-01 72 Rd., Forest Hills, N.Y.-2
 Bogen Co. David, P.O. Box 500, Paramus, N.J.-1
 Columbia Records, 799 7 Ave., New York 19, N.Y.-3
 Electronic Applications, 194 Richmond Hill Ave., Stamford, Conn.-2-3
 Ercona Corp., 16 W. 46 St., New York 36, N.Y.-1-2-3
 Fidelitone Inc., 6415 Ravenswood Ave., Chicago 26, Ill.-1
 General Kinetics Inc., 555 23 St., S., Arlington 2, Va.-1
 Int'l Radio & Electronics Corp., S. 17 St. & Mishawaka Rd., Elkhart, Ind.-3
 Lafayette Radio 165-08 Liberty Ave., Jamaica 33, N.Y.-3
 Lipps Eng'g Edwin A., 1511 Colorado Ave., Santa Monica, Calif.-1-2
 Magnetics Box 6960, Washington 20, D.C.-1
 Magnecord Div., Midwestern Instruments, P.O. Box 7186, Tulsa, Okla.-3
 Marco Industries, 3rd & Franklin Sts., Womelsdorf Pa.-1
 Metzner Eng'g Corp., 1041 N. Sycamore Ave., Hollywood 38, Calif.-3
 Michigan Magnetics, Inc., Vermontville, Mich.-3
 Microtran Co., 145 E. Mineola Ave., Valley Stream, N.Y.-1
 North American Philips Co., 230 Duffy Ave., Hicksville, N.Y.-3
 Nortronic Co., 1015 S. 6 St., Minneapolis 4, Minn.-1-2
 Pentron Corp., 777 S. Tripp Ave., Chicago 24, Ill.-1-2-3
 Permoflux Products Co., 4101 San Fernando Rd., Glendale 4, Calif.-3
 Pro-Tex Reel Band, 2108 Payne Ave., Cleveland 14 Ohio-1

Radio Corp. of America, Cherry Hill, Delaware Twp., Camden 8, N.J.-8
 Reiter Co., F., 3340 Bonnie Hill Dr., Hollywood 28, Calif.-1
 Roberts Electronics, 1028 N. LaBrea, Hollywood 38, Calif.-1-3
 Robins Industries Corp., 36-27 Prince St., Flushing 54, N.Y.-1
 Saxton Products, Inc., 1661 Boone Ave., New York 60, N.Y.-1
 Scott Instrument Labs., 17 E. 48 St., New York 17, N.Y.-1
 Shure Bros., 222 Hartrey Ave., Evanston, Ill.-2
 Smolin Labs., Woodbrook Dr., Springdale, Conn.-3
 Superscope, Inc., 8520 Tujunga Ave., Sun Valley, Calif.-3
 Tandberg of America, 10 E. 52 St., New York 22, N.Y.-2-3
 Tayloreal Corp., 185 Murray St., Rochester 6, N.Y.-1
 Telectro Industries Corp., 35-16 37 St., Long Island City 1, N.Y.-1-2-3
 Viking of Minneapolis, 9600 Aldrich Ave. S., Minneapolis 20, Minn.-1-2-3
 V-M Corp., Benton Harbor, Mich.-1-3
 Walsco Electronics Mfg. Co., 100 W. Green St., Rockford, Ill.-1
 Webcor Inc., 5610 W. Bloomingdale Ave., Chicago 39, Ill.-1-3
 Webster Electric Co., 1900 Clark St., Racine, Wis.-1-2-3
 Wollensak Optical Co., 20 E. 21 St., Chicago 16, Ill.-3

12—TUNERS

AM or FM "single play" 1
AM & FM "simultaneous play" 2
Multiplex adaptable 3

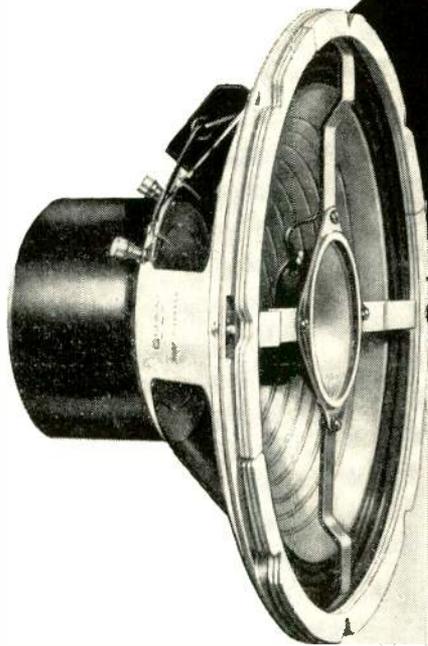
Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.-1-2
 Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif.-1-3
 American Geloso Electronics, Inc., 312 7 Ave., New York 1, N.Y.-1
 Ampex Audio, Inc., 1020 Kifer Rd., Sunnyvale, Calif.-2-3
 Arkay Radio Kits, 120 Cedar St., New York 6, N.Y.-1-2-3
 Bell Sound Systems, 555 Marion Rd., Columbus 7, Ohio-1-2-3
 Blonder-Tongue Labs., 9 Alling St., Newark 2, N.J.-1
 Bogen Co., David, P.O. Box 500, Paramus, N.J.-1-2-3
 Brand Products Inc. (Madison Fielding), 11 Lorimer St., Brooklyn 6, N.Y.-2-3
 British Industries Corp., 80 Shore Rd., Port Washington, N.Y.-1
 Capehart Corp., 216 W. 14 St., New York 11, N.Y.-1-3
 DeWald Radio, Div., United Scientific Lab., 35-15 37 Ave., Long Island City 1, N.Y.-1-2-3
 Dynamic Electronics-New York Inc., 73-39 Woodhaven Blvd., Forest Hills, L.I., N.Y.-1-2-3
 Electronic Development Associates, 125 E. 46 St., New York 17, N.Y.-1-2-3
 Electronic Instrument Co. (Eico), 3300 Northern Blvd., Long Island City 1, N.Y.-1-3
 Ercona Corp., 16 W. 46 St., New York 36, N.Y.-1
 Erie Resistor Corp., 644 W. 12 St., Erie 6, Pa.-1
 Granco Products, Inc., 36-07 20 Ave., Long Island City 5, N.Y.-1-2
 Harmon-Kardon Inc., 520 Main St., Westbury, N.Y.-1-2-3
 Heath Co., Benton Harbor, Mich.-1
 Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.-1-2-3
 McIntosh Lab. Inc., 2 Chambers St., Binghamton, N.Y.-1-3
 Miller Co., J. W., 5917 S. Main St., Los Angeles 3, Calif.-1-2-3
 Mobil Electronics Mfg. Co., 1111 State Rd. 67 E., Anderson, Ind.-3
 Pilot Radio Corp., 37-06 36 St., Long Island City 1, N.Y.-1-2-3
 Precise Development Corp., 2 Neil Court, Oceanside, N.Y.-1
 Precision Electronics Inc. (Grommes), 9101 King St., Franklin Park, Ill.-1-2-3
 Regency Div., Idea Inc., 7900 Pendleton Pike, Indianapolis 26, Ind.-1
 Sargent-Raymont Co., 4926 E. 12 St., Oakland 1, Calif.-1-3
 Scott Inc., H. H., 111 Powder Mill Rd., Maynard, Mass.-1-2-3
 Setchell-Carlson, Inc., New Brighton, St. Paul 12, Minn.-2
 Sherwood Electronics Labs., 4300 N. Calif. Ave., Chicago 18, Ill.-1
 Simpson Mfg. Co., Mark, 32-28 49 St., Long Island City, 3, N.Y.-1
 Stromberg-Carlson, Special Products Div., 1400 N. Goodman St., Rochester 3, N.Y.-1
 Tech Master Corp., 75 Front St., Brooklyn 1, N.Y.-1-2-3
 Video Instruments Co., 3002 Penna. Ave., Santo Monica, Calif.-1-2
 Wells-Gardner & Co., 2701 N. Kildare Ave., Chicago 39, Ill.-1-3
 Whitley Electronics, Inc., 411 S. Chauncey St., Columbia City, Ind.-1

Alphabetical List of Manufacturers

(Numbers refer to sections
in which products are listed.)

Acoustic Research, Inc., 24 Thorndike St., Cambridge 41, Mass.-9
Acro Products Co., 369 Shurs Lane, Philadelphia 28, Pa.-1
Admiral Corp., 3600 W. Cortland St., Chicago 47, Ill.-7
Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.-1-4-5-7-9-12
Alonge Products, Inc. 163 W. 23 St., New York 11, N.Y.-11
Altec Lansing Corp., 1515 S. Manchester Ave., Anaheim, Calif.-1-4-5-9-12
American Electronics, Inc., 9449 W. Jefferson Blvd., Culver City, Calif.-4-11
American Geloso Electronics, Inc., 312 7 Ave., New York 1, N.Y.-5-11-12
American Loudspeaker Div., Contemporary American Furniture, 1821 Berneau, Chicago 13, Ill.-9
American Microphone Mfg. Co., 412 S. Wyman St., Rockford, Ill.-2-3-5-11
American Phono Needle Co., 1 Continental Ave., Forest Hills 75, N.Y.-6
Ampex Audio, Inc., 1020 Kifer Rd., Sunnyvale, Calif.-1-4-7-9-11-12
Amplifier Corp. of America, 398 Broadway, New York 13, N.Y.-11
A.R.F. Products, Inc., 7627 Lake St., River Forest, Ill.-1-4-7-9
Argos Products Co., 301 Main St., Genoa, Ill.-9
Arkay Radio Kits, 120 Cedar St., New York 6, N.Y.-1-12
Arnhold Ceramics Inc., Isophon Div., 1 E. 57 St., New York 22, N.Y.-9
Astatic Corp., Harbor & Jackson Sts., Conneaut, Ohio-2-3-5-6
Atlas Sound Corp., 1449 39 St., Brooklyn 18, N.Y.-9
Audio Devices, Inc., 444 Madison Ave., New York 22, N.Y.-10-11
Audio Fidelity, Inc., 770 11 Ave., New York, N.Y.-8-10
Audiogersh Corp., 514 Broadway, New York 12, N.Y.-2-3-4-9-11
Audio-Master Corp., 17 E. 45 St., New York 17, N.Y.-7-10-11
Audiopicker Labs., 1114 E. Emporia St., Ontario, Calif.-9
Barker Sales Co., 339 S. Broad Ave., Ridgefield, N.J.-1-2-9
Becker Electronic Mfg. Corp., 1091 Rockaway Ave., Valley Stream, N.Y.-9
Bell Sound Systems, 555 Marion Rd., Columbus 7, Ohio-1-11-12
Berger Communications, 109-01 72 Rd., Forest Hills, N.Y.-2-6-7-9-11
Blonder-Tongue Labs., 9 Alling St., Newark 2, N.J.-1-4-9-12
Bogen Co., Dav'd, P.O. Box 500, Paramus, N.J.-1-3-4-11-12
Bozak Sales Co., R. T., Box 1166, Darien, Conn.-9
Bradford Audio Corp., 27 E. 38 St., New York 16, N.Y.-9
Brand Products Inc. (Madison Fielding), 11 Lorimer St., Brooklyn 6, N.Y.-1-12
British Industries Corp., 80 Shore Rd., Port Washington, N.Y.-1-3-4-7-9-12
Cabinart Div. G&H Wood Products, 99 N. 11 St., Brooklyn 11, N.Y.-9
Calif. Cabinet Co., 522 S. San Pedro St., Los Angeles 13, Calif.-9
Capehart Corp., 216 W. 14 St., New York 11, N.Y.-1-4-7-9-12
CBS-Hytron, 100 Endicott St., Danvers, Mass.-2
Cetron, Inc., 1974 E. 61 St., Cleveland 3, Ohio-9
Columbia Records, 799 7 Ave., New York 9, N.Y.-8-11
Components Corp., 106 Main St., Denville, N.J.-1-3-4-7-8
Concertapes, Inc., P.O. Box 88, Wilmette, Ill.-8-10
Cook Labs., Inc., 101 2 St., Stamford, Conn.-1-8-10
Counterpoint Recordings Inc., 333 6 Ave., New York, 14, N.Y.-8-10
Decca Records, 50 W. 57 St., New York 19, N.Y.-8
DeRo Electronics, 134 Nassau Rd., Roosevelt, L.I., N.Y.-1-7-9
DeWald Radio Div., United Scientific Labs., 35-15 37 Ave., Long Island City 1, N.Y.-1-12
Duotone Co., Locust St., Keyport, N.J.-2-5-6-7-9-10
Dynaco Inc., 617 N. 41 St., Philadelphia 4, Pa.-1
Dynamic Electronics-New York Inc., 73-39 Woodhaven Blvd., Forest Hills, L.I., N.Y.-1-4-7-9-12
Electron Enterprises, 6917 W. Stanley Ave., Berwyn, Ill.-1-4-7-9
Electronic Applications, 194 Richmond Hill Ave., Stamford, Conn.-1-3-4-5-9-11
Electronic Development Associates, 126 E. 46 St., New York 17, N.Y.-1-4-12

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Electro-Sonic Labs., 35-54 36 St., Long Island City 6, N.Y.-2-3
Electro-Voice, Inc., Buchanan, Mich.-1-2-5-9
Electrovox Co. (Walco), 60 Franklin St., East Orange, N.J.-4-6-7
Elektra Corp., 361 Bleecker St., New York 14, N.Y.-8-10
Emerson Radio & Phono. Corp., 14 & Coles Sts., Jersey City 2, N.J.-7
Ercona Corp., 16 W. 46 St., New York 36, N.Y.-1-2-3-4-5-9-10-11-12
Erie Resistor Corp., 644 W. 12 St., Erie 6, Pa.-1-2-12
Fairchild Recording Equipment Corp., 10-40 45 Ave., Long Island City 1, N.Y.-1-2-3-7
Fanon Electric Co., 98 Berriman St., Brooklyn 8, N.Y.-1-4-7
Federal Electronics Sales, Federal Electronics Bldg., Rockville Centre, L.I., N.Y.-2
Fen-Tone Corp., 106 5 Ave., New York 11, N.Y.-1-2-3-4-5-6-7
Ferrodynamics Corp., Gregg St. & Route 17, Lodi, N.J.-(Sonaromic)-10
Fidelitone Inc., 6415 Ravenswood Ave., Chicago 26, Ill.-6-7-10-11
Fidelity Distributors, 7803 Sunset Blvd., Hollywood 46, Calif.-8-10
Fourjay Industries, 2360 W. Dorothy Lane, Dayton 39, Ohio-9
General Electric Co., Specialty Electronic Components Dept., W. Genesee St., Auburn, N.Y.-1-2-3-6-7-9
General Kinetics Inc., 555 23 St., S., Arlington 2, Va.-11
Graco-Steers Corp., 20 Main St., Belleville 9, N.J.-3
Granco Products, Inc., 36-07 20 Ave., Long Island City 5, N.Y.-7-9-12
Greene Co., L. Charlton, 314 Washington St., Newton 58, Mass.-1-7-9
Hallmark Electronics Corp. (Paramount), 383 Concord Ave., New York 54, N.Y.-7-8-9
Harman-Kardon Inc., 520 Main St., Westbury, N.Y.-1-12
Hartley Products Co., 521 E. 162 St., New York 51, N.Y.-9
Heath Co., Benton Harbor, Mich.-1-2-3-7-9-12
Int'l Pacific Recording (Omegatape), 854 N. Vine St., Hollywood 38, Calif.-8-10
Int'l Radio & Electronics Corp., S. 17 St. & Mishawaka Rd., Elkhart, Ind.-11
Jensen Industries, 7333 W. Harrison St., Forest Park, Ill.-2-6
Jensen Mfg. Co., 6601 S. Laramie Ave., Chicago 38, Ill.-9
Klipsch & Associates, Hope, Ark.-9
KLH Research & Devel. Corp., 30 Cross St., Cambridge, Mass.-9
Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N.Y.-1-2-3-5-9-10-11-12
Lansing Sound, Inc., James B., 3249 Casitas Ave., Los Angeles 39, Calif.-9
Leslie Creations, Lafayette Hill, Pa.-7
Lipps Eng'g., Edwin A., 1511 Colorado Ave., Santa Monica, Calif.-11
Livingston Audio Products, P.O. Box 202, Caldwell, N.J.-10
London Records, 539 W. 25 St., New York 1, N.Y.-8
Lowell Mfg. Co., 3030 Laclede Station Rd., St. Louis, Mo.-9
Luxe Lamp Corp., 102 Columbus Ave., Tuckahoe, N.Y.-5
McIntosh Lab. Inc., 2 Chambers St., Binghamton, N.Y.-1-12
Magnavox Co., 2131 Bueter Rd., Fort Wayne, Ind.-7
Magnelectrics, Box 6960, Washington 20, D.C.-11
Magnecord Div., Midwestern Instruments, P.O. Box 7186, Tulsa, Okla.-11
Marantz Co., 25-14 Broadway, Long Island City 6, N.Y.-1
Marco Industries, 3rd & Franklin Sts., Womelsdorf, Pa.-11
Mercury Records Corp., 35 E. Wacker Dr., Chicago 1, Ill.-8
Metzner Eng'g Corp., 1041 N. Sycamore Ave., Hollywood 38, Calif.-3-11
Michigan Magnetics, Inc., Vermontville, Mich.-11
Microtran Co., 145 E. Mineola Ave., Valley Stream, N.Y.-7-11
Miller Co., J. W., 5917 S. Main St., Los Angeles 3, Calif.-12
Miller Mfg. Co., M. A., 4 & Church St., Libertyville, Ill.-2-4-6-7
Minnesota Mining & Mfg. Co., 900 Bush Ave., St. Paul 6, Minn.-10
Mobil Electronics Mfg. Co., 1111 State Rd., 67 E., Anderson, Ind.-9-12
Motorola, Inc., 4545 W. Augusta Blvd., Chicago 51, Ill.-7
Musical Corp., 4512 W. Jefferson, Los Angeles 16, Calif.-1-7
National Tape Library, 2413 Penna. Ave., N.W., Washington 7, D.C.-10
Neshaminy Electronic Corp., Neshaminy, Pa.-9
Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, Calif.-1
North American Philips Co., 230 Duffy Ave., Hicksville, N.Y.-5-9-11
Nortronics Co., 1015 S. 6 St., Minneapolis 4, Minn.-1-4-11
Olympic Radio & Television, 34-01 28 Ave., Long Island City 1, N.Y.-4-7-9
OR Radio Industries, Inc (Irish), Shamrock Circle Opelika, Ala.-10
Oxford Components, Inc., 556 W. Monroe St., Chicago 6, Ill.-9
Pentron Corp., 777 S. Tripp Ave., Chicago 24, Ill.-1-4-9-11
Permotlux Products Co., 4101 San Fernando Rd., Glendale 4, Calif.-1-9-11
Pfanstiehl Chemical Corp., 104 Lake View Ave., Waukegan, Ill.-6
Philco Corp., "C" & Tioga Sts., Philadelphia 34, Pa.-7
Pickering & Co., Sunnyside Blvd., Plainview, L.I., N.Y.-2-3-4-6-9
Pilot Radio Corp., 37-06 36 St., Long Island City 1, N.Y.-1-4-7-9-12
Powers Co., J. J., 1317 S. 5 Ave., Maywood, Ill.-1-4-9
Precision Development Co., 2 Neil Court, Oceanside, N.Y.-1-7-12
Precision Electronics Inc. (Grommes), 9101 King St., Franklin Park, Ill.-1-12
Pro-Tex Reel Band, 2108 Payne Ave., Cleveland 14, Ohio-11
Quam-Nichols Co., 226 E. Marquette Rd., Chicago 37, Ill.-9
Racon Electric Co., 1261 Broadway, New York 1, N.Y.-9
Radio Corp. of America, Cherry Hill, Delaware Township, Camden 8, N.J.-7-11
Radio Corp. of America, RCA Records Div., 155 E. 24 St., New York, N.Y.-8
Radio Eng'g Co., Inquirer Bldg., Philadelphia 30, Pa.-3
Radio Merchandise Sales, 2016 Bronxdale Ave., New York 62, N.Y.-9
Radio Music Corp., 84 S. Water St., Port Chester, N.Y.-1-2-3
Recofon Corp., 62-35 Barnett Ave., Long Island City 4, N.Y.-2-6-7
Reeves Soundcraft Corp., 10 E. 52 St., New York 22, N.Y.-10
Regency Div., Idea Inc., 7900 Pendleton Pike, Indianapolis 26, Ind.-1-12
Reiter Co., F., 3340 Bonnie Hill Dr., Hollywood 28, Calif.-11
Rek-O-Kut Co., 38-19 108 St., Corona 68, N.Y.-3-4
Revere Camera Co., 320 E. 21 St., Chicago 16, Ill.-4
Riemer Co., David, 601 W. 26 St., New York 1, N.Y.-3-5-7-9
Roberts Electronics, 1028 N. La Brea, Hollywood 38, Calif.-1-4-11
Robins Industries Corp., 36-27 Prince St., Flushing 54, N.Y.-7-11
Rockbar Corp., 650 Halstead Ave., Mamaroneck, N.Y.-3-9
Ronette Sales Corp., 190 Earle Ave., Lynbrook, N.Y.-2-3
Sargent-Raymont Co., 4926 E. 12 St., Oakland 1, Calif.-1-12
Saxton Products, Inc., 1661 Boone Ave., New York 60, N.Y.-9-11
Scott Inc., H. H., 111 Powder Mill Rd., Maynard, Mass.-1-2-3-4-12
Scott Instrument Labs., 17 E. 48 St., New York 17, N.Y.-11
Setchell-Carlson, Inc., New Brighton, St. Paul 12, Minn.-1-7-9-12
Sherwood Electronics Labs., 4300 N. Calif. Ave., Chicago 18, Ill.-1-12
Shure Bros., 222 Hartrey Ave., Evanston, Ill.-2-3-5-6-11
Simpson Mfg. Co., Mark, 32-28 49 St., Long Island City 3, N.Y.-1-12
Smolin Labs., Woodbrook Dr., Springdale, Conn.-3-4-8-9-10-11
Sonotone Corp., Elmsford, N.Y.-2-5-9
Stephens Trusonic Inc., 8538 Warner Dr., Culver City, Calif.-5-9
Stere-O-Craft, Div. Craft Recording Corp., 1650 Broadway, New York, N.Y.-8-10
Stereophony Inc., 112 Oak Plaza, St. Paul 9, Minn.-10
Stereo Sound Studios, 238 E. 26 St., New York 10, N.Y.-8-10
Stevens Products, Inc., 86 Main St., East Orange, N.J.-7
Stromberg-Carlson, Special Products Div., 1400 N. Goodman St., Rochester 3, N.Y.-1-3-4-7-9-12
Superscope, Inc., 8520 Tujunga Ave., Sun Valley, Calif.-11
Tandberg of America, 10 E. 52 St., New York 22, N.Y.-9-10-11
Tannoy (America) Ltd., P.O. Box 177, E. Norwich, L.I., N.Y.-1-2-5-9
Taylorcorp., 185 Murray St., Rochester 6, N.Y.-11
Tech Master Corp., 75 Front St., Brooklyn 1, N.Y.-1-4-12
Telectro Industries Corp., 35-16 37 St., Long Island City 1, N.Y.-1-4-7-11
Telex Co., 46 Lakeview Ave., Yonkers, N.Y.-2-6
Thorens Co., Thorens Ave., New Hyde Park, N.Y.-3
Turner Co., 909 17 St., N.E., Cedar Rapids, Iowa-5
United Audio Products, 202 E. 19 St., New York 3, N.Y.-2-3-7-9
Universal Woodcrafters Inc., La Porte, Ind.-1-9
University Loudspeakers, Inc., 80 S. Kensico Ave., White Plains, N.Y.-9
Urania Records, 233 Main St., Belleville 9, N.J.-8-10
Utah Radio & Electronic Corp., 1124 E. Franklin St., Huntington, Ind.-9
Vanguard Recording Society, 256 W. 55 St., New York 19, N.Y.-8-10
Vidaire Electronics Mfg. Corp., 44 Church St., Baldwin, L.I., N.Y.-7
Video Instruments Co., 3002 Penna. Ave., Santa Monica, Calif.-1-12
Viking of Minneapolis, 9600 Aldrich Ave. S., Minneapolis 20, Minn.-4-11
V-M Corp., Benton Harbor, Mich.-3-4-7-9
Vox Productions, Inc., 236 W. 25 St., New York, N.Y.-8-10
Walco Electronics Mfg. Co., 100 W. Green St., Rockford, Ill.-7-11
Waters Conley Co., 17 E. Chestnut St., Chicago 11, Ill.-7
Weathers Industries, 66 E. Gloucester Pike, Barrington, N.J.-1-2-3-4-9
Webcor, Inc., 5610 W. Bloomingdale Ave., Chicago 39, Ill.-1-3-4-7-9-11
Webster Electric Co., 1900 Clark St., Racine, Wis.-1-2-4-5-6-9-11
Wellcor, Inc., 1218 N. Wells St., Chicago 10, Ill.-9
Wells-Gardner & Co., 2701 N. Kildare Ave., Chicago 39, Ill.-1-4-7-9-12
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Westminster Recordings Co., 257 7 Ave., New York 1, N.Y.-8-10
White Inc., Stan, 725 S. LaSalle St., Chicago 5, Ill.-9
Whitley Electronics, Inc., 411 S. Chauncey St., Columbia City, Ind.-1-4-7-9-12
Wollensak Optical Co., 20 E. 21 St., Chicago 16, Ill.-11
Zenith Radio Corp., 6001 W. Dickens Ave., Chicago 39, Ill.-7
Zodiac Recording Co., 501 Madison Ave., New York 22, N.Y.-8-10

Industry Associations

with name of secretary unless otherwise noted

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American Institute of Electrical Engineers 33 W 39th St New York 18 N Y W S Hibshman
American Institute of Physics 335 E 45th St New York 17 N Y Wallace Waterfall
American Physical Society Pupin Physics Bldg Columbia University New York 27 N Y Dr Karl K. Darrow
American Standards Assn 70 E 45th St New York 17 N Y George F. Hussey Jr
Association of Electronic Parts & Equipment Mfrs 11 S LaSalle St Chicago 3 Ill Kenneth C. Prince
Audio Engineering Society P O Box 12 Old Chelsea Station New York 11 N Y C J LeBel
Electronic Development Institute 125 E. 46 St New York 17 N Y B Berger
Electronic Industries Assn 1721 De Sales St N W Washington 6 D C James D. Secrest
Institute of High Fidelity Mfrs 125 E 23rd St New York 10 N Y A. Schwartzman
Institute of Radio Engineers 1 E 79th St New York 21 N Y George W. Bailey
Instrument Society of America 313 Sixth Ave Pittsburgh 22 Pa Wm H. Kushnick Exec Director
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National Assn of Music Merchants 222 W Adams St Chicago 6 Ill William R. Gard
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National Electrical Mfrs Assn 155 E 44th St New York 17 N Y Joseph F. Miller Managing Director
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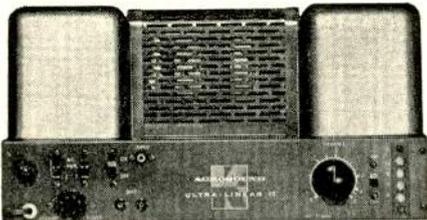
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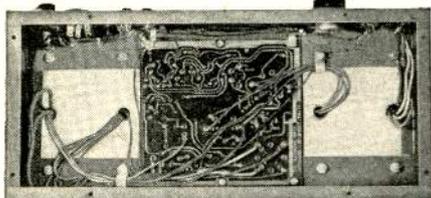


Circle 93-03 on inquiry form p. 73

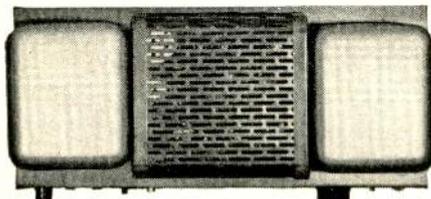
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Circle 94-01 on inquiry form p. 73

Master Control

(Continued from page 50)

need some attention when the loudness level is changed appreciably or when the seating arrangement is altered. A possible solution and simplification may be in the use of a recently introduced dual volume control which may be adjusted individually and then operated jointly by locking the concentric shafts.

A desirable characteristic of a balance control is to be able to balance the output level of each of the two channels, one against the other, without altering the overall volume level. This can be accomplished by stacking two linear potentiometers and wiring one in reverse order as shown in Fig. 2. Adjusting this control lowers the volume of one channel and increases the volume of the other, thus keeping the total output at the same level.

It is possible to use a compensated type of volume control as a combination loudness contour and volume level adjuster. Provisions may be employed to switch the compensation network out, and leave the control function to handle the volume level only. Still another way is to use separate controls and networks for each of these functions.

Functions & Modes

The most convenient way to choose a program source is to be able to turn a switch to the desired position. A rotary-selector, multi-gang switch with up to 12 positions may be used for this purpose. The complexity of the switch may be minimized by limiting its functions only to the job on hand. Further simplification can be achieved by using the same input on the control box for more than one program source. Consideration must be given to the impedance and amplification

requirements of the program source. Where more than one source has the same output characteristics, it can be fed into the same jack on the master control.

Fig. 3 shows a simple arrangement of two switches which can reverse the two channels, or permit them to play straight through. It is also possible to select either channel and feed it into both amplifiers for monophonic listening on both amplifiers and their respective speaker systems. This in effect doubles the amount of power output.

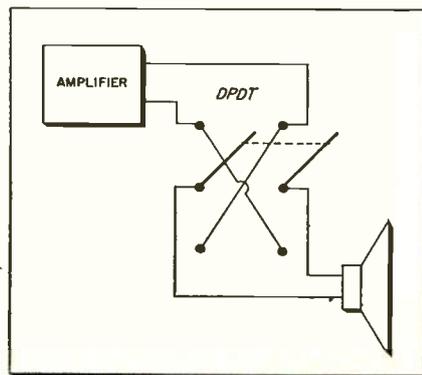
Other than the balance and volume controls nothing thus far has gone into the control box that would materially alter the requirements for matching impedances and other pre-amplifier functions. Manufacturers specifications for matching and equalization should be followed. If the amplifier and preamplifier do not have the appropriate circuitry, it may be built into the control box. Some manufacturers have input adapters which can be plugged into the line between the program source and the preamp.

In the absence of equalization networks it is possible to set the bass and treble controls for proper playback, but the correct position of the controls will have to be predetermined and marked.

With stereo via FM multiplex there is a very nice feature: because of the sum and difference type of program makeup, the output from the difference channel can be adjusted and faded in. Without the difference channel, both speaker systems get the same program; they are virtually in parallel. As the difference channel component is brought up, the stereo effect appears without abruptly changing the output from either speaker. This makes quite a sophisticated demonstration.

This can also be done with other stereo program source material, but it requires elaborate equipment to convert the signal to sum and difference components. Just one more switch, but not on the master control, to consider. This is a speaker phasing arrangement for only one channel as shown in Fig. 4. Since it is possible, for several different reasons, to have stereo program material, at the output of each amplifier, in phase from one program source and out of phase from another, and since the only valid way to phase speaker systems for stereo is by listening to the stereo program, a phasing switch is most convenient. This switch can be located either near the amplifier or the speaker. •

Fig. 4—Speaker phasing switch provides a quick way to check for proper stereo phasing while listening to a stereo program.



Multiplexing

(Continued from page 63)

have the same information as the righthand microphone and the left speaker will have the same information that was impressed on the left microphone.

$$(A+B) + (A-B) = 2A$$

$$(A+B) - (A-B) = 2B$$

The way the subcarrier is developed is very interesting, and also very complex. The problems of signal-to-noise ratio, and cross talk are still occupying the full-time efforts of many engineers. However, sufficient progress has been demonstrated to justify consideration by the FCC for multiplex broadcasting. The subcarrier for FM multiplexing is nothing more than a continuous sinusoidal signal operating at a frequency of over 20,000 cycles. The reason for selecting an ultrasonic frequency is to prevent it from being heard and thus interfering with the main program in a regular FM receiver not equipped for multiplex. Also the receiver deemphasis network does much to kill this high frequency signal and keep it from getting into the audio amplifier stages. From 30 kc to 70 kc could be used in actual practice. Some work is now going on in approximately the 32 kc to 67 kc range.

At the receiver end, the FM station is picked up and handled in the conventional manner up to the point just past the second detector and before the deemphasis network.

The A+B portion is allowed to go straight through the receiver to both amplifiers, while the A-B signal is picked off by a bandpass filter before the deemphasis network has an opportunity to attenuate it. This signal is then demodulated and passed through a phase splitter. The in-phase part of the A-B signal is fed to one amplifier and the out-of-phase part of the A-B signal is fed to the other amplifier. As was shown, this action restores the right and left signals.

Adapters are available for use in those areas presently experimenting with FM multiplex for stereo. These units range in price from approximately \$50 to \$100.

The FCC has already granted permission to some broadcasters to experiment with multiplexed stereocasting on FM, and it looks as though multiplexed stereo will be another program source for stereo in the very near future. •

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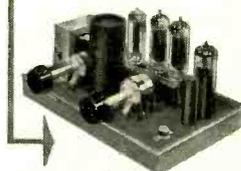
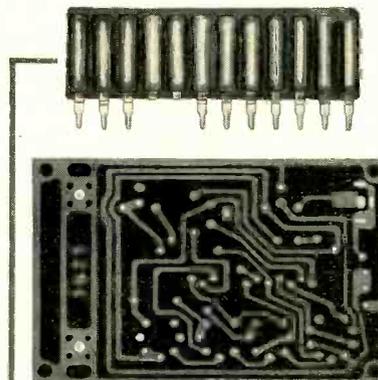
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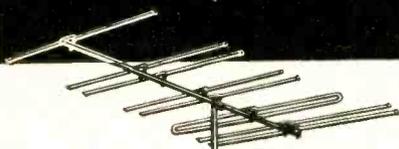


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Stereo Discs

(Continued from page 49)

cause the needle to go straight down if both channels are equally pulling in a downward direction. An out-of-phase force, that is, one channel pushing up and the other channel pulling down, will cause the needle to travel laterally to one side or the other depending upon the direction of the forces. Thus the stylus can travel in any direction depending upon the forces exerted on it. From this it can be seen that even though the information is cut into the groove at a 45° angle, the stylus is displaced either horizontally or vertically or both from the reference groove at any given moment. Even if only one channel is modulated, there is a diagonal movement which consists of horizontal and vertical components. The RIAA standard specifies that lateral modulation of the stereo disc produce in-phase signals to the speakers. This in-phase signal condition differs from the in-phase mechanical motion of the stylus and should not be confused.

One of the most difficult-to-understand phenomena of the single-groove stereo record is how the stylus can track a groove that seemingly has one sidewall going one way, and another sidewall going another as shown in Fig. 5. Perhaps this is due to difficulties engendered by the inability to use old concepts to explain new ones, and worse still, to at least temporarily discard any previous ideas. The first and probably most important misconception to eliminate is that the weaving back and forth of the groove's sidewalls indicate lateral motion. The groove in Fig. 4 has sidewalls going back and forth in a Mae West fashion, yet there is no lateral motion on the part of the stylus. However, this pinching and expanding does indicate a rising and falling stylus. It is the center of the groove that describes lateral motion.

Since the stylus can assume a position that is displaced both horizontally and vertically from a given reference point, it is possible for the groove to have different widths, and different lateral displacement from one instant to the next. Therefore the groove walls do not appear to be symmetrical. The center line at point A in Fig. 5 shows lateral movement to the left, and the wider distance between the walls shows vertical modulation in a downward direction. At point B the stylus is riding high

but without any lateral displacement. Again there is no horizontal offset at point C, but the stylus is way down. Point D indicates that the stylus is off to the right but riding at reference height. If at this point not too much confusion has set in, it should be evident that it is possible for a stylus to track such a groove.

This brings up a rather controversial point. Since the stylus contacts both sidewalls at any given instant, and since both its relative width and lateral displacement transmits the intelligence to both elements in the cartridge, is it correct to say that one wall contains the intelligence in one channel and the other wall contains the other channel? Where would the needle be if one wall were left out? Even so, in the illustration in Fig. 5, the inner sidewall represents the left channel which in this case contains a higher frequency signal than the right channel, which in turn is responsible for the shape of the outer wall. It is the combination of the two walls and their relative position which provides the information to the stereo or monophonic cartridge. Suffice it to say that it works, and it is revolutionizing the hi-fi industry. •



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ELECTRONIC TECHNICIAN • Stereo, 1959

Needles for Stereo

(Continued from page 56)

lateral components, which can produce corresponding distortions in both "45" channels:

1. The 2nd harmonic of lateral components appear in the vertical channel. At high frequencies this is relatively unimportant. But . . .

2. IM products (difference frequencies) from the lateral components also appear in the vertical. This can produce a buzzing sound on high-amplitude, complex high-frequency sounds, such as those high impact items.

3. Lower frequency components of vertical movement can intermodulate the higher frequency lateral components, producing a "dithery" effect in the reproduction.

Stylus Size

There is still another effect due to the vertical component of the recording. The size of the stylus can cause increased 2nd harmonic distortion in the vertical component plus the production of difference frequencies (IM) within these components, thus exaggerating #2 effect considerably. Fig. 3 shows how the path traversed by a larger needle differs from the actual vertical component. Compare the shape of the dotted line with that of the actual cutting. The smaller the needle, the more nearly its path agrees with the original recording.

The answer for this is a smaller stylus, which reduces both pinch effect and its associated distortions, and the dominantly vertical distortion. Early experimental stereo records and styli for them have been using a tip radius of 0.7 mil, as compared with the standard 1 mil for monophonic LPs and 3 mils for the 78s. The RIAA recommendation for the future is 0.5 mil—and not without good reason, from what we have seen!

But what does reducing tip size do? If the pickup design remains about the same, the effective compliance of the record vinyl at the stylus tip will increase, so the resonant frequency will come down, unless the mass of the stylus and its mounting comes down proportionately. This means it is more important than ever to have a clean mounting.

Reducing tip size, and keeping the stylus pressure the same means the pressure per square inch (which already measures in tons per square inch) will be radically increased. A

change from 1 mil to 0.5 mil will multiply this wear-producing pressure by about 4 times.

Needle Material

Since the advent of LPs, the transition from steel-to-sapphire-to-diamond has been gaining momentum. Now it is widely recognized that diamonds are not only the best, but by far the cheapest both for records and styli. The step to 0.5 mil should multiply this incentive toward the use of diamond needles.

Diamonds should be good: accurately shaped, precision mounted, and micropolished. Extra care is needed when installing these new needles. The life of a diamond can not be taken for granted. It should be checked regularly.

It is false economy to get a pickup with one stylus and expect it to do dual service. Figs. 4 and 5 show what

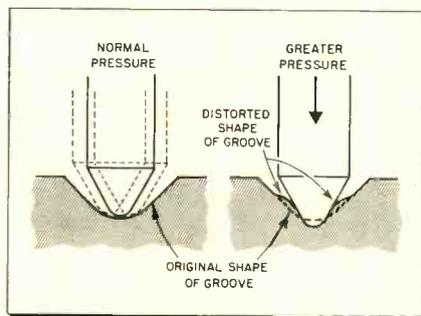
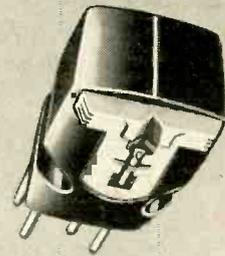


Fig. 5—Small stylus with normal pressure will slide along the bottom of the groove in an erratic manner. (B) Increased pressure reduces erratic behavior, but increases wear.

using a large stylus in a small groove, or vice versa, will do. Either way, if only the regular pressure is used, distortion is apt to result. Fig. 4A shows how a needle, which is too large but with normal pressure, rides high in the groove. Distortion due to a tendency to bounce, and in severe cases serious tracking problems are introduced such as groove skipping, and in the case of changers, failure to trip the cycling mechanism. Distorted records and excessive wear can be expected if stylus pressure is increased, as shown in Fig. 4B. On the other hand, too small a stylus, with normal pressure, has a tendency to move about in the bottom of the groove in an erratic manner causing distortion and excessive needle scratch, as shown in Fig. 5A. Increasing needle pressure in this case also results in distorted discs and excessive wear. Increasing the pressure to avoid this distortion also results in considerably increased wear in the styli. •

PRECISION . . .

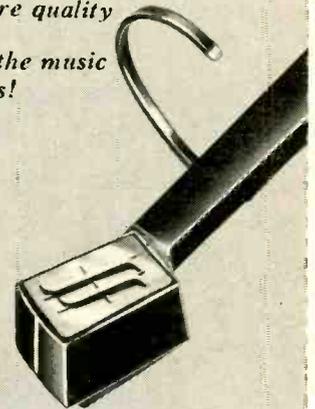


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Stereo Glossary

balance control: A differential gain control, whose function is to increase the level in one channel, while reducing it in the other, or vice versa, without affecting the overall volume level of the stereo system.

binaural: Two eared; applied to a kind of recording to be played into separate headphones to create a sense of depth which does not necessarily reflect actual listening conditions in the studio or concert hall.

cardioid: As applied to microphones, heart-shaped sensitivity pattern. Provides maximum pickup in front, and minimum pickup from the rear of the microphone.

compatibility: The ability of a new and old system to be used interchangeably. Specifically, a stereo system usable with monophonic program source; or stereo program that can be reproduced monophonically on a monophonic system.

carrier: Unmodulated radio signal used to convey information through space.

compliance: Ability to yield or flex. In stylus and cartridge measurements it is expressed as an integral number which is equal to the number of 10^{-6} cm moved by 1 dyne of force. The higher the number the better.

counter: A type of FM demodulator, particularly suitable for a multiplex subcarrier. It counts the number of cycles and gives an output proportional to its count at any instant.

decoding: In multiplex, a process of separating the subcarrier from the main carrier.

difference channel: A combination of the difference between left and right stereo channels.

focus control: See balance control.

forty-five/forty-five: The accepted type of monogroove stereo recording, so named because the stylus motion for each channel is at a 45° angle.

hole-in-the-middle: An effect of a divided sound source sometimes encountered in an area midway between speaker systems. An out-of-phase condition can exaggerate this effect, as can too widely separated speakers.

integrated: Applied to speakers or enclosure design, arrangement of speakers, usually on a common axis to create the impression that the sound is coming from a point source, especially the middle and high frequencies (in the same stereo channel).

matrixing: The process of combining left and right channels, to produce sum and difference signals. Also the reverse process, to restore left and right channels from the sum and difference signals.

monaural: One eared. Frequently used loosely instead of monophonic.

monophonic: Single channel, whether presented over one or more speaker systems.

monogroove stereo disc: A stereo recording in which all the program is contained in one groove.

multiplex: A method of simultaneously carrying one or more additional radio programs on one radio transmission within the assigned bandwidth.

omnidirectional: As applied to microphones, uniform pickup of sound from all directions.

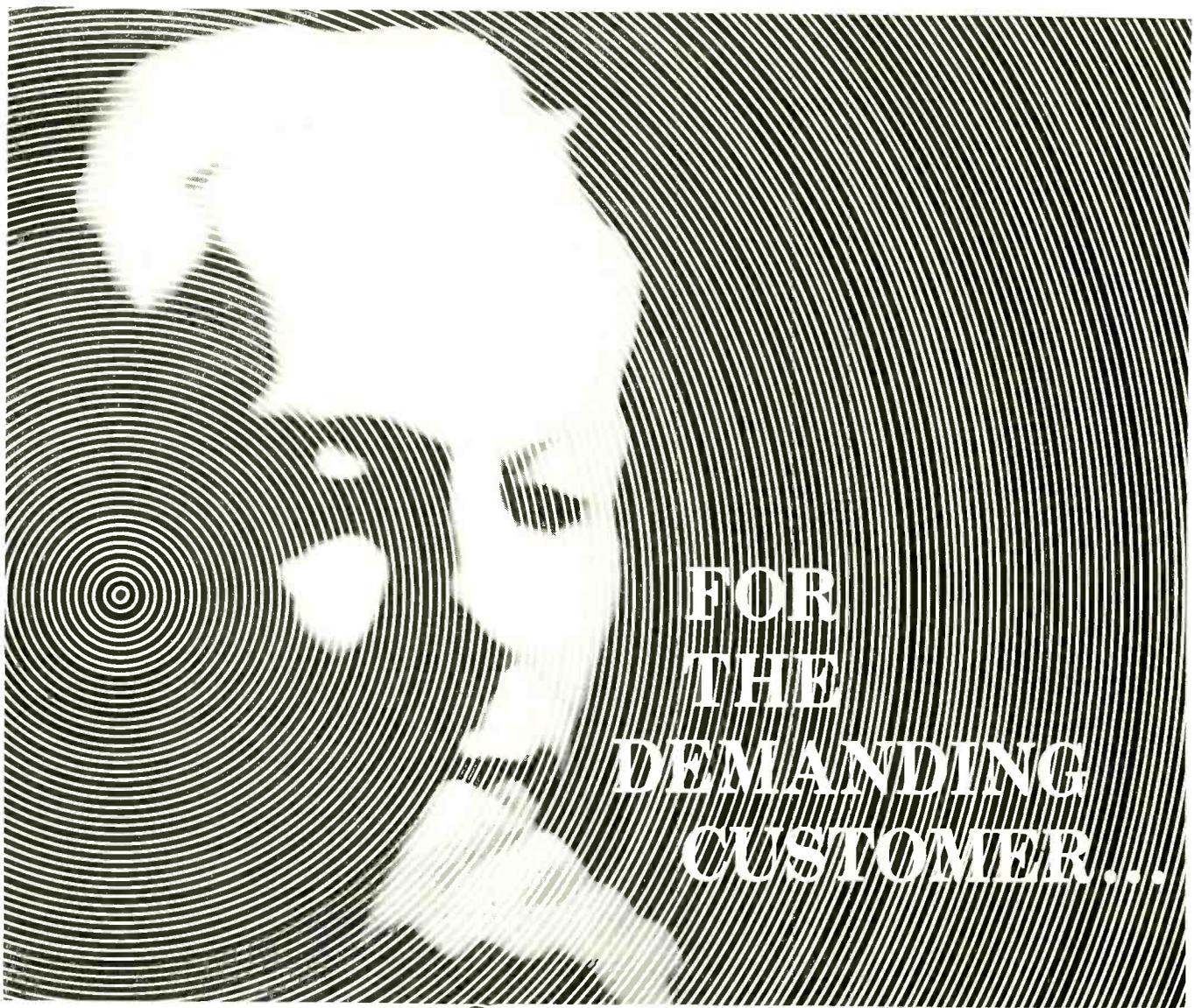
ping-pong effect: Dissociation due to some sounds coming first from one speaker, and then from the other.

stereophonic: Also referred to as stereo. Two or more separate channels of sound blended in a listening area in such a manner as to create a sense of realism and depth in sound reproduction.

subcarrier: A relatively low ultrasonic frequency used to accept modulation from additional programs, such as a second stereo channel, and then modulating the main radio station carrier.

sum channel: A combination of left and right stereo channels. It is identical to the program which may be recorded or transmitted monophonically.

vertical-lateral: A type of stereo monogroove recording in which one channel is recorded by vertical movement and the other by lateral movement of the stylus; as a basic system, this has been rejected in favor of 45/45.



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Output level: 21 mv at 1000 cps
Compliance: 3×10^{-6} cm per dyne
Tracking force: 3 to 6 grams
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Other Dynetic models \$15.00 and up

MONAURAL

Studio Dynetic
TONE-ARM



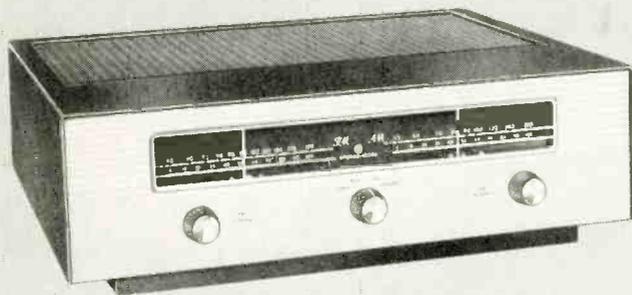
Model M16

Tracks at 1 gram! Impossible to scratch records. With integral cartridge, .0007" diamond stylus. The ultimate in high fidelity—reproduces all the sound—even beyond the audible spectrum. Pays for itself in prolonged record life—tracks perfectly at an incredible one-to-two grams. Even plays warped records with Hi-Fi response. For transcription-type turntables (M-12 for 12" records, M-16 for 16").
Frequency response: 20 to 20000 cps \pm 2 db
Output level: 10 mv at 1000 cps
Compliance: 7×10^{-6} cm per dyne
Tracking force: 1 to 2 grams
Price complete: \$79.50 audiophile net.

Write for literature on monaural and stereo cartridges, tone arms, microphones, magnetic recording heads:
Shure Brothers, Incorporated, 222 Hartrey Avenue, Evanston, Illinois, Dept. 14-I

Circle 99-01 on inquiry form page 73

HARMAN- KARDON MAKES STEREO SENSIBLE



Harman-Kardon stereo instruments are the most flexible on the market today. Intelligent design assures ease of operation. The new Duet stereo tuner and Trio stereo amplifier — make stereo attractive, effective, inexpensive — and sensible.

THE TRIO, Model A-224, Stereo Amplifier — actually embodies *three* excellent instruments in one handsome, compact unit. The Trio is: A complete stereo preamplifier with two separate 12 watt power amplifiers (24 watt peaks each.) A complete 24 watt monaural amplifier (48 watt peak.) A 24 watt monaural amplifier with complete stereo preamplifier arranged to convert an existing monaural amplifier to stereo. Outstanding features include: Separate ganged treble and bass controls, balance control, mode switch, speaker selector switch for local and remote speaker systems, contour control, tape output for recording application and rumble filter.

THE TRIO, Model A-224 \$99.95
the Cage (AC-24) optional 7.00

THE DUET, Model T-224, Stereo Tuner: Monaural! Binaural! Whatever the application, this new tuner is designed to give maximum performance. A superb monaural tuner—the T-224 incorporates separate AM and FM channels for receiving stereo broadcasts through this *one* unit. Rear jack makes it adaptable for multiplex reception.

While the DUET is an ideal AM/FM monaural tuner—it's specifically designed for the growth in stereo broadcasting. As stereo broadcasting grows—the value of the DUET multiplies for you. Costs just a few dollars more than conventional monaural tuners! (The DUET incorporates a simple indexing scale to permit easy identification of five pairs of "stereo" stations).

THE DUET, Model T-224
\$114.95
Prices slightly higher on the West Coast.

For additional information on Harman-Kardon stereo and monaural units, simply send a postcard with the word stereo on it to Harman-Kardon, Dept. ET9, Westbury, N. Y.

harman kardon